

Transforming Cities Fund - Nottingham & Derby Providing Centralised Traffic Signal Bus Priority Via East Midlands

Introduction

The Transforming Cities Fund (TCF) aims to improve productivity and spread prosperity through investment in public and sustainable transport in some of the largest English city regions and was first announced in November 2017.

Derby and Nottingham submitted a combined bid and were successful in receiving funding in the first tranche of TCF funding with a value of £8.4m which included a £5.045m Public Transport Technology Package.

This paper explains the development and implementation of one keystone of the public and sustainable transport infrastructure in Derby & Nottingham – Central Bus Traffic Signal Priority.

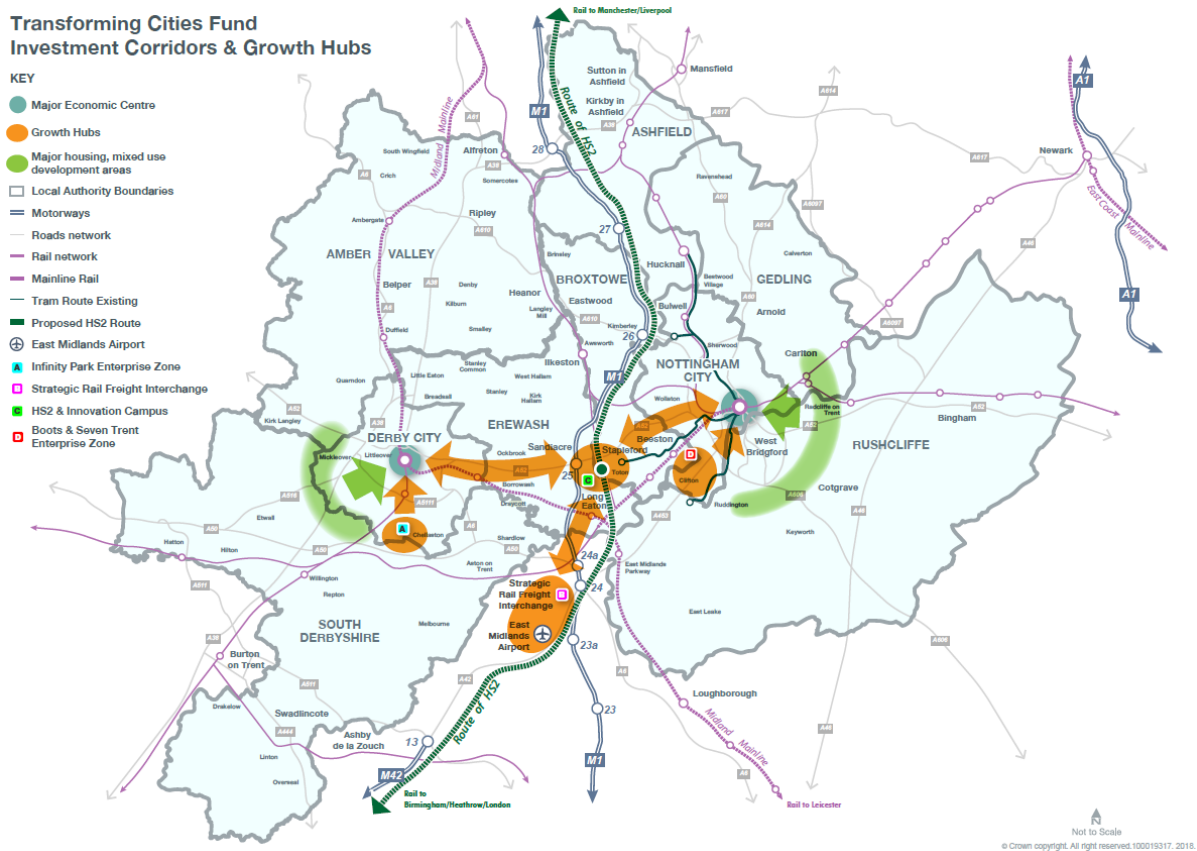


Figure 1 - Derby & Nottingham Transforming Cities Bid Area

Local Bus Traffic Signal Priority

Nottingham and Nottinghamshire has a long and varied history of providing bus priority at traffic signals. Methods of detecting buses in mixed traffic lanes have varied over the years. Tag based local detection systems such as Siemens SIETAG have been installed, Microsense MSEL and Applied Traffic algorithm detector pack systems and local radio systems such as the INIT LISA system.

Between 2012 and 2018 over 70 junctions were fitted with the INIT LISA bus priority system which uses local bus radio to transmit a request from the bus to the local traffic signal

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controller allowing bus priority to be implemented through local Hurry Calls, MOVA or sent back to SCOOT for central control. The advantage of the INIT LISA unit system over the loop detection systems is the bus request trigger can be set to only activate if the bus is behind schedule. The disadvantages of the INIT system is it is only used by Nottingham City Transport and one Trent Barton route within Nottingham and the surrounding area. The system requires bespoke equipment on the bus and within the traffic signal controller. The system also requires bespoke equipment in the bus operator back office.



Figure 2 - Local Bus Priority

The local radio system requires management and maintenance of street equipment. There is also little feedback on the operation and frequency of bus priority requests.

Centralised Traffic Signal Bus Priority

A central traffic signal bus priority system requires the bus to monitor its GPS position and when it reaches predefined locations the bus will generate a priority request trigger message. The priority trigger message is sent back to the system suppliers back office server. The back-office server then forwards the request to the appropriate UTC system, usually via a virtual private network (VPN). The priority request can be used to request priority at the traffic signals being approached by the bus.

Via East Midlands (ViaEM) was commissioned by the Derby & Nottingham Transforming Cities Area to project manage the provision and system implementation of a centralised traffic signal bus priority system. Via East Midlands is a company owned by Nottinghamshire County Council and provides sustainable highways services for Nottinghamshire and across the wider East Midlands region.

The central traffic signal bus priority solution requires no additional bus equipment as the requests are processed and sent through the electronic ticket machine



Figure 3 – Basic Central Bus Priority

The complications of providing central traffic signal bus priority multiply when dealing with multiple highway authorities, Urban Traffic Control (UTC) centres and Bus Operators.

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The area has the following Highway Authorities:

- Nottingham City Council
- Derby City Council
- Nottinghamshire County Council
- Derbyshire County Council
- Highways England

Traffic Signal junctions in the region are currently connected in to two UTC Centres – with Derbyshire County planning to develop a UTC Centre

1. Nottingham City / Nottingham County / Highways England located in Nottingham
2. Derby City
3. (Derbyshire County Council planned UTC Centre)

The major Public Transport Operators in the area:

- Nottingham City Transport
- Trent Barton
- Stagecoach
- Arriva
- CT4N
- Marshalls

To provide central traffic signal bus priority over the large geographical area covered by Nottingham & Derby TCF a modular and scalable approach was required. The decision was made to implement a central system for bus traffic signal priority and to pass the traffic signal priority requests through a Traffic Signal Priority (TSP) Data Broker.

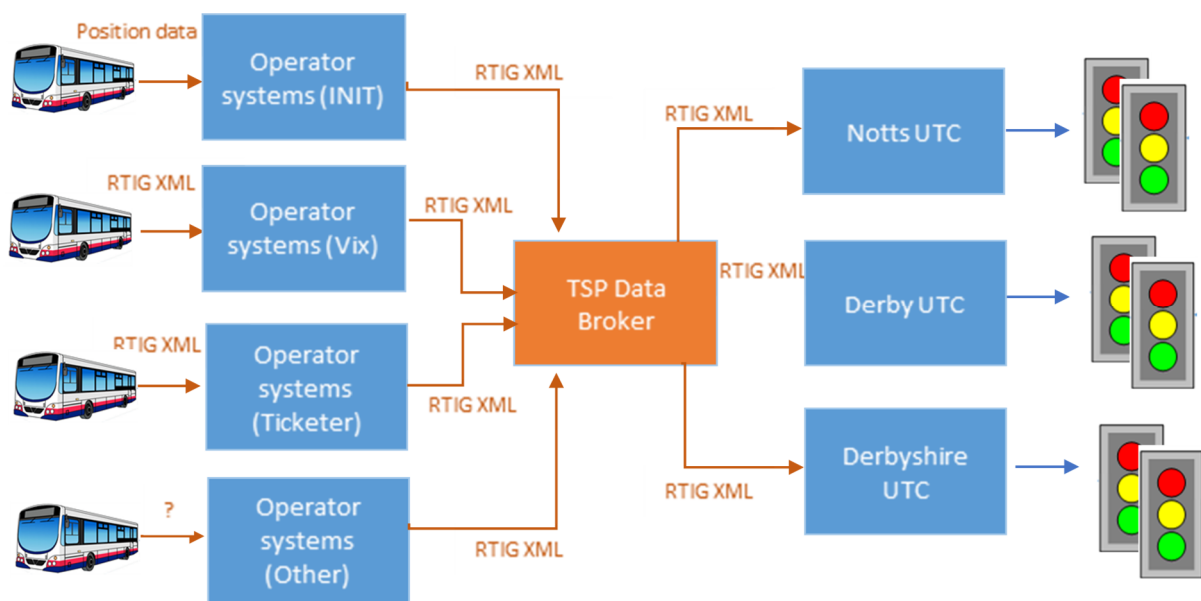


Figure 4 - Central Bus Priority Data Broker TCF Nottingham & Derby (source Ben Hallworth)

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Benefits of Bus Traffic Signal Priority Through a TSP Data Broker

The proposal to introduce a TSP Data Broker reduces the number of connections from operator systems to UTC's which minimises connection costs and linkage failures. The TSP Data Broker will handle different connection types from different operator systems.

The TSP Data Broker can be programmed to send only the bus requests that are required to the UTC server. This enables filtering of the bus requests and prioritising of bus requests for particular routes and particular times of day. This granular approach may not be necessary for most junctions but can be used at particular locations in a targeted way to maximise bus benefit whilst balancing delays to other users.

The TSP Data Broker solution allows cross boundary bus movements to send requests to different UTC systems as they cross from one UTC area to the next. The TSP Data Broker solution also enables priority requests to be monitored and dashboards to be produced automatically for all system data.

Trapeze Group NOVUS-TLP Data Broker

The NOVUS-TLP system was selected to provide the TSP Data Broker for the bus priority system across the Derby & Nottingham Transforming Cities Fund area. The NOVUS-TLP provides all the benefits of the Central Bus Priority Data Broker solution. The system has a web-based data input for junction trigger data and dashboard monitoring.

Junction triggers are located on the approaches to the traffic signal junction and on the exits from the junction. The junction triggers are placed in the system using a web interface. Users can therefore access the system from a variety of devices and locations, perfect in the event of a global pandemic. Junction triggers are placed and can be moved interactively on a map. ViaEM have been populating the system with junction details and trigger locations during the summer of 2020.

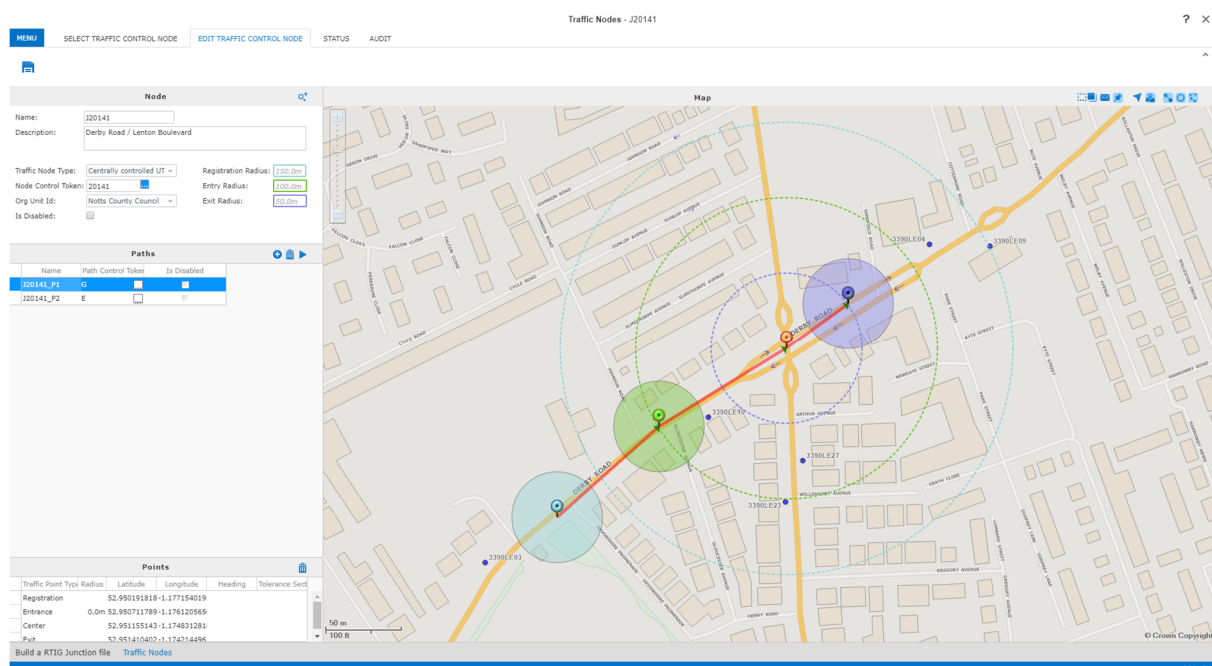


Figure 5 – NOVUS -TLP Bus Priority Trigger Input Interface

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The trigger locations are exported from NOVUS-TLP as a file from the web page which is uploaded into the bus operators ticket machine systems. A vehicle with the correct criteria including location, direction and route entering the trigger zone will send a trigger through to the NOVUS-TLP TSP Data Broker. The TSP Data Broker will then pass the request for priority onto the relevant UTC for the junction.

ViaEM have been working with Trapeze on the NOVUS-TLP dashboards to enable simple and timely monitoring of bus priority request through the system. The TSP Data Broker and bus operator feeds have been configured to pass all trigger requests into the system even if the bus is ahead of schedule. This volume of requests enables monitoring of trigger levels to highlight drops in system performance or linkages into the system that can be investigated.

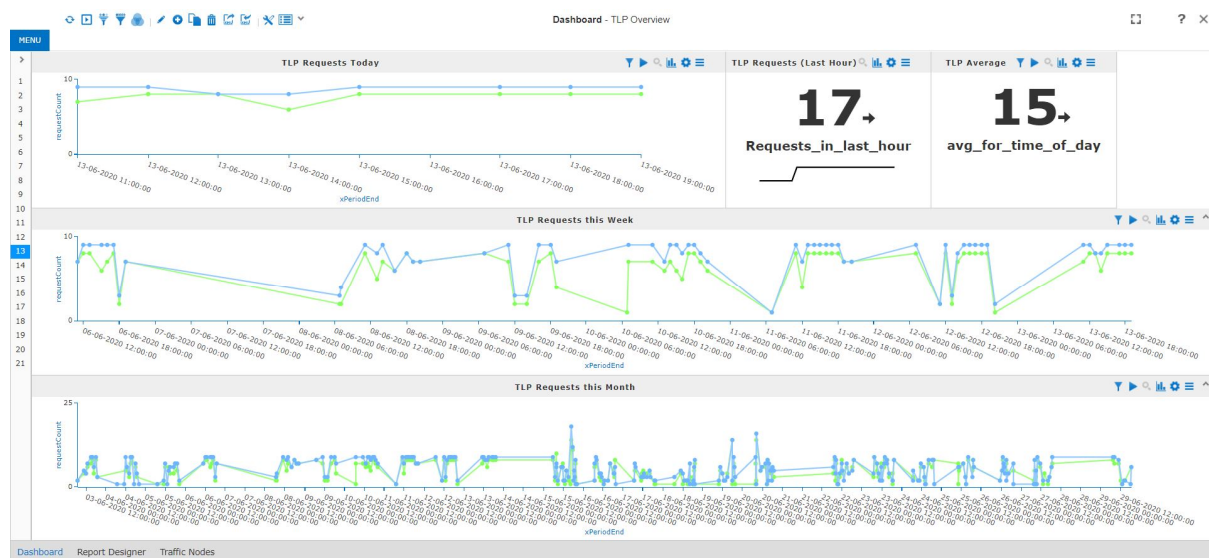


Figure 6 – NOVUS -TLP Bus Priority TLP Overview Dashboard

To enable a targeted approach to improving junction performance for public transport services a dashboard view has been developed that highlights the highest and lowest average travel time through junctions within the system.

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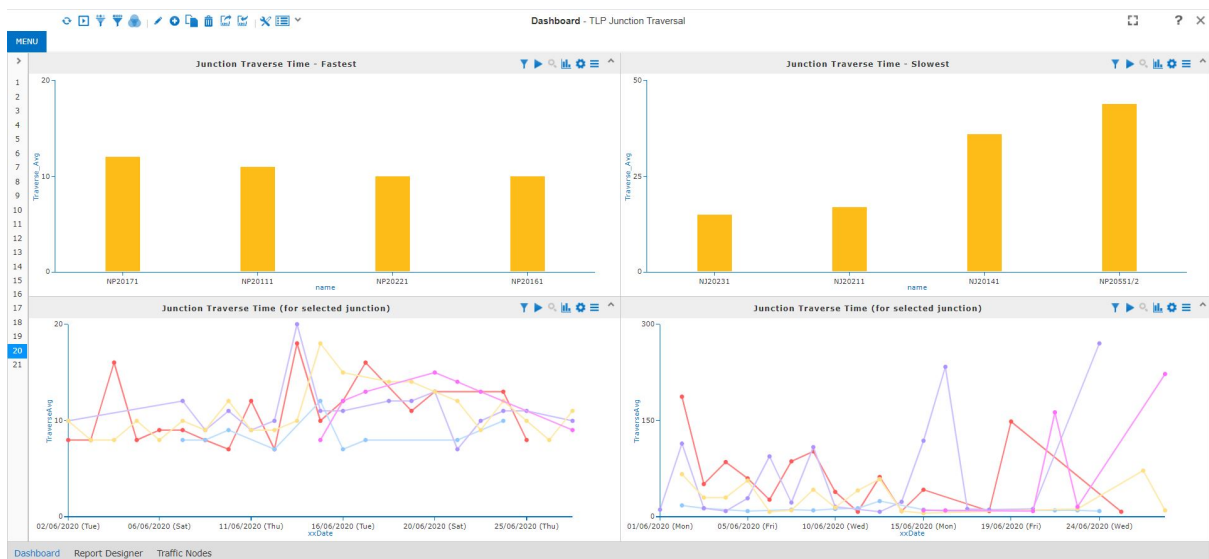


Figure 7 – NOVUS -TLP Bus Priority TLP Junction Traversal Dashboard

This dashboard enables engineers to assess where junctions are causing significant delays to bus services. The data can be filtered by day and time to narrow down when junction performance is an issue. Using UTC junction timing logs and CCTV recording could allow for specific improvement strategies to be developed and implemented to improve public transport service journey times and reliability.

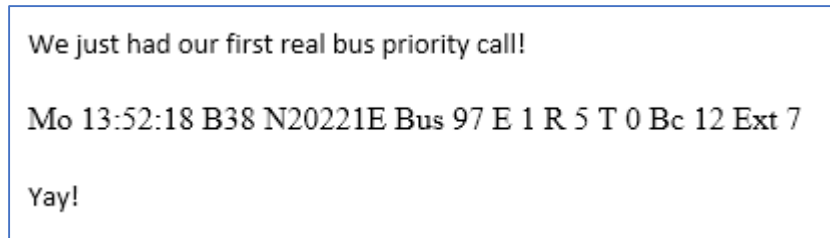
Derby & Nottingham Centralised Traffic Signal Bus Priority Implementation

The bus operator CT4N was chosen as the test operator for phase 1 of the central bus priority junction implementation along Derby Road between Nottingham City Centre and QMC Hospital. Junction upgrades were carried out to junctions and pedestrian crossings along this corridor during summer 2019 to provide SCOOT control and enable central bus priority. These junction upgrades were project managed by ViaEM for Nottingham City Council.



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The Nottingham Siemens UTC system was upgraded to enable central bus priority and to accept the VPN connection from the NOVUS-TLP Data Broker during spring 2020. Ticketer provide ticket machines for CT4N and the connection from the Ticketer server into the NOVUS-TLP system was also completed and commissioned in spring 2020. Following SCOOT database setup and testing, this was a very proud moment:



We just had our first real bus priority call!

Mo 13:52:18 B38 N20221E Bus 97 E 1 R 5 T 0 Bc 12 Ext 7

Yay!

Figure 8 – First Bus Priority TLP Message

Nottinghamshire County Council also provided funding during 2019-2020 to upgrade junctions around Mansfield Town centre and the corridor out to Kings Mill Hospital.

As of August 2020 there are 237 junctions in the Derby & Nottingham NOVUS-TLP TSP Data Broker system.

Derby & Nottingham Centralised Traffic Signal Bus Priority - The Future

Derby & Nottingham area were successful in a bid for Transforming Cities Fund 2 (TCF2) funding to a value of £161 million. The provision of bus priority using the centralised system is a significant part of the proposals with traffic signal upgrades specified at 64 junctions in Nottinghamshire and 68 installations in Nottingham City. Junction upgrades are also planned for sites across Derby City and Derbyshire as part of TCF2.

Trent Barton have a Ticketer based system and are planning to connect into the bus priority system during autumn 2020. Stagecoach have a ticket machine and back office system provide by VIX and are also planning to connect into the system in summer of 2020. These connections will dramatically increase the number of buses sending requests through the system.

As part of any traffic signal installation upgrade or refurbishment scheme connection into the bus priority system will be part of the standard specification. ViaEM will be designing and project managing TCF2 upgrades over the next 3 years, so a busy time ahead.