Real Time Optimiser Commercial Partnering Arrangement

Market Engagement Briefing Paper

26 July 2016

EVERY JOURNEY MATTERS

CONTENTS

1. Background

Transport for London's (**TfL's**) Surface Intelligent Transport System programme (**SITS**) is intended to deliver £1,000m of benefits through delay reduction for all road users by 2036 – through faster, automated responses to live road conditions using an enhanced signal control system with a predictive capability.

London's road space is becoming increasingly constrained with more people using the existing road space. With an additional five million road trips a day by 2030 and continued growth in demand, the cost of delay in 2036 is estimated to be £12.55bn, up from £4.77bn in 2014. To meet this challenge, TfL needs to be more proactive in the way it manages its road space.

Currently TfL operators monitor road space using CCTV cameras. A typical road incident, such as a collision and the congestion that results from it, can take up to 20 minutes to detect and respond to. This exacerbates delay.

TfL operators managing the delay have to use multiple systems, many of which are approaching the end of their operational life. This gives TfL an opportunity to replace, upgrade and integrate many of these systems using its extensive in-house delivery knowledge.

A significant part of SITS will be to provide an improved Real Time Optimiser and a replacement Urban Traffic Control System, as further described in this Briefing Paper.

2. Purpose

2.1. Overview

TfL has published a Prior Information Notice (**PIN**) in which TfL provides that following a desktop analysis, TfL believes SCOOT is the only product which can meet TfL's requirements for a Real Time Optimiser considering the complexities around inter-operability, programme, functionality and the significant costs associated with integrating an alternative product.

The purpose of this Briefing Paper is to:

- explain TfL's market engagement exercise;
- set out TfL's requirements for a Real Time Optimiser;
- summarise TfL's analysis of the real time optimiser market;
- outline TfL's proposed commercial partnering arrangement in relation to the Real Time Optimiser; and
- explain what TfL intends to do next if its analysis of the real time optimiser market is correct.

2.2. RTO Requirements

TfL's requirements for a Real Time Optimiser (the **RTO Requirements**) are detailed in this Briefing Paper in:

- Section 4, in respect of certain over-arching technical programme requirements;
- Section 5, in respect of certain minimum technical requirements; and
- the relevant provisions in Section 7, in respect of the proposed commercial arrangement (in particular, the treatment of intellectual property set out in Section 7.2 and commercial exploitation set out in Section 7.4).

2.3. Glossary

A glossary of terminology used in this Briefing Paper is set out in Section 10.

3. Market Engagement

3.1. Objective

TfL has published the PIN which, together with this Briefing Paper, details TfL's requirements for the Real Time Optimiser and explains the London environment, specifically the infrastructure which is in place in order to operate the network.

It is our intention to test with the marketplace our conclusion that only a SCOOT-based solution can meet the RTO Requirements and, if our market engagement confirms this, we will move directly to engage with the current SCOOT owners in relation to the RTO Requirements via the negotiated procedure without prior publication.

3.2. Process

The PIN is open to the marketplace for a period of 5 weeks.

Any supplier who reasonably believes that it would be able to deliver a Real Time Optimiser using a product other than SCOOT which meets the RTO Requirements, is requested to submit a response to TfL in accordance with Section 3.3 by midday on 1 September 2016.

In the event that any supplier reasonably demonstrates that it is able to meet the RTO Requirements using a product other than SCOOT, then TfL would look to invite the supplier to a 1:1 session which would be used to clarify the supplier's position. In this event, TfL will contact the relevant supplier, provide an agenda and agree a mutually convenient time and location to meet. In the event that any supplier has not, in TfL's reasonable opinion, demonstrated that it is able to meet the RTO Requirements using a product other than SCOOT, TfL reserves the right not to hold a 1:1 session with that supplier.

TfL considers that in the event the marketplace does not respond it may reasonably conclude that this lends support to the conclusions TfL has drawn from its market analysis.

In the event that the marketplace reasonably demonstrates that it can meet the RTO Requirements and this has been confirmed at the 1:1 sessions then TfL would look to run an open competition under the public procurement rules as applicable.

PIN Timetable		
	Start Date	**End Date**
Publish PIN and period responses can be provided	25 July 2016	01 September 2016 (12 noon)
Supplier 1:1 consultations (if applicable)	15 August 2016	05 September 2016

3.3. Supplier Response

If any supplier considers it can meet all of the RTO Requirements using a product other than SCOOT, the supplier is requested to provide TfL with a short paper (limited to 10 A4 sides) that sets out the basis on which the supplier can meet all of the RTO Requirements. Without limiting the application of the RTO Requirements, as part of your response you must explain:

- how you are able to deliver an effective cutover to your proposed solution to secure zero downtime for London;
- how data mapping/conversion from TfL's existing SCOOT real time optimiser would be carried out, in migrating the underlying databases that shape our operational systems;
- the extent to which TfL will be required to make material changes or compromises to its network or infrastructure if TfL adopted your proposed alternative technology; and

- whether there will likely be any method changes to the operational modes/methods used for traffic control and management within London as a result of adopting your proposed alternative technology.

4. Key Constraints for the Real Time Optimiser

The Real Time Optimiser must accommodate the key constraints set out in this Section 4.

Timescales

TfL must replace its existing UTC/RTO solution by 2019, as a result of the current platform (open VMS) reaching its end of life. As a consequence only existing, proven products in the marketplace which could be reasonably configured to work for London in a relatively short timeframe can be considered.

Infrastructure continuity

The Real Time Optimiser must not affect the performance and availability of the road network. This means that:

- Existing traffic detectors must not be replaced or relocated as this will create severe disruption to the road network. This does not preclude new sensors being introduced providing that the sensors can be installed without disrupting the road network.
- Any new hardware installed on the street must comply with the standards currently in place (UTMC, see 5.3). Currently when new hardware is installed on the street it is commissioned onto the UTC system by ensuring the communication and hardware functionality operate as expected, only after this can the equipment be confidently and safely used under UTC/RTO. Due to the large scale deployment of UTC/RTO throughout London this is a resource intensive activity and as such the Real Time Optimiser must not require any significant re-commissioning of on-street hardware.
- Engineers (internal TfL employees and external contractors) rely on the existing communication infrastructure to remotely access the on street equipment for operational, commissioning and fault diagnostic purposes ('business and usual' activities). The communication infrastructure is the backbone to all communications to and from the on street equipment. The Real

Time Optimiser must be compatible with the existing protocols and data formats otherwise the ongoing business as usual activities would be severely impacted.

Integration costs

TfL has made significant financial investments into London's streets and roads including in relation to the integration of SCOOT. Given the very significant costs associated with integrating an alternative product, any new Real Time Optimiser would need to:

- Offer significant benefits in order to provide an appropriate return on TfL's investment.
- Maximise the use of existing systems and infrastructure so as to minimise the redundancy of previous significant investment (e.g. TfL's modelling work) in the existing UTC/RTO.

Staff ability to carry out their duties

The Real Time Optimiser must not affect the ability of TfL staff to carry out their duties. This means that:

- Engineers must be able to implement strategies and changes to signal timings to keep London moving. The Real Time Optimiser must therefore take into account the training that Traffic Engineers go through before they are permitted to make timing changes unsupervised.
- The Real Time Optimiser must not affect the ability of the Contractors and Engineers to meet agreed SLA(s) for the maintenance, repair and fault diagnostics of the on street equipment.
- It must be possible to reuse the extensive understanding and knowledge of the movement of goods, people and vehicles across the network and key corridors. Any replacement Real Time Optimiser must therefore allow Engineers to transfer this knowledge and understanding without the need for extensive training as this would not be practical due to departmental resources.
- TfL consider that it is not possible that a third party could simply agree to undertake this activity in order to keep TfL staff free.

Business Continuity

- The replacement system must not affect the operation of TfL's day to day business. This means that TfL's existing programmes must not be affected.

A link the TfL website which advertises opportunities and existing programmes can be found here.

5. Minimum Technical Requirements for the Real Time Optimiser

This Section 5 sets out certain minimum technical requirements for the proposed Real Time Optimiser.

Sections 5.1 and 5.2 below demonstrate the type of networks within London and are specifically provided to show the typical location of existing vehicle detectors used for SCOOT optimisation.

5.1. Linear network

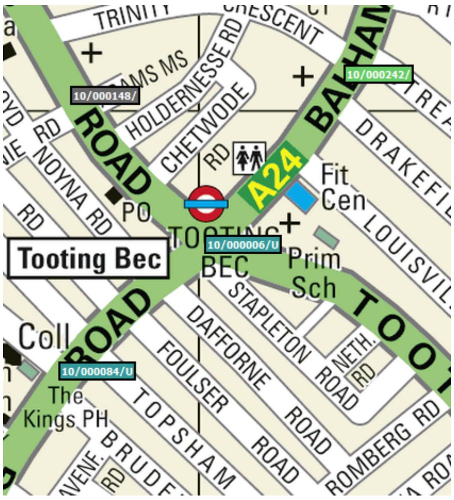
Balham High Road by Drakefield Road Traff

Balham High Road by Ritherdon Road Traff

Ducting Loop and Detection Point Plan.|

Traffic Signals Layout_Trinity Rd by

Upper Tooting Road by Beechcroft Road T



5.2. Roundabouts

Redbridge Roundabout

Crooked Billet Roundabout (Southsi

Crooked Billet Roundabout (Northsi

***attachments are available upon request if you are unable to open them.**

5.3. Configuration of On-street and In-station Equipment

Data transfer between the Outstation Transmission Unit (OTU) and the current TfL in-station equipment uses Simple Network Management Protocol (SNMP) as the communication protocol as defined by UTMC UG405 part 2.

Signal controllers operate under the TR2210 specification.

Implications for the Real Time Optimiser

Any change to the SNMP mapping will require a re-commissioning of the on street equipment to ensure functionality and connectivity is not affected. It will also affect the SCOOT system which retrieves detector data from a specific location in the SNMP message. To avoid a potential rework and therefore disruption to the network, the Real Time Optimiser must be compatible with the industry standard data protocols, specifically UTMC UG405 part 2 compliant.

5.4. Detectors Infrastructure Installed On-Street

5.4.1. Current Vehicle Detection

The SCOOT system obtains information on traffic flows from detectors. 14,595 traffic detectors (inductive loops and/or magnetometers) have been sited and installed across London with over 3,890 signalled sites under SCOOT control in London.

The location of the detectors is an important factor to the effectiveness of SCOOT. The preferred configuration is to place the detectors at the upstream of the stop line. However where this is not possible detectors are placed either downstream or at the stop line. TfL have records where all the detectors are located.

Figure 1 the distribution of journey times for detectors placed upstream of the stop line.

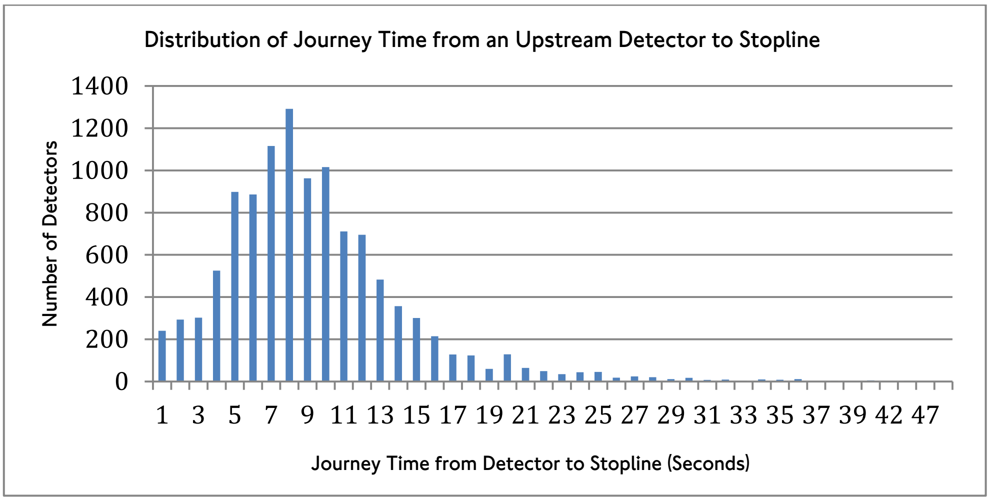
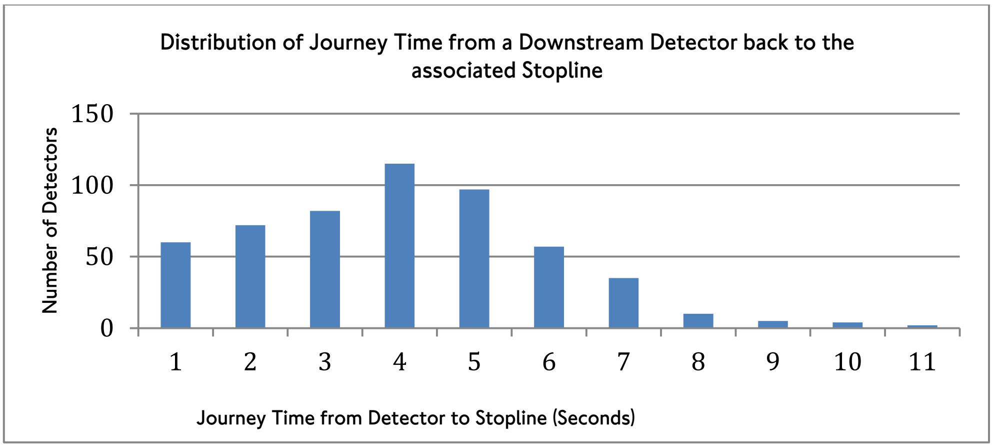


Figure 2 the distribution of journey times for detectors placed downstream of the stop line.



Detectors can be used for more than one signalled site; currently the data from 1,227 detectors are used for multiple sites within the SCOOT system.

The status of these detectors is sampled every 250 milliseconds and the data package sent to the UTC system every second. The detector data has a fixed format within the SNMP message and the configuration of the SCOOT system is set for this format.

Implications for the Real Time Optimiser

TfL has invested heavily in the existing detectors both in terms of financial value and expertise. The Road Space Management SCOOT programme continues to install additional SCOOT sites and it is not considered reasonably practicable to install a new detection system to replace the existing due to the scale of deployment and the significant cost associated with it. If the detection system is changed, TfL would have to:

- Get Traffic Control Equipment Maintenance and Related Services 2 (TCMS2) contract approval for the new detectors. The TCMS 2 contract specifies a rate card for installation of new kit and agrees service charges for successful up-time of type-approved components installed on street, therefore it needs to pass endorsement from the maintenance contractor.
- Train the engineers on how they work and how to site them.
- Install and commission them, likely to require revalidation of the SCOOT model for each SCOOT link.

The scale of changing the detection system would cause severe disruption to the road network. Therefore the Real Time Optimiser must make use of the current on street vehicle detectors currently used for SCOOT optimisation.

5.4.2. Bus Detection

Within London 3,268 virtual GPS based bus virtual detection points have been sited, validated and configured within the controller. These have been configured to detect specific bus routes i.e. to distinguish between the different bus movements at the signalled site.

When a bus passes a virtual detection point (VDP), transponders located on street send this information to the on street controller. This in turn sends a 2 second demand on a specific location within the junction controller reply bit pattern via the SNMP message.

Implications for the Real Time Optimiser
Although the locations of Bus VDP points can be changed (and at some site remotely) the new locations will need to be validated to ensure they are operating correctly and located in the correct place (issues such as parking, bus stop location, traffic queue and junction operation etc. will also need to be taken into account by time of day and day type). With 3,268 VDP points currently, this is a resource intensive task. Changes to the existing VDP would therefore have to be automated. Further, the VDP locations are programmed into the physical bus on board computer and the information is also used to inform the Countdown system. Any significant changes to the current VDP locations would therefore have major affects on the bus service.

If a new technology is used to locate buses then it will need to go through a full approval as part of the TCMS2 contract with maintenance contractors. It would have to be demonstrable that the locating and commissioning of the new technology would have minimal impact on the road network.

5.4.3. Cycle Detection

TfL are installing cycle detection monitors, which these operate using various technologies. However, the output from the detectors are identical to SCOOT vehicle detector i.e. 250 millisecond resolution which detects the presence sent to the UTC system every second.

Implications for the Real Time Optimiser
TfL has started to deploy cycle detection; the roll out is currently limited to 8 sites but is likely to expand quickly. Since the deployment of cycle detection

is currently small, there is scope for the Real Time Optimiser to deploy new technologies alongside the currently deployed detectors. The Real Time Optimiser must be able to demonstrate its ability to carry out cycle detection in order to provide business continuity.

If a new detection technology were chosen then this would also have to undergo full type approval as part of the TCMS2 contract with maintenance contractors which would be at additional time and cost to TfL.

5.4.4. Pedestrian Detection

TfL are deploying pedestrian detectors, which either count the number of pedestrians waiting to cross or the percentage of the crossing area occupied by pedestrians. The detector information is then converted into a format readable by the current UTC/RTO system.

TfL have also developed interfaces to configure and view the pedestrian detection data in real time. The views are closely integrated with what the SCOOT system is applying on street so that the Engineer has a true reflection of what is happening.

Implications for the Real Time Optimiser
The current roll out of the pedestrian functionality is on 5 sites with 37 detectors. Since the deployment is currently small, the Real Time Optimiser may introduce new technologies to deliver and enhance this functionality. There must be no degradation between the Real Time Optimiser and the current system.

If a new detection technology were chosen then this would also have to undergo full type approval as part of the TCMS2 contract with maintenance contractors which would be at additional time and cost to TfL.

5.5. Detector Calibration

Detector calibration is the heart of the SCOOT configuration and this section will therefore go into some detail to describe the configuration to draw out the level of flexibility and parameters that can be changed. The following configuration data is mapped to the detector location as received in the UTC system; this data can be used as is or converted for use in the Real Time Optimiser.

Entry Link	Normal Link	Filter Link	Exit Link

6,374	7,119	852	1,476

Key: A Link is defined as a symbolic representation of a length of road leading from one junction to another and terminating in a Traffic Signal Stop Line, where all traffic on the link receives the same signal.

- Each normal, entry and filter link has been assigned a journey time and a queue clear time measured from the associated stop line to the detector. This may be changed by the time of day and day type (weekday/weekend) from within the UTC system.
- The vehicle rate of discharge in units of Link Profile Units per second. This can be changed by time of day and day type from within the UTC system.
- The green stages at the associated junction where vehicles passing over the detector will receive a green signal at the associated junction.
- A main down stream detector has been assigned on 6,092 SCOOT links. This is where it is deemed the stop line will be significantly exit blocked when the downstream detector is permanently occupied.
- The extra green received by the traffic movement over the loop during the inter-stage periods.
    - This has been calibrated to account for demand dependent stages, variable intergreens etc. and by peak period and day type.
    - This is entered into the system using two parameters
        - Extra green time in seconds at the start of the stage (start lag)
        - Extra green time in seconds at the end of the stage (end lag)
- Extra capacity due to lane flaring at the stop line
    - These parameters have been calibrated based on traffic usage and by peak period and day type (weekday/weekend).
    - This is entered into the system using the following parameters
        - The number of approach lane to the associated stop line
        - The number of lanes at the associated stop line
        - The time in seconds vehicle (i.e. extra capacity) used by vehicles in the flared lane.
- Where appropriate additional detectors placed to measure traffic leaving/entering a link have been identified and calibrated for by the use of SCOOT composite link. There are 150 such links within the London SCOOT system. The following parameters are set in the system to provide this functionality:

    - The location of the additional detectors to be used i.e. OTU and NIB position.
    - Associated journey times from either the main detector to the supplementary detection or from the supplementary detector to the associated main detector stop line. This is dependent on the location of the supplementary detection in relation to the main detector stop line.
    - Any changes to the Link Profile Unit to vehicle conversion.
    - The green stages of the supplementary detectors if appropriate.

- Where detectors are placed near the stop line, these have been identified and configured as SCOOT stop line links. There are 430 such detectors configured within London's SCOOT system. These operate as Stop line Link within SCOOT and the operation of the junction has been calibrated to accommodate for this.

- Where there are no detectors directly available to measure the vehicle demand, reduced SCOOT has been used i.e. a virtual detector created. This allows detection data from the surround network to be used to create a virtual detector. The following information has been configured for such links
    - The appropriate detector has been identified to provide data for the virtual detector.
    - The journey time from the identified detector to the associated stop line of the virtual detector.
    - The percentage of vehicle flow from the identified detector to transfer to the virtual detector. This may be changed by time of day and day type.
    - The percentage of flow on the virtual detector that comes from the identified detector.
    - If no appropriate detector is available a uniform flow may be assigned to the virtual detector. This may be changed by time of day and day type.

There are 118 such virtual (Reduced SCOOT) detectors configured in London's SCOOT system.

Implications for the Real Time Optimiser

SCOOT detectors are calibrated by time of day and day type. The parameters used are specific to SCOOT and have been adjusted manually where required for the functionality of SCOOT. Following this they are validated to ensure correct data is being received and modelled. A significant amount of resource and engineering time has been invested in the setup/configuration of these detectors for use in SCOOT.

It is not considered reasonably feasible to re-calibrate these detectors based on resource implications and the timescales of the SITS programme. The location of these detectors may not be suitable for other RTOs and have been specifically sited and calibrated for use with SCOOT. Therefore, TfL can only consider the use of replacement detectors as part of the Real Time Optimiser if they can be automatically calibrated and offer the same amount of fine tuning as the current system.

5.6. Bus Priority

For each of the 3,268 Virtual Bus Detector Points (VDP), the London SCOOT system has been calibrated with the following parameters which may be changed by time of day and day type at pre-defined times by the UTC system:

- The location of the VDP as received within the UTC system.
- The average journey time of a bus from the VDP point to the associate stop line at the signalled site.
- The variation of the bus journey time if different to the standard 2 seconds.
- The time taken for a queue from the VDP point to the stop line to clear.
- The configured local extension timer set within the signalled site controller.
- Bus extension and recall saturation values used within the SCOOT system to control the operation of Bus Priority and the recovery from.

These VDP have been sited in relation to the SCOOT detection (i.e. downstream of the SCOOT detection).

Implications for the Real Time Optimiser

The bus VDP have been sited in relation to the SCOOT detectors (i.e. downstream of SCOOT detections). The parameters used to configure/calibrate these points are those required within SCOOT. Due to the tight integration, it would not be possible to make parameter or location changes to the VDP without significant resource effort. TfL would therefore require any new technology to have an automated way of migrating and mapping the existing VDP and associated parameters to the new system. The Real Time Optimiser must be able to not only demonstrate its capability to execute bus priority but also demonstrate this priority operating alongside other priorities in order that TfL does not lose any advanced optimisation capability that the SCOOT system currently offers.

5.7. Local Network Strategies

Signalled sites controlled by London UTC/RTO system are either controlled under Fixed Time (FT) or SCOOT control. In total there are 62,176 (SCOOT and FT) plans in London's UTC/RTO system and growing. Currently 868 signalled sites operate under FT control with 634 in the process of these being converted to SCOOT control.

The plans have been created based on TfL experience and understanding of the road network usage and output from the modelling software. The current UTC/RTO system can be run offline to fully integrate with the VISSIM model software to accurately test the plans, timetables and strategies for a multitude of scenarios.

FT plans consist of the following information:

- The cycle time for the site
- The time within the cycle at which the UTC system is to send a specific stage to the controller.
- The time in seconds a response is expected from the controller after a stage demand is sent.
- The forcing of demand dependent stages
- If there is no demand received for a stage, to which stage the extra time should go i.e. the preceding or following stage.

SCOOT controlled sites are much more complex and this is reflected in the number of parameters available to be configured to provide a multitude of control. SCOOT controlled sites consist of the following parameters which may be changed by time of day and day type at pre-defined times (timetable) by the UTC system:

- The grouping of junctions into SCOOT regions as it is deemed the signalled sites are required to be linked.
- The range of operating cycle times for each region by peak period and day type specific.
- The forcing of the double or single cycling of signalled sites in relation to the main region.
- The following SCOOT parameters have been fine tuned to ensure the junctions operate in the desired manner and within constraint set by the traffic engineer.

SCOOT parameter	Number of Links
Congestion importance factors	8,526

Link Bias	1209
Default offset defined in relation to the SCOOT plan	3,915
Split Weightings	1,236

There are 26,415 SCOOT plans in total, created for each peak period and where required for weekend peak periods. These SCOOT plans contain:

- The cycle time for the site
- The time within the cycle at which the UTC system is to send a specific stage to the controller.
- The time in seconds a response is expected from the controller after a stage demand is sent.
- The forcing of demand dependent stages.
- If there is no demand is received for a stage, to which stage the extra time should go i.e. the preceding or following stage.
- The fixing or allowing the SCOOT system to single or double cycle the signalled site within the region cycle time.

Implications for the Real Time Optimiser

The thousands of plans that have been created are critical to the operation of the network. Some of these plans are used during events and incidents based on knowledge and experience built up over the years. The Real Time Optimiser must be able to migrate and reuse these network plans. If new parameter settings are required this would need to be checked and this is likely to be an unrealistic exercise due to the number of plans in operation. The Real Time Optimiser must make use of the existing plans otherwise severe network disruption and significant change to the regular network users would arise.

In addition TfL do not want to lose any of the subtle nuances that have integrated into the plans base on in depth understanding of the current UTC/RTO system.

5.8. Advanced Network Strategies

Through the SCOOT system a number of advance strategies have been implemented and functionality of these must be recreated in the Real Time Optimiser using the same parameters currently used or by providing an automated migration plan/technique.

- SCOOT Ghost staging, implemented at 106 sites using the following parameters
    - GASS, Ghost Assessment Period, the number of cycles to assess ghosting.
    - GTLO, Ghosting Threshold Lower Limit, used to control when stages start to Ghost.
    - GTUP, Ghosting Threshold Upper Limit, used to control when stages stop Ghosting.

- SCOOT Cycle Time Independence (SCTI), currently implemented in 52 SCOOT regions using the following parameters
    - The upper and lower limits to allow and remove SCTI based on network vehicle delay.
    - Data smoothing factors.

- Link maximum Saturation (SCOOT GOLD) currently implemented at 70 SCOOT links using the following parameters
    - Desired link saturation value
    - Multiplier to control how strongly to keep the link at the desired saturation value.

- SCOOT Gating, currently there are 337 SCOOT Gating Clusters configured within the system. The following information is used to configure these
    - Title for the gating cluster
    - Links to trigger the gating and associated trigger thresholds (saturation and SCOOT congestion)
    - Link to gate and the upper and lower green time to implement
    - The decision to increase or decrease the green time for the gated link.

- London's UTC system has the capability to group commands together and implement them through one command. There are 3,376 procedures, with 2,973 associated cancel procedures to revert the changes if required.

  These procedures can contain any user command within the UTC and SCOOT system. Boolean logic commands (such as 'wait', 'if' etc.) can also be used within these procedures.

The SCOOT system allows coordination between sites to be permanently fixed through the configuration of SCOOT multi-nodes. The majority of the multi-nodes contain 2 sites; multi-nodes can contain up to 7 sites.

- As part of the advanced features available within SCOOT the following SCOOT parameters have been set to implement the desired strategy:

SCOOT parameter	Number of Links
Offset Weightings	135
Congestion Offsets and Congestion Weightings	126
Congestion link of links, weighting importance factors and link Congestion weighting	1,256

Implications for the Real Time Optimiser
SCOOT has been developed with TfL to tackle the challenges faced in London. A lot of the functionality is specifically for London such as SCOOT Gold used during the Olympics. The Real Time Optimiser must provide the same functionality and use the current system settings to migrate to the Real Time Optimiser either via an automated transition or by simply using the same settings.

There can be no degradation to the existing functionality as this will directly affect the network performance and user experience.

5.9. UTC Integrated Strategies

TfL uses a System Activated Strategy Selection (SASS) tool. This system reads information from the UTC/RTO system and based on Boolean logic will implement a set of commands while running through pre-set timers.

There are 106 SASS incidents configured with on average each containing 4 or more scenarios. This system is bespoke to London and is integrated with the UTC system.

5.10. The UTC Environment

TfL have invested in the development of visualisation and interface tools. Currently the following tools are available to London Traffic Control Engineers.

- Gater (SCOOT Component)
    - GATER is a SCOOT Gating Cluster monitoring display designed to simplify the use of Gating by amalgamating the various SCOOT Messages and parameter into a single Graphical user Interface (GUI).
- Grapple (SCOOT Component)
    - Grapple is a graphical display program which shows the operation of the SCOOT offset optimiser at a node. It displays the delay–offset relationship for the links involved in the optimisation and the overall delay–offset relationship for the node. It is updated every region cycle when the offset optimiser runs.

- SCODA (SCOOT Component)
    - SCOOT data is compiled using SCODA. SCODA operates on a client-server basis; the client software is resident on the desktop.

- SLiVa (SCOOT Component)
    - SLIVA is a SCOOT Link Validation display that gives you a visual representation of the queue model, the validation messages with a scrolling history, the relevant link parameters and the ability to change them and a scratch-pad for making comments about the validation.

- Sphinx (SCOOT Component)
    - The Sphinx Node Split History display is a tool for investigating the behaviour of a node. The main display is a pie-chart of the SCOOT stage lengths of the node with a time-now indicator moving around the chart showing the progress through the cycle.

- Vega (SCOOT Component)
    - Vega is a graphical display program which shows the operation of the SCOOT traffic model on a link. It displays the flow arriving on the link (Cyclic Flow Profile), the effective reds and greens, and the corresponding variation of the queue on the link over one cycle. It is updated continuously to correspond with current traffic behaviour on street.

- ASPIC (front-end to ASTRID)
    - ASTRID is a reporting service used for analysing some of the data mined out of the SCOOT system and can be graphically represented by ASPIC and is useful for traffic engineers.

Implications for the Real Time Optimiser

This implications section relates to 5.9 and 5.10 above.

As a consequence of UTC being developed to work intrinsically with SCOOT, we would require a UTC product which is capable of working with our RTO.

Suppliers would need to either utilise our own UTC system or provide one which is capable of working with the SCOOT solution and infrastructure.

6. Market Analysis

6.1. Absence of competition

TfL has undertaken an extensive desktop assessment exercise with a view to ascertaining whether there are any viable alternative products to TfL's existing SCOOT system within the marketplace that could meet the RTO Requirements identified at Section 2.

Under EU procurement regulations, TfL is obliged to tender the RTO Requirements unless it can rely on a specific exemption for use of the negotiated procedure without prior publication (one of which is where competition is absent for technical reasons).

Our analysis demonstrates that competition is absent for technical reasons. The results of our analysis are set out below in which we explain our reasons why the alternative products available in the market that we have examined would not meet the RTO Requirements.

6.2. Alternative products

The constraints below are all unique, for the purposes of calling out material concerns in the products which we assessed. However they are displayed in this fashion to avoid duplication in the document.

Product A

- The supplier system is not designed to be used within the required UTC environment, but rather operated by the street signal controller at isolated junctions or linked junctions.
- The supplier system has limited settings, which would be required by engineers to manipulate the operation.

- The supplier system requires a different detection system to the current TfL system, which uses loop/ magnetometers where a high level of investment has taken place.
- The supplier system provides bus and Tram priority based on timers, but is not intelligent enough to ascertain the prioritisation impact has to other traffic .
- The supplier system does not provide facilities required to control the timings and junction linking that is required in dense, coordinated networks within inner London.

Product B

- The supplier system has limited coordination between sites within dense/ congested networks such as inner London
- The supplier system is subject to loss of detection, when this occurs it reverts to a more basic localised control mechanism using fixed times, which is not acceptable for inner London.
- The supplier system can only provide limited advanced techniques to implement specific network strategies under predefined conditions.
- The supplier system can only optimise for vehicle traffic and no other modes.

Product C

- The supplier system is not a real time optimiser, but a signal plan selection tool, this is acceptable, but a much larger detection coverage is required in order to fully represent changing traffic patterns during incidents and events.

Product D

- The supplier system is not geared for closed, dense networks found in inner London and is more so tuned for highway intersections
- The supplier system does not provide the required full offset optimise functionality of the current system where every cycle can be optimised depending on the prevailing traffic flow.
- The supplier system solution would be severely compromised if it were to use the current TfL detection mechanisms of loop/ magnetometers.

Product E

- The supplier solution only optimises the network control every 10 to 20 minutes, whereas a second by second optimisation is required.

Product F

- The supplier solution is not specifically optimised for inner London's dense urban networks, it is more so optimised for large interchanges.
- The supplier solution requires a combination of upstream and stop line detectors in order to optimise correctly.

Product G

- The supplier solution may not be particularly effective in dense networks where there are multiple transport routes in conflict with one another
- The supplier solution does not optimise to the level of granularity that the current solution does.
- The supplier solution requires accurate, frequently maintained detection to mitigate and manage their optimisation method.

Product H

- The supplier solution would require a paradigm shift from existing adaptive control to a more dynamic methodology.
- The supplier solution requires additional supplier specific hardware to be installed at each site.
- The supplier solution would require further detection to be installed to carry out the optimisation, not all of TfL's junctions are setup detection wise in the way the supplier would require.

7. Proposed Commercial Arrangement

7.1. Partnering Arrangement

TfL intends to establish a commercial partnering arrangement with a strategic supplier regarding the development of the Real Time Optimiser. TfL currently anticipates this would be through either a corporate or a contractual joint venture although all options are being considered. TfL is committed to establishing a market leading Real Time Optimiser which works for London.

TfL also requires that the Real Time Optimiser developed under the commercial arrangement would be provided back as a service to TfL.

7.2. Intellectual Property

As a general principle each party to the commercial arrangement would retain ownership of its pre-existing IPR, but TfL would require licences of supplier IPR akin to ownership where relevant (e.g. so TfL can use SCOOT or the viable alternative product in connection with its business prior to the development of the Real Time Optimiser, and to the extent supplier IPR forms part of the Real Time Optimiser).

All future developments/improvements to the current version of SCOOT / viable alternative product would be jointly owned by TfL and the commercial partner and appropriate rights and restrictions would be put in place as part of the commercial arrangement.

7.3. Mutual Development

TfL will work with the commercial partner to develop the SCOOT or viable alternative product to enable increased functionality within the existing environment, but it is important that both parties are committed to developing the Real Time Optimiser into something which can work within the changing environment of Intelligent Transport Systems for the next 10+ years.

The investment from each party for the development of the Real Time Optimiser will be agreed as part of the proposed commercial arrangement. TfL is expecting to make a significant financial investment (£millions) in the Real Time Optimiser.

7.4. Commercial Exploitation

TfL expects that the commercial partner would commercially exploit the Real Time Optimiser once developed, and that TfL would share in any exploitation revenue against an agreed revenue sharing arrangement. TfL would provide resource and expertise during any bidding process which the commercial partner undertakes as part of the commercial exploitation.

7.5. UTC

TfL has developed its own UTC system, which it owns the IP rights to. TfL's UTC capability and associated IPR will be made available to the commercial arrangement as appropriate, adding value to the proposition and also securing at least TfL's existing level of capability.

8. Proposed Direct Award

The Public Contracts Regulations 2015 allow for authorities to use the negotiated procedure without prior publication where the services in question can be supplied only by a particular economic operator where competition is absent for technical reasons provided no reasonable alternative or substitute exists and the absence of competition is not the result of an artificial narrowing down of the parameters of the procurement (Regulation 32(2)(b)(ii)).

TfL is carrying out this market engagement process in order to confirm whether or not there are any alternative providers which can feasibly satisfy the RTO Requirements and therefore whether or not it is in a position to rely on this specific provision in these 2015 Regulations. TfL has already set out at Section 6 above some of the technical reasons why it believes competition for the RTO Requirements is absent.

9. Legal Notices

Neither the receipt of this document by any person, nor the supply of any information is to be taken as constituting the giving of investment advice by TfL or any of its advisers to any supplier.

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No information in this document is, or should be relied upon as, an undertaking or representation as to TfL's ultimate decision in relation to the agreement. TfL reserves the right without prior notice to change the procurement process detailed in this PIN or to amend the information provided, including, but not limited to, changing the timetable, the scope and nature of the procurement and the procurement process. In particular, TfL reserves the right to issue circulars to suppliers providing further information or supplementing and/or amending the procurement process for this PIN. In no circumstances shall TfL incur any liability in respect of any changes. This will be subject to the requirements of public law, the UK and EU procurement rules and Treaty on the functioning of the European Union rules and general principles.

Direct or indirect canvassing of the Mayor, any members of the Greater London Authority, employees, directors, board members, agents and advisers of TfL and any of its subsidiaries by any person concerning the PIN or any related procurement process and any attempt to procure information from any of the foregoing concerning the PIN may result in the disqualification of the person and/or the relevant organisation from consideration during the market engagement or for any associated procurement.

TfL reserves the right without prior notice not to follow up this document in any way or with any interested parties. TfL also reserves the right to terminate this process at any time without awarding an agreement. TfL will not enter into a contract based solely on the responses to this PIN and no information contained in this document or in any communication made between TfL and any supplier in connection with this shall be relied upon as constituting a contract, agreement or representation that any contract shall be offered in accordance with this PIN.

10. Glossary

Term	Definition
FT	Fixed Time
Ghost staging	A ghost stage is defined as a demand dependent stage that has not been included within the optimisation model when calculating the node minimum cycle time, with the purpose of reducing the region cycle time.
GASS	Ghost Assessment Period
GTLO	Ghosting Threshold Lower Limit
GTUP	Ghosting Threshold Upper Limit
OTU	Outstation Transmission Unit
NIB	Nibble
PIN	defined in Section 2.1
RTO	Real Time Optimiser
RTO Requirements	defined in Section 2.2
SCTI	SCOOT Cycle Time Independence
SITS	defined in Section 1
SCOOT	Split Cycle Offset Optimisation Technique
SLA	Service Level Agreement
SNMP	Simple Network Management Protocol
TCMS2	Traffic Control Equipment Maintenance And Related Services Control 2 Contract
UTC	Urban Traffic Control
UTMC	Urban Traffic Management and Control
VDP	Virtual Detection Points
VISSIM	Verkehr In Städten - SIMulationsmodell (German for "Traffic in cities - simulation model"

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EVERY JOURNEY MATTERS