

Birmingham Eastside Extension

ES Volume 2 Technical Appendix L2 Transport Assessment

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West Midlands Combined Authority

Mott MacDonald

Birmingham Eastside Extension

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1 Introduction

1.1 Introduction

The purpose of this Transport Assessment (TA) is to support the Transport and Works Act Order (TWAO) application for the Birmingham Eastside Extension (BEE) by assessing the impact the proposals have on the highway network, highway users (both motorised and non-motorised), and public transport users. Impacts resulting from the scheme's introduction may be positive or negative. Where a negative impact is identified appropriate mitigation measures have been considered.

The scope of works undertaken for this TA builds upon the BEE Scoping Report that was submitted to Birmingham City Council (BCC) on 6 May 2015 (see **Appendix A**). Subsequent to this, BCC confirmed in an email dated 30 December 2015 (to the Department for Transport) responding to the Environmental Impact Assessment (EIA) scoping opinion consultation that the scope of works had been agreed with Transport for West Midlands (TfWM) and Mott MacDonald.

The TA considers the impact of the proposed scheme on the following transport receptors:

- Traffic
- Buses
- Light Rail
- Heavy Rail
- Coaches
- Active Modes (walking and cycling)
- Parking
- Taxis
- Access and Servicing
- Road Safety
- Emergency Services.

1.2 Existing Midland Metro Routes

The Midland Metro is an extensive, electrically powered light-rail / tram connecting Wolverhampton City Centre with Birmingham City Centre. The existing Midland Metro links key areas and local centres along the route such as West Bromwich and Wednesbury.

Line 1 (Wolverhampton to Birmingham Snow Hill) was opened in 1999 and consisted of 20.1km of mainly reserved track, with a short on-street section in Wolverhampton. There were 23 stops along the route, including three with National Rail interchanges and four park & ride sites. At peak times, eight trams departed Birmingham Snow Hill (Wolverhampton bound) per hour.

The Birmingham City Centre Extension (BCCE) recently saw the route extend from Snow Hill Station to New Street Station, with intermediate stops on Bull Street and Corporation Street. From 6 December 2015, services ran through Snow Hill to Bull Street (the first time trams to have run in the city centre since they were withdrawn in 1954). The final part of the BCCE (Bull Street to New Street Station) opened on Monday 30 May 2016.

There are now 26 stops along the Midland Metro route, with a peak frequency of 10 trams per hour in each direction. The system currently carries five million passengers per year.

1.3 Future Midland Metro Expansion

The provision of a Light Rail Transit (LRT) System is a core element of the Local Transport Plan for the West Midlands. BCC and TfWM have been and are currently developing various extensions to the existing Midland Metro Line 1.

These are as follows:

- Centenary Square Extension (CSQ) - TWAO approved
- Edgbaston Extension (EDGE) - TWAO approved
- Wolverhampton City Centre Extension (WCCE) - TWAO approved
- Wednesbury to Brierley Hill Extension (WBHE)
- Birmingham to Eastside Extension (BEE)
- East Birmingham to Solihull Extension (EBS).

The proposed route for the BEE is shown in **ES Volume 2 Technical Appendix A**. BEE consists of a 1.7km twin track extension to the Midland Metro network forming a delta junction with the BCCE line at the junction between Corporation Street and Bull Street. BEE will provide a link to regeneration areas and transport hubs. The extension will consist of both segregated and shared use track.

1.4 Proposed Study Area

1.4.1 Baseline Conditions

The Birmingham 'Big City Plan', launched in September 2010, has designated the Eastside area (170 hectares) as an "area of transformation". The Eastside area is home to the largest physical regeneration project in Birmingham aimed at transforming and revitalising a previously neglected part of the city centre. The Eastside area is home to Eastside City Park, which is the first new park in the city in 125 years, as well as Millennium Point (a science, technology and education centre) which attracts over one million visitors per year. Aston University, Birmingham City University, Ormiston Academy and Birmingham Metropolitan College are also located in the Eastside area and would benefit from an improved public transport network.

Rail, bus and coach all currently provide public transport links in the Eastside area (see **Appendix B** for locations of these transport hubs). These public transport networks would benefit greatly from tram connections to the city centre, Wolverhampton, and the proposed extensions.

1.4.2 Future Growth

BCCs emerging Core Strategy provides a city-wide framework for future change in Birmingham. The city's ambitious growth agenda is set to meet the needs of a growing population whilst creating a stronger economy. As described in the emerging Core Strategy, the city centre is Birmingham's greatest asset, and

the in-depth Big City Plan produced by BCC (2010) highlights many extensive growth opportunities within the city centre. The Big City Plan is a physical regeneration and strategic planning tool presenting a 20 year vision (to 2031) set to transform 800 hectares of the city centre to help create a world class global city.

The Big City Plan provides a framework for Birmingham to:

- Help contribute £2.1 billion to the economy per annum over the next 20 years
- Create a well-connected, efficient and walkable city centre
- Provide 28 kilometres of enhanced walking and cycling routes
- Create over 50,000 new jobs
- Provide 5,000 new homes
- Integrate sustainable development and address the impact of climate change
- Deliver five areas of transformation supporting the growth of the City Core.

Proposals in the Big City Plan to provide 50,000 new city centre jobs, for example, will add significant pressure to the existing transport network. Therefore, improved connectivity is vital in securing the city's success as is evident in the emerging Core Strategy and in recent investment, including the £600 million New Street Gateway project and £300+ million on extending the Midland Metro through the city centre. In addition, new exits towards the south side of New Street Station will galvanise the regeneration of its southern neighbourhoods and connect the Smithfield area and new Curzon HS2 hub to the city centre. The northern exit links to the Midland Metro.

The 22 hectare site labelled the "Southern Gateway" occupies a key strategic location connecting the Bullring, City Core and business district. The area has major development opportunity with close proximity to major transport links, such as New Street Station, Moor Street Station and the proposed HS2 terminus. Southern Gateway is also proposed to be served by the Midland Metro.

To capitalise on Birmingham City Centre's potential, it is important to connect the city centre to the wider metropolitan area. In 2013, 1.6% of city centre commuters in the morning peak used the tram system[1]. Midland Metro expansion, along with further investment within an integrated public transport network, will raise accessibility levels across the city, supporting BCCs vision to create a world class city.

1.4.3 High Speed Rail

Birmingham's long-term future is also reliant on high-speed rail. Population increases and economic changes are predicted to double the demand for journeys between Birmingham and London by 2043[2]. Upgrading existing infrastructure is providing the means to cope with increasing demand at present, but the proposed HS2 line will provide a significant capacity increase for passengers and freight within the UK, whilst providing improved links to continental Europe. The proposed terminus station at Curzon Street in Birmingham (see **Appendix B** for location) will be one of the largest new stations built in Britain in the last

1 West Midlands Integrated Transport Authority (2015) West Midlands Travel Trends

2 HS2 (2011) Demand for Long Distance Travel

100 years, with an estimated 25,000 passengers per day when it opens in 2026[3]. The BEE will link the terminus station with other central Birmingham stations connecting onward journeys to the wider rail network.

Significant national and local economic benefits are predicted as a result of HS2, with a predicted 26,000 jobs to be created as a result of the development in Birmingham and Solihull alone. A £4bn increase in economic output per year is also forecast for Birmingham as a result of HS2, and it is therefore vital that the wider metropolitan region can access the benefits of such development. This is highlighted in the HS2 West Midlands Connectivity Package[4] which emphasises the importance of linking the HS2 Curzon Street Station with other modes of public transport.

Significant heavy rail investment in the Curzon area has triggered a "Curzon Street HS2 Masterplan" (see **Appendix B** for masterplan area) formally adopted by BCC in August 2015. Curzon Street Station will act as a catalyst for regeneration in Birmingham Eastside, unlocking many regeneration sites. The Masterplan seeks to ensure that the station is fully integrated into the urban fabric of the city centre, requiring high quality walking, cycling and public transport connections continuing into the city centre and throughout the wider city. A key proposal of the Masterplan is therefore the Midland Metro extension through to Birmingham's Eastside. The economic advantages of rapid transit networks are well documented and, again, an integrated transport network consisting of the Midland Metro extension to Eastside will facilitate and encourage such development

1.5 Birmingham Eastside Extension (BEE) Proposals

Seven route options from Bull Street to the proposed HS2 station were initially considered by Mott MacDonald in a report dated 2014[5], and these options are summarised in Table 1.1.

Table 1.1: Initial Route Options for Birmingham Eastside Extension

Option	Description
1	Option 1 would run from Bull Street to High Street, Carrs Lane, Moor Street Queensway, Park Street and Curzon Street.
2	Option 2 would run along the southern edge of the Martineau Galleries re-development and on Albert Street. It would then follow Moor Street Queensway towards Curzon Street, similar to Option 1.
3	Option 3 would start at the Bull Street /Corporation Street junction and run through the Martineau Galleries Phase 2 re-development. It would then run on Moor Street Queensway before terminating at the Millennium Point within the Eastside Quarter.
4	Option 4 would start at Bull Street and run through the northern part of the Martineau Galleries re-development. It would then follow Priory Queensway, Masshouse Lane and Park Street before terminating at Millennium Point.
5	Option 5 would run in front of the Wesleyan Building. It would then turn towards Priory Queensway to follow the remainder of the route similar to Option 4.

[3] HS2 (2014) High Speed Two Information Paper, H4: Birmingham Curzon Street Station

4 TfWM – HS2 Unlocking the Benefits, West Midlands Connectivity Package

5 Mott MacDonald (February 2014) Midland Metro Phase 2 High Speed 2 Link

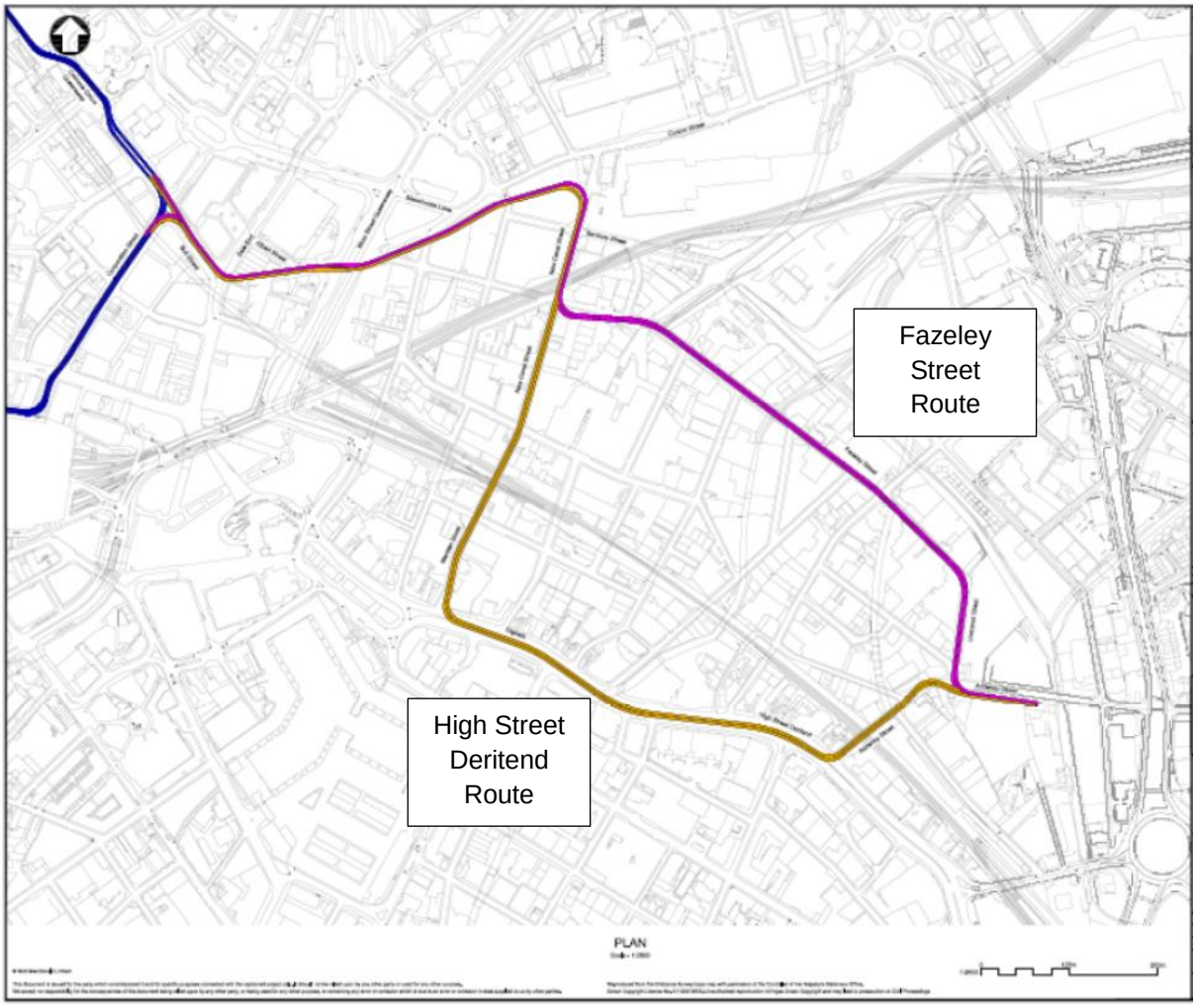
Option	Description
6	Option 6 would start at New Street / Corporation Street, continuing along New Street and High Street before either joining Option 1 into Carrs Lane or continuing on to pass through the proposed Martineau Galleries Phase 2 re-development
7	Option 7 is comprised of an eastbound track along the line of Option 2 and a westbound track along the line of Option 1.

Five options were dismissed, and route options 1 and 2 were presented at public consultation over 4 weeks from 27 February to 28 March 2014. Of the two route options considered, Option 2 received more positive comments from respondents.

Subsequent to this, further development of the BEE scheme was undertaken. This looked at extending the proposed alignment beyond the proposed HS2 station to serve Digbeth to the south and extend towards Watery Lane Middleway, whilst integrating with the development work for the Curzon Masterplan.

Continuing from the HS2 station, several route options were considered, and the final two route options to be taken forward to public consultation are shown in Figure 1.1.

Figure 1.1: Illustration of the Original Fazeley Street and High Street Deritend Proposed Routes



Source: Steer Davies Gleave (February 2015) Initial Outline Business Case, Birmingham Eastside Extension

The route options were as follows:

- Fazeley Street Route
- High Street Deritend Route.

The Fazeley Street route was proposed to run along Fazeley Street from the junction with New Canal Street. It would continue onto Liverpool Street, where a stop would be located close to the junction with Great Barr Street and Heath Mill Lane. The route would turn east into Adderley Street where it would terminate.

The High Street Deritend route was proposed to run southwards along New Canal Street before running onto Meriden Street and turning left onto High Street Deritend. The route would operate along the centre of High Street Deritend, with a stop located close to the junction with Milk Street serving Birmingham Coach Station and the Custard Factory. The route would continue into Adderley Street where it would terminate.

The two route options were taken to public consultation between 10 and 31 October 2014. The High Street Deritend Route was eventually taken forward as it was strongly preferred by the public at consultation and provided connections to existing infrastructure such as Birmingham Coach Station and Custard Factory, as well as being preferred from an engineering perspective.

Initial patronage forecasts for the High Street Deritend option were higher than for the Fazeley Street option in both modelled years (2021 and 2031). The modelled results showed a significant increase in passengers alighting at a stop on High Street Deritend compared with only Fazeley Street since the High Street Deritend option served Birmingham Coach Station, Custard Factory and other established businesses and attractions (BEE Strategic Business Case, TfWM, 2016, paragraph 3.39).

Following consultation and confirmation of the BEE route, the BEE alignment was shortened to terminate on High Street Deritend in order to avoid abortive works. This is because the BEE would require a terminus facility tram stop at Adderley Street, which would not be required when the route was extended further towards Birmingham Airport as it would be a ‘through’ tram stop. In order to provide this short term terminus facility, additional land acquisition would be required (and involve building demolition), to allow for tram movements without blocking general traffic for a stationary tram. The view was taken that such additional land acquisition and building for a short-term measure was not justifiable.

The final route alignment from Corporation Street to High Street Deritend is shown in **ES Volume 2 Technical Appendix A.**

2 The Transport Assessment

2.1 Background

The BEE will provide important new public transport infrastructure and, in this respect, does not represent a traditional land use development that increases demand for car-based travel. In conjunction with the remainder of the Midland Metro network, the BEE will cater for increased travel demand as it improves public transport accessibility to existing and future residential, employment and commercial sites within Birmingham City Centre and the Eastside area. The scheme also enhances Midland Metro's integration with all modes of transport and will therefore have an impact on all transport modes within the locality through which it passes.

2.2 Purpose of the Study

This Transport Assessment (TA) examines the temporary and permanent changes the BEE will have on the transport network. It provides an understanding of how the scheme will function alongside other transport modes and how it may affect highway and public transport users. The changes resulting from the implementation of the scheme may be positive or negative. Where a significant negative impact is identified, the measures designed to avoid, reduce or remedy any potential adverse consequences are detailed.

2.3 Transport Assessment Scoping Report

The Guidance on Transport Assessment (2007) published by the Department for Transport was withdrawn as guidance in October 2014. The introduction of the National Planning Policy Framework (March 2012) and the supporting National Planning Practice Guidance therefore provide a basis for which this TA has been undertaken.

Paragraph 32 of the National Planning Policy Framework (NPPF) states that all developments that generate significant amounts of transport movement should be supported by a Transport Assessment. In this case, the BEE route alignment will have a material impact on the surrounding highway network in terms of changes to traffic movement.

The NPPF (Annex 2, page 57) defines a Transport Assessment as a 'comprehensive and systematic process that sets out transport issues relating to a proposed development. It identifies what measures will be required to improve accessibility and safety for all modes of travel, particularly for alternatives to the car such as walking, cycling and public transport and what measures will need to be taken forward to deal with the anticipated transport impacts of development'.

Further to this, the NPPG states that key issues to consider at the start of preparing a Transport Assessment should include:

- The planning context of the development proposal
- Appropriate study parameters (i.e. area, scope and duration of study)
- Assessment of public transport capacity, walking/cycling capacity and road network capacity

- Road trip generation and trip distribution methodologies and/or assumptions about the development proposal
- Measures to promote sustainable travel
- Safety implications of development
- Mitigation measures (where applicable) – including scope and implementation strategy.

The Transport Scoping Report for this TA was developed within the context of this guidance.

The Scoping Report was initially submitted to BCC on 6 May 2015. Subsequent to this, a meeting was held at BCC to agree the final scope. BCC confirmed in an email dated 30 December 2015 (to the Department for Transport) responding to the EIA scoping opinion consultation that:

'I together with colleagues in Transportation and Planning and Regeneration have been working closely with both TfWM and their transport consultants Mott MacDonald on the proposed Metro alignment and the Traffic and Transport (TA) methodology. The scope of the TA has been agreed with TfWM and their consultant including the study area, additional traffic and pedestrian counts, junction assessment requirements and I have agreed the use of the Birmingham City Centre Traffic Model to assist with this process'.

Traffic modelling and analysis forms a significant element of the assessment. The TA considers the junctions directly affected by the BEE to determine appropriate control interfaces, as well as junctions not located directly on the track alignment but identified by BCC for consideration. The TA summarises the detailed analysis that has been undertaken.

This TA provides an examination and understanding of the implications of the scheme on transportation issues. The TA will form an appendix to the Environmental Impact Assessment (EIA) which will be submitted as part of the Transport and Works Act Order (TWAO) application for the scheme.

2.4 Geographic Extent of the Study

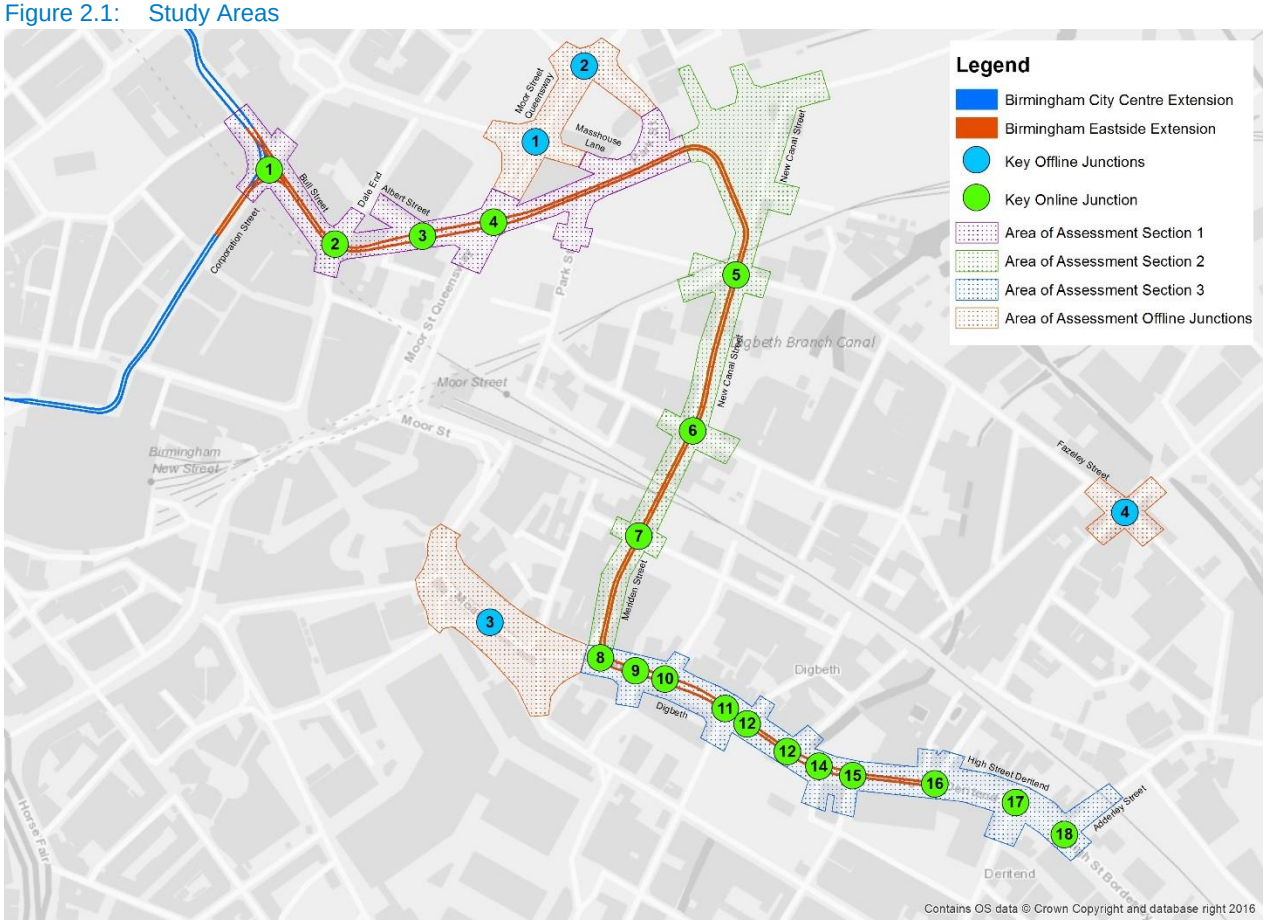
Chapter 5 of this report describes how the area of influence of the scheme has been derived and used for the purpose of understanding the likely impacts of predicted changes in traffic flow following the introduction of BEE.

Through much of the TA, for the purpose of describing the route and assessing its impacts, the proposed route corridor has been broken down into three sections:

- Section 1: Corporation Street to Eastside Park
- Section 2: Eastside Park to Meriden Street
- Section 3: Meriden Street to Adderley Street.

These sections are shown in Figure 2.1.

Figure 2.1: Study Areas



Source: Mott MacDonald

BCC, as the Local Planning and Highway Authority, has been involved in the derivation of the extent of the study and with the methodology adopted (extent of study area resultantly agreed in a scoping exercise with BCC).

2.5 Transport Impact Overview

The receptors to be assessed are summarised in Table 2.1. This table considers the impact for each of these receptors. The level of assessment required will be explained in more detail in the subsequent chapters.

Table 2.1: Estimate of net impact assessment requirements per receptor

Receptor	Net Impact?	Reason	Assessment Required
Traffic (changes in patterns and flow)	YES	BEE will have an impact on junction capacity along the whole route alignment.	Strategic and local modelling assessment of impacts.
Bus services	YES	BEE will have a potential impact on bus movements along the length of the route.	Consideration of impacts on bus routeing, stop positions and delay.
Light Rail	YES	BEE will interact directly with the Birmingham City Centre Extension route at the junction of Corporation Street / Bull Street.	Consideration of operational impacts between trams on different routes.
Heavy Rail	YES	BEE will pass through the proposed HS2 rail station at Curzon Street.	Consideration of operational interaction between trams and HS2 station.
Pedestrians	YES	BEE route will affect pedestrian routes and safety.	Consideration of pedestrian routes and safety.
Cyclists	YES	BEE route will affect cycle routes and safety.	Consideration of cycle routes and safety.
Parking	YES	BEE could have an impact on existing parking provision along the route, including off street surface and multi-storey car parks, and on street car parking.	Consideration of potential reductions in on street parking and impacts on the access to existing surface and multi storey car parks.
Taxis	Potentially	BEE could have an impact on taxi movements along the whole route.	Consideration of impacts on taxi routeing, rank positions and delay.
Coaches	YES	BEE will pass Digbeth Bus Station.	Consideration of operational interaction between trams and Birmingham Coach Station.
Access and servicing	YES	BEE needs to accommodate access and servicing arrangements along the whole route.	Consideration of adjacent access and servicing arrangements.
Emergency services	Potentially	BEE could have an impact on emergency service routes and access, particularly along High Street Deritend.	Consideration of emergency service routes and potential delay.
Road Safety	YES	Running of the route along the whole alignment will result in an increase in modal conflict opportunities.	Road safety assessment.
Construction	YES	The construction of BEE will have an impact on the surrounding highway	Construction impact assessment.

2.6 Structure of the Assessment

The TA is structured as follows:

- Chapter 3 – Scheme Proposals and Description
- Chapter 4 – Policy Review
- Chapter 5 – Modelling Methodology
- Chapter 6 – Impact on Traffic
- Chapter 7 – Impact on Bus Services

- Chapter 8 – Impact on Light Rail
- Chapter 9 – Impact on Heavy Rail
- Chapter 10 – Impact on Coaches
- Chapter 11 – Impact on Walking and Cycling
- Chapter 12 – Impact on Parking
- Chapter 13 – Impact on Taxis
- Chapter 14 – Impact on Access and Servicing
- Chapter 15 – Impact on Road Safety
- Chapter 16 – Impact on Emergency Services
- Chapter 17 – Impact from Construction
- Chapter 18 – Summary and Conclusions.

3 Scheme Proposals and Description

3.1 Introduction

The purpose of this chapter of the TA is to provide an overview of the route, a specific scheme description, and to summarise the operational details of BEE.

3.2 Route Overview

The proposed BEE consists of a 1.7km twin track extension to the Midland Metro network, providing a link between Birmingham City Centre, the Curzon Street HS2 Station, Birmingham Coach Station and the regeneration area of Digbeth. The proposed track alignment is shown in **ES Volume 2 Technical Appendix A.** A description of the existing situation along the proposed BEE track alignment can be found in **Appendix C.**

The extension will consist of both segregated and shared-use track. The track alignment will cross the highway at-grade at junctions and these junctions will need to be remodelled accordingly.

Modifications must be made to the existing highway network for the inclusion and prioritisation of a tram route within the existing urban environment, whilst also providing vehicular, pedestrian and cycling access. The trams will operate on a fixed and clearly identified route, requiring priority at signalised junctions and remaining on segregated track where appropriate to ensure the most efficient service.

The proposed BEE route will diverge from the current tram network at the Corporation Street / Bull Street junction and terminate on High Street Deritend. There will be a Bus Interchange, as well as a stop at the proposed HS2 terminal site (currently New Canal Street). The terminal stop is located between Milk Street and Floodgate Street (along High Street Deritend), with track for layover purposes continuing to the Heath Mill Lane junction.

The route passes under the West Coast Main Line along New Canal Street, and the Chiltern Railway Line along Meriden Street. It crosses over the River Rea adjacent to Rea Street on High Street Deritend. It will also pass under the viaduct carrying the proposed HS2 rail line across New Canal Street.

The scheme will include four Tram Stops as follows:

- Albert Street (directly west of Moor Street Queensway)
- New Canal Street (within the proposed HS2 station)
- Meriden Street (adjacent to the junction with Bordesley Street)
- High Street Deritend (directly east of the junction with Rea Street and Milk Street).

The proposed route will require the demolition of a number of buildings on Dale End and Meriden Street.

The BEE will consist of a combination of sections with Overhead Line Equipment (OLE) and without OLE (i.e. catenary-free). Catenary-free trams run on batteries and do not rely on continual OLE to operate. The scheme will comprise the following sections:

- From the junction at Bull Street/Corporation Street to Albert Street stop will use OLE

- From Albert Street stop to High Street Deritend Terminus will be catenary-free
- The route for the turn back and tram layover along the remainder of High Street Deritend will use OLE

For the purpose of description, the tram route is described as inbound and outbound, as follows:

- Outbound refers to the divergence of the BEE route from the BCCE towards the terminal stop on High Street Deritend.
- Inbound refers to the tram direction from its terminal stop on High Street Deritend to Birmingham City Centre and the BCCE route.

3.3 Scheme Description

3.3.1 Section 1: Corporation Street to Eastside Park

The BEE diverges from the existing tram system at the Corporation Street / Bull Street junction. The junction is currently signalised, and will remain signalised upon the introduction of the BEE (although the junction will be remodelled).

The junction will consist of shared and segregated use, with the outbound section of the BEE being segregated from general traffic (the existing cycle lane will remain). The inbound side of the track will be a shared use up to and beyond the Corporation Street junction. Pedestrian footways will be retained on either side of the road, and three pedestrian crossings at the Corporation Street / Bull Street junction will be provided (with a central pedestrian refuge).

From the Corporation Street / Bull Street signalised junction, the BEE will continue south-east towards the Bull Street / Dale End junction. This junction is currently a priority junction but will be signalised upon the introduction of the tram. To facilitate the link from the Bull Street / Dale End junction to the Moor Street Queensway / Albert Street junction, the King's Parade building (nos. 1-7) will be demolished to enable two-lane running.

From the Bull Street / Dale End junction to the Moor Street Queensway / Albert Street junction, the track alignment will be shared use on a new alignment. Throughout this report, this section of track which connects the two junctions is referred to as the 'New Alignment'. The track alignment will pass through an existing car park and on-street disabled parking bays on New Meeting Street (consisting of 28 spaces), and onto Albert Street (where 3 disabled on-street bays are located). All the current spaces will be removed or relocated. All existing disabled parking provision will be relocated within the BEE proposals, and the loss of general parking will be on private land serving the Kings Parade building (to be demolished).

Existing disabled parking bays will be relocated to Dale End, with provision for 7 bays. The Dale End taxi rank will be reconfigured, with all of the existing provision (space for 10 taxis) to be relocated to the northern side of Dale End (in a 50m taxi rank).

Along the New Alignment there will be an eastbound cycle lane provided at the junction with Moor Street Queensway, as well as two bus stops (either side of the alignment).

The first outbound tram stop is located directly west of the Moor Street Queensway / Albert Street junction. Passengers will access trams from a central platform between the inbound and outbound tracks.

A U-turn facility is provided along the New Alignment to allow vehicles to access the NCP car park (as the right-turn is impeded by the location of the proposed tram stop). Vehicles using the U-turn facility will block the inbound track alignments, although it is anticipated the low use of the U-turn facility combined with the 6 minute tram headway means that this will be an unlikely occurrence.

The existing signalisation of the Moor Street Queensway / Albert Street junction will be modified upon the introduction of the BEE. A Bus Interchange is to be provided directly east of the Moor Street Queensway / Albert Street junction. This interchange bounds the south of Hotel La Tour. The Bus Interchange will provide four bus stands and one SPRINT stand (see Section 7.2), and will be located in close proximity to the Moor Street Queensway bus mall, the Albert Street tram stop and the HS2 Curzon Street Station.

At the Bus Interchange, the outbound and inbound track is tram-only. An access to the Bus Interchange will be provided from Masshouse Lane which will provide access to the four bus stands and one SPRINT stop within the Bus Interchange, as well as providing access to a service / drop-off point to provide access to Hotel La Tour.

Directly east of the Bus Interchange at Hotel La Tour, a signalised junction is to be constructed at the existing Park Street / Masshouse Lane junction. A section of Park Street, from Albert Street towards the south, will be stopped up as part of the HS2 proposals.

East of the proposed signalised junction, both tracks will be segregated from vehicular traffic between the proposed signalised junction up to, but excluding, the New Canal Street / Fazeley Street junction. This section of the route follows the former alignment of Albert Street which has been recently removed to enable the development of the Eastside Park.

3.3.2 Section 2: Eastside Park to Meriden Street

The second tram stop will be located north of the New Canal Street / Fazeley Street junction, within the proposed development site of the Curzon Street HS2 Station. This will provide an integrated transport interchange between heavy rail and the Midland Metro network once both schemes are in operation.

The track alignment runs in a north-south direction at the New Canal Street / Fazeley Street junction. At the junction, the track alignment becomes shared use for all traffic. On the outbound side of the track, between the New Canal Street / Fazeley Street and the New Canal Street / Bordesley Street junction, there is land take (of up to 6.5m) to allow for the tram and pedestrian footways (of a 2m minimum width).

The third tram stop following the track alignment in an outbound direction is located directly south of the New Canal Street / Bordesley Street junction. The tram stop platforms are located either side of the

alignment. 2m footways are shown in the proposals either side of the tram stop platforms, which contributes to the level of land-take required (see **ES Volume 2 Technical Appendix A, MMD-300207-HS29-DRA-0000-0014**).

South of the tram stop, the track alignment travels on existing highway up to the Digbeth B4100 / Meriden Street junction. This junction will remain signalised although it will be reconfigured to allow for a tram-only stop line, and separate traffic stop line at the junction. All traffic and trams turn left at this junction, with the tram track alignment occupying two segregated central lanes along Digbeth (B4100). The South and City College will have to be demolished at the Digbeth (B4100) / Meriden Street junction to allow for junction reconfiguration.

3.3.3 Section 3: Meriden Street to Adderley Street

In Section 3 of the route, the track alignment continues along Digbeth (B4100) and High Street Deritend in an east-west direction.

The track alignment will be segregated from other vehicles for much of the length of this section, with two vehicular lanes either side of the track alignment. At the junction with Rea Street, there will be short sections of shared track to allow for vehicular movements at the junctions.

The BEE track alignment will run in the existing offside lanes in either direction of the carriageway along Digbeth (B4100) and High Street Deritend, and services will terminate between Rea Street and Milk Street. However, the track will be constructed as far as Heath Mill Lane to allow for a tram turn-back and lay over facility.

Signalised pedestrian crossings provide access to the final tram stop, with the two platforms located either side of the track alignment. A loading bay south of High Street Deritend is to be removed as part of the BEE proposal. Footway widths along Digbeth (B4100) and High Street Deritend are also reduced to allow for the BEE track alignment, tram stops and associated engineering works.

Furthermore, highway works will be undertaken to ensure the route has capacity to extend in an easterly direction for a potential extension towards Birmingham Airport. This includes the reconfiguration of the High Street Deritend / Alcester Street junction, where approaches on the High Street Deritend junction are proposed to be reduced to two-lanes (apart from the eastbound approach which flares into three lanes to allow a right-turn into Alcester Street).

3.4 Operational Details

An indicative timetable for the delivery of BEE is provided in Table 3.1

Table 3.1: Indicative Timetable for Delivery of BEE

Activity	Target Period
BEE Scheme TWAO application submission	2016 Q3
Secretary of State's decision (anticipated)	2017 / 2018
Discharge of BEE TWAO planning conditions	2018 onwards
BEE scheme construction	Q1 2020 to Q4 2021
BEE commissioning, testing, operational	2022

The operational hours of the BEE are proposed to be:

- Sunday to Wednesday inclusive from 06.00 (Sunday) to 01.00 (Thursday)
- Thursday to Saturday inclusive from 06.00 (Thursday) to 03.00 (Sunday).

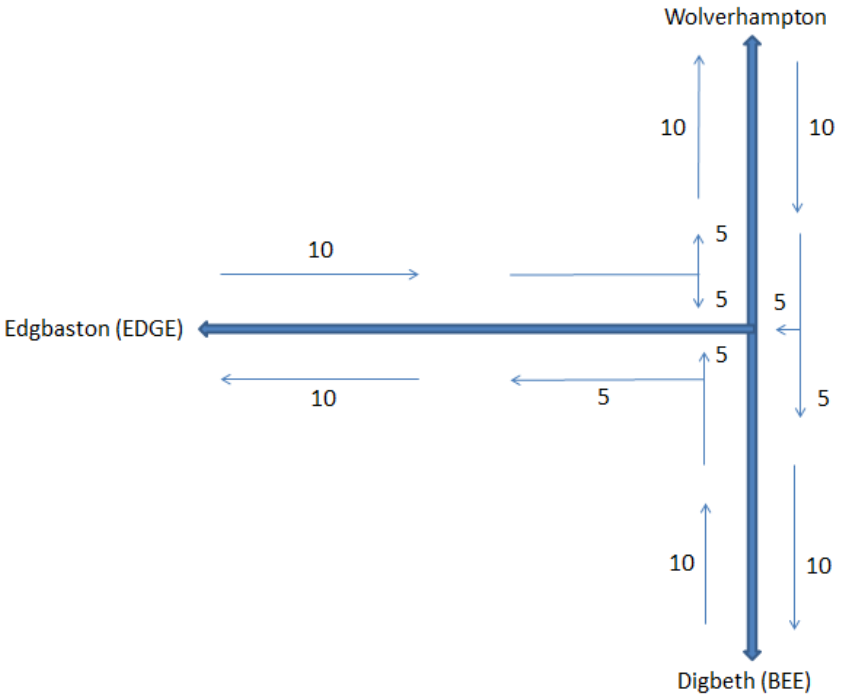
Table 3.2 shows the proposed frequency of tram services during the above operational hours.

Table 3.2: Frequency of tram services during BEE operation

Time period	Monday to Wednesday (trams per hour)	Thursday to Saturday (trams per hour)	Sunday (trams per hour)
06:00-19:59	10	10	10
20:00-01:00	4	None	4
20:00-03:00	None	4	None

The number of trams travelling on the section between Bull Street and Snow Hill Rail Station will not increase in frequency to facilitate BEE. Outbound services operating on the BEE route will alternate between those travelling towards Hagley Road via EDGE (5tph) and Wolverhampton (5tph). Inbound services will alternate between those travelling from Hagley Road via EDGE (5tph) and Wolverhampton (5tph). The various movements for BEE services at the Corporation Street / Bull Street junction are summarised in Figure 3.1.

Figure 3.1: Tram Operations (frequency per hour)



Source: Mott MacDonald

The estimated journey time along the BEE route from the existing Bull Street Stop to each of the proposed tram stops is as follows (with a 25 second dwell time at each stop):

- Albert Street Stop – 75 seconds
- New Canal Street Stop (HS2) - 173 seconds
- Meriden Street Stop – 244 seconds
- High Street Deritend Stop – 344 seconds.

4 Policy Review

4.1 Introduction

This chapter provides an overview of the planning policies which are of most relevance to the proposed BEE. Relevant planning and transport policy has been considered at the following levels:

- National
- Regional
- Local

The following documents have been considered:

- National policy:
  - National Planning Policy Framework (2012)
  - 'Creating Growth, Cutting Carbon: Making Sustainable Local Transport Happen' (2011)
  - 'Future of Transport – A network for 2030' (2004)
- Regional policy:
  - West Midlands Strategic Transport Plan: Movement for Growth (2015)
  - West Midlands Combined Authority – Strategic Economic Plan (2016)
  - West Midlands Local Transport Plan (2011)
  - The Midlands HS2 Growth Strategy (2015)
  - Greater Birmingham and Solihull Local Enterprise Partnership, Birmingham City Centre Enterprise Zone, Investment Plan 2013/2014 – 2022/2023 (2014)
  - Towards a World Class Integrated Transport Network (2013)
- Local policy
  - Birmingham Development Plan (2031)
  - Big City Plan (2010)
  - Birmingham Connected White Paper (2014)
  - Curzon Street HS2 Masterplan (2015)
  - Birmingham Smithfield Masterplan (2016)

4.2 National Policy

4.2.1 National Planning Policy Framework (NPPF), 2012

The NPPF sets out the Government's planning policies for England and how these are expected to be applied. The Town and Country Planning Act 1990 requires that applications for planning permission must be determined in accordance with the Development Plan, unless material considerations indicate otherwise. The NPPF must be taken into account in the preparation of local and neighbourhood plans and is a material consideration in planning decisions.

Supporting sustainable development is the overarching purpose of the planning system. There are three dimensions to sustainable development:

- **An economic role** – contributing to building a strong, responsive and competitive economy by ensuring that sufficient land of the right type is available in the right places and at the right time to support growth and innovation.

- **A social role** - supporting strong, vibrant and healthy communities by providing the supply of housing required to meet the needs of the present and future generations.
- **An environmental role** – contributing to protecting and enhancing our natural, built and historic environment.

Chapter 4 of the NPPF ('Promoting Sustainable Transport') identifies the important role that transport can play in facilitating sustainable development and contributing to wider sustainability and health objectives. "The transport system needs to be balanced in favour of sustainable transport modes, giving people a real choice about how they travel".

Encouragement should be given to solutions which support reductions in greenhouse gas emissions and reduce congestion. Of particular relevance to this TA, paragraph 31 notes, "Local authorities should work with neighbouring authorities and transport providers to develop strategies for the provision of viable infrastructure necessary to support sustainable development, including transport investment necessary to support strategies for the growth of ports, airports or other major generators of travel demand in their areas."

Paragraph 32 of the NPPF states "all developments that generate significant amounts of movement should be supported by a Transport Statement or a Transport Assessment and that plans and decisions should take account of whether:

- The opportunities for sustainable transport modes have been taken up to reduce the need for major transport infrastructure.
- Safe and suitable access to the site can be achieved for all people.
- Improvements can be undertaken within the transport network that cost effectively limit the significant impacts of the development. Development should only be prevented or refused on transport grounds where the residual cumulative impacts of development are severe".

The NPPF (Annex 2, page 57) defines a Transport Assessment as a "comprehensive and systematic process that sets out transport issues relating to a proposed development. It identifies what measures will be required to improve accessibility and safety for all modes of travel, particularly for alternatives to the car such as walking, cycling and public transport and what measures will need to be taken to deal with the anticipated transport impacts of development".

This TA responds to the key issues outlined above in the subsequent chapters of this report.

4.2.1.1 National Planning Practice Guidance

The NPPF (March 2012) is supported by National Planning Practice Guidance, which provides a basis for which this TA has been undertaken.

The NPPG states that the following should be included within TAs (although varying site by site):

- "Information about the proposed development, site layout, (particularly proposed transport access and layout across all modes of transport)

- Information about neighbouring uses, amenity and character, existing functional classification of the nearby road network;
- Data about existing public transport provision, including provision/ frequency of services and proposed public transport changes;
- A qualitative and quantitative description of the travel characteristics of the proposed development, including movements across all modes of transport that would result from the development and in the vicinity of the site;
- An assessment of trips from all directly relevant committed development in the area (i.e. development that there is a reasonable degree of certainty will proceed within the next three years);
- Data about current traffic flows on links and at junctions (including by different modes of transport and the volume and type of vehicles) within the study area and identification of critical links and junctions on the highways network;
- An analysis of the injury accident records on the public highway in the vicinity of the site access for the most recent three-year period, or five-year period if the proposed site has been identified as within a high accident area;
- An assessment of the likely associated environmental impacts of transport related to the development, particularly in relation to proximity to environmentally sensitive areas (such as air quality management areas or noise sensitive areas);
- Measures to improve the accessibility of the location (such as provision / enhancement of nearby footpath and cycle path linkages) where these are necessary to make the development acceptable in planning terms;
- A description of parking facilities in the area and the parking strategy of the development;
- Ways of encouraging environmental sustainability by reducing the need to travel; and
- Measures to mitigate the residual impacts of development (such as improvements to the public transport network, introducing walking and cycling facilities, physical improvements to existing roads)."

Based upon the nature of the proposed scheme, the necessary points highlighted above have been addressed within this TA.

4.2.2 'Creating Growth, Cutting Carbon: Making Sustainable Local Transport Happen', 2011

In 2011, the Department for Transport (DfT) produced a White Paper entitled "Creating Growth, Cutting Carbon – Making Sustainable Local Transport Happen". This maintains the focus on enabling sustainable mode choices and active travel to reduce dependency on car journeys through greater integration with local land use planning. The 2011 White Paper also looks to decentralise planning and economic power through the Localism Bill and Regional Growth Funds / Local Enterprise Partnerships. This document emphasises:

- The contribution of transport to the economy
- The challenge of cutting carbon from the transport system
- The challenge of making the best use of existing infrastructure to reduce congestion
- The promotion of sustainable modes

It is considered that BEE will provide opportunities to improve public transport access to the Eastside area. It is anticipated that the BEE could reduce vehicular congestion through encouragement to utilise the Midland Metro network. For this reason it is considered that the BEE is compliant with national policy.

4.2.3 'Future of Transport – A network for 2030', 2004

This White Paper produced by the DfT provides guidance on the future policies in transport, with an emphasis on three central themes:

- **Sustained investment** – the spending review outlined the Government's commitment to deliver sustained improvements to transport networks.
- **Improvements in transport management** – reorganising the rail industry to improve performance, drive down costs and get better value from public spending.
- **Planning ahead** – national, regional and local governments will ensure that transport decisions are taken alongside decisions on liveability, sustainable communities and other policy areas.

The document outlines the need for a transport network that can meet the challenges of a growing economy and the increasing demand for travel, but can also achieve environmental objectives. BEE achieves this by providing greater connectivity between Birmingham City Centre and Digbeth, as well as providing linkages to HS2.

4.3 Regional

4.3.1 West Midlands Strategic Transport Plan: Movement for Growth, 2015

The West Midlands Integrated Transport Authority (WMITA) was established to "plan for, and deliver, a transport system across the West Midlands Metropolitan area that will boost our regional economic and improve the family lives of our residents and workers." The WMITA Movement for Growth document sets out the vision and strategy for how they will achieve their objectives.

An overarching theme of the Movement for Growth document therefore is unlocking the economic potential of HS2 by improving local accessibility to the HS2 Curzon Street Station (paragraph 4.19).

Investment in infrastructure (highway improvements, increasing rail capacity, public transport improvements and cycling / walking investment) and 'behaviour change' (informing people to make the best travel choice) will achieve three key aims:

- Improved national and regional links to boost the economy.
- Improved links across the Metropolitan Area to provide better access to jobs, leisure and services.
- Improved links within local communities to reduce their reliance on cars for short distance trips.

In regard to BEE specific reference is made to its funding in paragraph 7.4, and in addition, repeated reference to the HS2 Connectivity Package (of which the BEE is included) and its benefits in terms of "plugging-in" Birmingham Curzon Street and the Metropolitan Area are mentioned throughout the document.

The vision for the public transport network is based on suburban rail, metro light rail, tram, train, very light rail and SPRINT (Bus Rapid Transit) lines running on suitable routes in one single network. This will be integrated with local bus services and underpinned by park & ride, passenger information, promotion and ticketing.

4.3.2 West Midlands Combined Authority – Strategic Economic Plan (2016)

The West Midlands Strategic Economic Plan (SEP) sets out the vision, objectives, strategy and actions to improve the quality of life for everyone who lives and works in the West Midlands.

The SEPs ambition is based on the recognition that, through devolution, the West Midlands' assets can be enhanced to benefit not only its residents and businesses, but the entire nation.

Eight priority actions for the West Midlands are presented within the SEP (page 8), with priority action '5' being:

- HS2 Growth: maximising the benefits of the largest infrastructure project in Europe.

The WMCA's vision is to fully maximise the benefits of HS2 in order to drive economic growth across the Midlands. Within priority action 5 (page 46) it states that in order to achieve this, a programme of investment in connectivity improvements will be implemented to facilitate access to the HS2 hubs for workers, residents and businesses.

The extension of the Midland Metro network and creation of an interchange within the HS2 Curzon Street Station will provide access from Birmingham, West Bromwich and Wolverhampton, among other locations, to the station. This will facilitate access to the largest infrastructure project in Europe for workers, residents and businesses in the Midlands.

4.3.3 West Midlands Local Transport Plan, 2011

The West Midlands Local Transport Plan (WMLTP) 2011-2026 is a statutory document which focuses on providing sustainable travel and transport choices in the West Midlands with improved connectivity within and between centres.

The WMLTP lists a set of policies on how TfWM plan to deliver the various elements of their strategy. In relevance to Midland Metro this includes:

- 'A rail and rapid transit network as a "backbone for development." (page 76)'
  - Local rail network will be expanded in order to meet the forecasted growth in patronage.
  - High levels of service standards and accessibility will be delivered on the rail network. This will include a reliable surface and several possible routes to take the customer as close as they need to the desired location.
  - The rapid transit network will be expanded, aiming towards a zero emissions target in order to create sustainable transport system.
  - Interim rapid transit arrangements to be developed in and around Birmingham City Centre.

- 'Improved safety and security'
  - Reductions in numbers of casualties is sought, including achieving an understanding where and why collisions occur and with whom. By carrying out this research, commuting can become as safe as possible to ensure people using and not using the transport are kept as safe as possible.
  - Measures will be taken to reduce actual and perceived safety concerns towards public transport use.

The WMLTP also identifies rapid transit network as "integral to promoting thriving centres" (page 47) such as Birmingham Eastside (identified in the WMLTP as an "Impact Investment Location", page 19), whilst seeking to improve interchange facilities that link rail, bus, coaches and rapid transit networks.

Midland Metro extensions in Birmingham City Centre and new rapid transport lines in appropriate high volume corridors are seen as a primary transport challenge facing the Birmingham Metropolitan Area (page 69). TfWM plan on building a fast and reliable Midland Metro to serve key locations, whilst becoming a more sustainable method of transport aiming to emit zero emissions. TfWM also plan on carrying out research to ensure this method of transport is safe as possible for users and non-users of the Metro.

4.3.4 The Midlands HS2 Growth Strategy, 2015

The Midlands HS2 Growth Strategy produced by the GBS LEP (July, 2015) sets outs an approach to maximise a "once in a generation opportunity to deliver unprecedented growth and leave a lasting legacy for future generations."

The opportunity presented by HS2 will see the Midlands positioned at both the geographic and strategic centre of the UK's transport network. The region will not only benefit from billions of pounds of new infrastructure but also the opportunities for stimulation of new development, jobs and inward investment.

GBS LEP states that HS2 will create a step change in the Midland's economic performance, driving growth and significantly improving outcomes for its people, businesses and places. The growth strategy responds to the recommendations of the HS2 Growth Task Force and the challenge for local areas to demonstrate how they are going to respond to the opportunities presented by HS2.

The growth strategy focuses on getting Birmingham and the West Midlands ready to drive economic growth for the benefit of both current and future generations. Achieving this will require focused long-term planning and investment with prioritised and phased delivery.

An integrated Metro stop at New Canal Street will provide HS2 travellers with fast and efficient connections to the wider city centre. Additional stops will transform connections and boost the regeneration potential of Digbeth, whilst efficiently connecting the HS2 Station to Birmingham's public transport network.

4.3.5 GBS LEP, Birmingham City Centre Enterprise Zone, Investment Plan 2013/2014 – 2022/2023

The GBS LEP have documented the Investment Plan 2013/2014 – 2022/2023 in order to show their aspirations and proposals for the Birmingham City Enterprise Zone (EZ). The Birmingham City EZ includes 26 sites within 7 clusters in the city centre including Eastside.

One of the identified EZs is the 'Southern Gateway' site. This site is subject to £45.5 million investment in order to relocate the wholesale markets and deliver a new vibrant city centre destination. Furthermore, superfast broadband will be provided to the Southern Gateway area along with other IT clusters in Birmingham City Centre.

The 22 hectare site labelled the 'Southern Gateway' occupies a key strategic location connecting the Bullring, City Core and business district. The area is a major development opportunity with close proximity to major transport links such as New Street Station, Moor Street Station and the proposed HS2 terminus. There will be a focus on leisure, retail, food markets, commercial and residential space.

The investment plan has also been updated to provide a longer term approach to investment, in order to drive forward economic growth. In regards to the Metro, the vision is to improve connectivity for commuters, visitors and others leading to a major beneficial impact upon this part of the city centre.

4.3.6 Towards a World Class Integrated Transport Network, 2013

Towards a World Class Integrated Transport Network (April 2013) "sets out the long term vision and strategy framework to help transform the transport system serving the West Midlands."

The document highlights TfWM's vision for the Metro including:

- "To provide key targeted corridors, within the Rail and Rapid Transit Network, with a high capacity, rapid form of public transport, demonstrating good value for money."
- "For light rail and tram-train in the West Midlands to provide services in appropriate High Volume Corridors with the following characteristics:"
  - Service speed of 25 / 35 km / hr (light rail) and 25 / 50 km / hr (tram - train).
  - High levels of reliability through high levels of segregation from general traffic.
  - Attractive and accessible stops and services.
  - Daytime frequencies of 5 - 10 minutes (light rail) and 5 - 30 minutes (tram - train).
  - Delivery of permanent, visible and effective infrastructure in towns and city centres.
  - Integration with local bus services.

In regard to the Birmingham Eastside Extension, it is identified within this document as a Strategic Transport Intervention (part of the HS2 Connectivity transport package fund), earmarking the development to be in operation between 2019 and 2024 (page 105). Along with other transport schemes such as SPRINT (also identified as part of the HS2 Connectivity transport package fund), the BEE will help increase transport interchange opportunities in Birmingham City Centre.

Ensuring a fast and reliable tram service will increase the Midland Metro's patronage, gradually reducing congestion. Frequent trams at accessible stops give the customer autonomy in their journey, with a greater number of services and improved accessibility.

4.4 Local Policy

4.4.1 Birmingham Development Plan, 2031

The Birmingham Development Plan (BDP) is set to replace the Unitary Development Plan (UDP, adopted 2005) for Birmingham, although it is currently under a holding direction by the Secretary of State. This is due to a request from Sutton Coldfield MP to call in the BDP in relation the relaxation of the Green Belt included within the document. BCC have thereby been directed not to take any steps in connection with the adoption of the BDP.

Despite the holding direction, the issue in question is several miles from the city centre, and therefore, the principles of the BDP within the city centre are unlikely to change.

Highlighted in the BDP, by 2031 BCC aim to make Birmingham a renowned, enterprising, innovative and green city. The BDP contains visions, objectives and strategies covering residents' lifestyles to the economic growth of the city. In relevance to the Metro, the BDP states the following:

- "To provide high quality connections throughout the City and with other places including encouraging the increased use of public transport."
- "Transport improvements, as set out in the BDP, will be required to support the overall strategy for growth and ensure that the City has a world class transport network that is delivered in the most sustainable way."

4.4.2 Big City Plan, 2010

The Big City Plan (BCP) 2010 is a non-statutory planning and regeneration framework that highlights the city centre Masterplan, covering matters such as transformation, growth, sustainability, walkability, connectivity and heritage.

Regarding connectivity, there is information on the Metro and the extension from Snow Hill Station to New Street Station. TfWM's vision for an improved integrated bus network is also highlighted, including concepts such as SPRINT (bus rapid transit). The following statement is made concerning transport throughout the city:

- "The challenge for the future will be to improve the quality of the transport environment and the efficiency of the transport network, making the city centre a place that encourages people to move around on foot, bike and public transport."

The BCP focuses on the environment of the transport network as well as the efficiency of it to ensure that the perception of attractiveness is increased in order to appeal to the population of Birmingham, whilst also providing them with a safe and enjoyable journey.

4.4.3 Birmingham Connected White Paper, 2014

The Birmingham Connected White Paper, launched in November 2014, follows on from the previous Birmingham Mobility Action Plan. Birmingham Connected is directly linked to the policies and strategies set out in the Birmingham Development Plan (Section 4.4.1) which sets out a strategy for job growth, housing supply growth and sustainable progress. Its aim is that Birmingham Connected will become the "umbrella for all transport planning activity across the city".

Transport is understood as a vitally important factor in realising Birmingham's potential, and investment in a radically improved integrated transport system will support sustainable economic growth, job creation and linking communities. The five core objectives of Birmingham Connected are:

- Efficient Birmingham - facilitate the city's growth agenda in the most efficient and sustainable way possible, strengthening its economy and boosting jobs.
- Equitable Birmingham - facilitate a more equitable transport system, linking communities together and improving access to jobs and services.
- Sustainable Birmingham - specifically reduce the impact of air and noise pollution, greenhouse gas emissions and energy consumption.
- Healthy Birmingham - contribute to a general raising of health standards across the City through the promotion of walking and cycling and the reduction of air pollution.
- Attractive Birmingham - contribute to enhancing the attractiveness and quality of the urban environment in local centres, key transport corridors and the city centre.

Birmingham Connected provides a 20-year vision where a £1.2bn integrated public transport network is in place. The Midland Metro mass-transit system would sit at the top of a public transport hierarchy, supported by buses and improved trunk roads. A minimum of three more Metro lines is an objective of Birmingham Connected, including the BEE (page 21). Birmingham Connected states that Metro remains the preferred ultimate choice for certain corridors, although a SPRINT service would provide a reasonable starting point and sound business case for 'conversion' to Metro at a later date (page 21).

4.4.4 Curzon Street HS2 Masterplan, 2015

The Curzon Street HS2 Masterplan has been adopted by Cabinet as BCCs vision and framework for future development of the HS2 city centre terminus and wider regeneration of Eastside and Digbeth. The Masterplan incorporates a 140ha area (Eastside and Digbeth) concerning much of the proposed BEE track alignment (see **Appendix B** for masterplan area). The masterplan provides a strategic framework focused on encouraging development and regeneration, with an emphasis on transport as a facilitator of this. Birmingham Connected (Chapter 4.4.3) defines the vision for Birmingham's transport network, and played a vital role in producing the proposals in the Curzon Masterplan.

The masterplan identifies a range of development opportunities, with significant focus upon the proposed HS2 station (located within the masterplan boundary). The masterplan seeks to promote growth in order to achieve an increase in job provision (14,000 net), 2,000 new homes and a £1.3 billion economic uplift.

The BEE Metro development is a key proposal within the masterplan, ensuring the area has a fully integrated transport network (page 14).

The Curzon Street Masterplan Transport Strategy (AECOM, 2015) is a supplementary document that considers the transport implications of the Curzon Street HS2 Masterplan, with the BEE Metro proposal highlighted as an essential tool in order to fulfil the regeneration and development potential of the area. The document states that the proposals included in the Masterplan will generate 747 and 656 Metro passengers during the AM and PM peak hours respectively).

The BEE Metro extension therefore plays a pivotal role in the Curzon Street HS2 Masterplan and connectivity to the Masterplan area.

4.4.5 Birmingham Smithfield Masterplan, 2016

The Birmingham Smithfield Masterplan is currently being considered post-consultation. Once finalised, the Masterplan will be used to inform decisions on future development and investment in the Masterplan boundary.

Birmingham Smithfield is in the city centre, covering 14 hectares of land (see **Appendix B** for the masterplan area). The area includes the existing wholesale markets (planned to be relocated to new premises), the retail markets and Moat Lane gyratory.

The recent publication of the Birmingham Smithfield Masterplan for public consultation (March, 2016) builds upon the visioning document for the Smithfield area. The masterplan sets out to create a distinctive place, with high quality architecture, public spaces and a dynamic new residential neighbourhood.

The future for Birmingham Smithfield includes 300,000 sq/m of new floor space, 2,000 new homes and an investment value of over £500 million.

There are three development principles highlighted in the masterplan:
- Connectivity
- Activity
- Design

With connectivity highlighted as one of three development principles, the development of the Smithfield area is set to deliver radical improvements to accessibility, and will reconnect the site to the wider city. This will be achieved through the enhancement of walking, cycling and public transport (with the proposed BEE route bounding the northern boundary of the Smithfield Masterplan).

The masterplan also alludes to the redevelopment of New Street Station, the proposed HS2 link and the proposed Midland Metro extension as providing unrivalled accessibility. Bus services and SPRINT are also identified in the masterplan, providing quick and efficient ways of getting to and from the Smithfield area.

A largely car-free environment is proposed, with private cars being moved around the edges of the area. Parking will be rationed, with provision for a multi-storey car park on the periphery of the area. Park & ride facilities though are proposed to serve the Midland Metro.

Transport is an integral part of the Smithfield masterplan, and the development of the Midland Metro on its northern boundary will enhance accessibility to the area.

4.5 Conclusion

The policies and documents reviewed as part of this chapter demonstrate a strong support for the expansion of the Midland Metro system in Birmingham's Eastside area within planning policy. Specific reference to the Midland Metro extensions including the BEE can be found in the following:

- WMCA SEP (2016) - Priority Action 5 - HS2 Growth: maximising the benefits of the largest infrastructure project in Europe
- WMLTP (2011) - 'A rail and rapid transit network as a "backbone for development." (page 76)'
- Towards a World Class Integrated Transport Network (2013) – Identifies the BEE as one of the West Midlands "Strategic Transport Interventions" (page 105)

Both national and local policies encourage sustainable transport choices, promoting investment in transport infrastructure. The WMLTP details the positive impacts of Midland Metro extension in Birmingham City Centre, supporting concepts of sustainability, increased patronage of public transport and increased reliability and efficiency.

The overarching theme of local planning policy is to support economic growth with an accessible, sustainable and reliable public transport facility. An emphasis is placed on ensuring public transport services are capable of responding to demand. The BEE supports these policy aims and complements the aspiration to improve the public transport offering in Birmingham's Eastside, wider Birmingham, and the West Midlands.

5 Modelling Methodology

5.1 Introduction

This chapter of the TA describes the methodology for assessment of the scheme proposals to identify what impact the proposed BEE will have on the highway and its users. This chapter details the work and its findings.

5.2 Modelling Methodology Overview

To establish the current operation of the identified junctions and calibrate the junction capacity assessment models, traffic turning counts and queue surveys were undertaken in June 2015 at a number of on-line and off-line junctions. On-line junctions are those directly located on the proposed track alignment, or those affected by associated highway works, and off-line junctions are those not directly impacted by the scheme but identified by BCC for assessment.

2015 Base Year junction capacity assessments were undertaken using the surveyed flows, and the results of these assessments are shown in **Appendix D.**

The effect of the BEE scheme on the highway network has been determined using the Birmingham City Centre Strategic Highway Model which was built using the industry standard modelling software, SATURN (Simulation and Assignment of Traffic in Urban Road Networks).

Steer Davies Gleave (SDG) were commissioned by TfWM and BCC to update the SATURN model. The models were created between March 2015 and January 2016. Further updates to the future year models were undertaken between February and June 2016.

The SATURN model has been used to derive the following future scenarios in regard to traffic flows along the affected network:

- The first is the **Do Minimum (DM) – without tram** scenario:
  - This has been modelled for the forecast years of 2021 and 2031.
  - The DM scenario includes all committed developments (known schemes with planning consent), committed transport schemes and background traffic growth (see Table 5.1 for more information).
  - The DM scenario also includes HS2, although the High Speed Rail (London-West Midlands) Bill has not yet received Royal Assent.
  - The DM represents the future base situation against which the 'Do Something – with tram' scenario is compared.
- The second scenario is the **Do Something (DS) – with tram** scenario:
  - This is the DM scenario with the addition of the proposed BEE scheme.
  - The DS scenario has also been modelled for the forecast years of 2021 and 2031.
  - The difference in traffic flows and the changes in traffic routing between the DM and DS models therefore form the basis of assessing the scheme's impact on traffic for this TA.

It has been agreed with BCC which on-line and off-line junctions should be assessed, in terms of capacity, for the DM and DS scenarios. This is discussed in greater detail in Chapter 6.1 of this report. The operation

of these junctions has been assessed using detailed traffic models for signal and priority controlled junctions.

5.3 Strategic Level Traffic Modelling

The Birmingham City Centre SATURN model base year is 2004 but, given the significant changes to the road layout in Birmingham between 2004 and 2011, it has been necessary to update the model to a base year of 2011 to incorporate these changes. It has been updated to a 2011 base year (as opposed to a 2015 base year) to retain consistency with PRISM's (Policy Responsive Integrated Strategy Model) base year model. Notable changes between the 2004 and 2011 model include:

- Changes in bus priority and road layout on Moor Street Queensway
- The Ladywood Hamburger junction layout.

A 2011 base year was used as this year aligns with the PRISM and SATURN models. This has been agreed with BCC.

The SATURN model was updated by SDG, with inputs provided by BCC and TfWM to agree the assumptions behind the update. The update also incorporated the EDGE route from Centenary Square (CSQ) to Hagley Road.

Full details of the update process can be found in the 'BCC SATURN Model Update – Local Model Validation Report', by SDG (January 2016), which is attached in **Appendix E.**

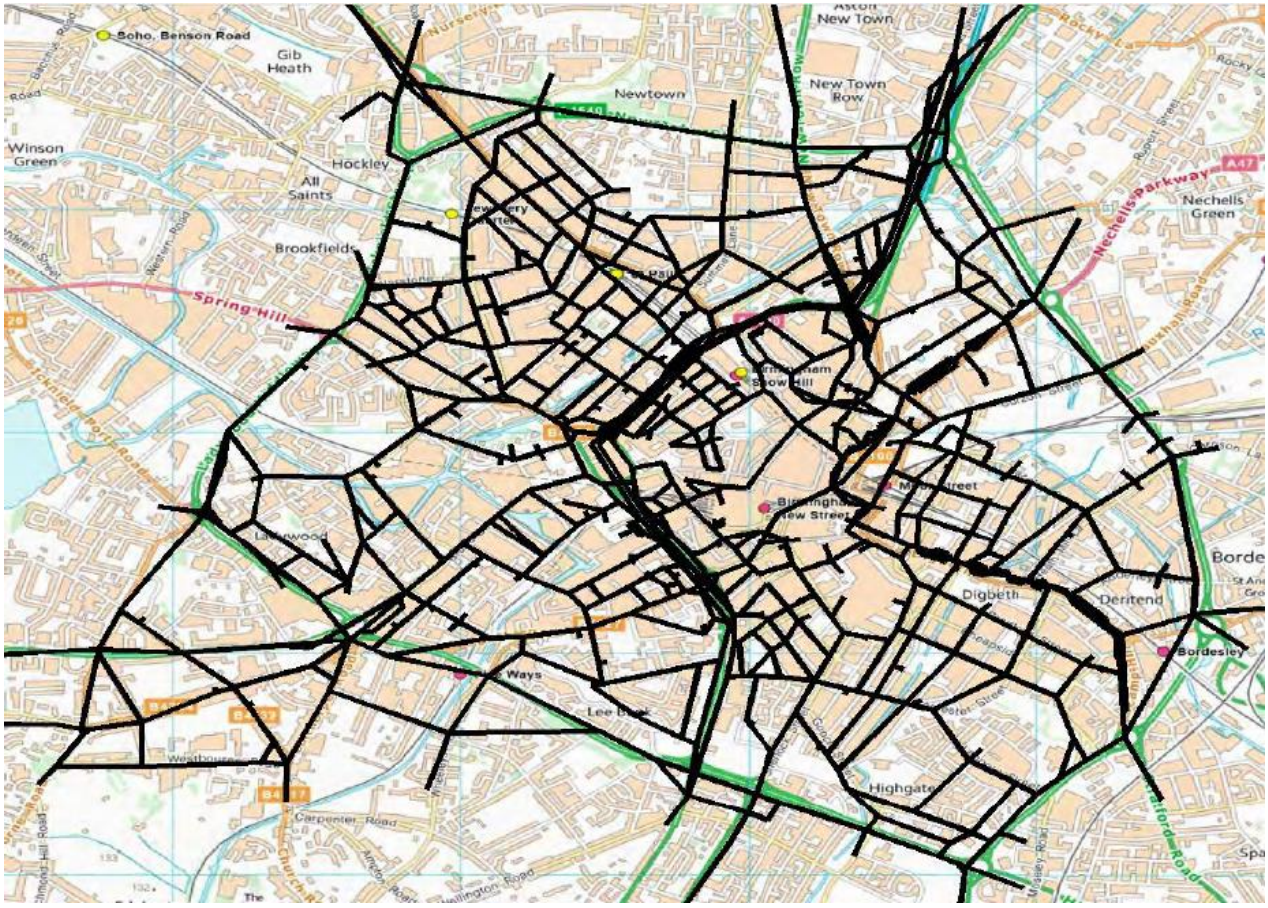
The updated SATURN model has been created from two existing source models:

- PRISM Model (Policy Responsive Integrated Strategy Model) – providing the initial traffic demand
- Birmingham City Centre SATURN model (Simulation and Assignment of Traffic to Urban Road Networks) – providing the network.

The PRISM model covers the West Midlands metropolitan area in around 1,000 zones, and includes a detailed network description of the highway and public transport networks. The PRISM model has been recently recalibrated to 2011. As the PRISM model is a regional strategic transport model, it is unsuitable to model the micro impacts of the BEE, but is suitable for providing the traffic demand used in updating the SATURN model. The SATURN model, with its more detailed representation of junctions and finer zoning system, is a more suited tool as opposed to PRISM to test the more detailed highway impacts of the BEE.

The SATURN model has a detailed representation of the roads and junctions within and including the Birmingham Ring Road (the modelled network covers central Birmingham Ring Road and is extended by 1km west in the Edgbaston area). The area of which the SATURN model covers is shown in Figure 5.1.

Figure 5.1: SATURN Model Area



Source: SDG (2016)

The Birmingham City Centre SATURN model has also been used to test a number of schemes with a similar level of impact across the city centre (for example EDGE).

The SATURN model represents the highway network as a series of links and nodes, with links representing the carriageway and nodes representing the junctions. The modelled area is divided into zones that contain the locations where journeys start (origins) and end (destinations). The base year network has 1,912 road links and 147 zones.

The demand is taken from the PRISM model; a four-stage demand model with a public transport, highway assignment and mode choice model. The base demand was taken directly from the PRISM model and adjusted to calculate the peak hours. The model covers the AM and PM peak hours of:

- 08:00-09:00
- 17:00-18:00.

The SATURN model contains the following user classes

- Car Work (1 PCU)
- Car Non-Work (1 PCU)
- Light Goods Vehicles - LGV (1 PCU)
- Heavy Goods Vehicles - HGV (2.5 PCUs)
- Taxis (1 PCU)
- Buses (2.5 PCUs).

Buses are coded in SATURN as fixed flows. Buses and HGVs have a passenger car unit (PCU) factor of 2.5 to convert from vehicles into car equivalents. To maintain consistency, the PCU factors used in the SATURN model have also been applied to the 2015 observed traffic counts. Matrix estimation was applied to the model to improve the local calibration. In order to calibrate / validate the model, a variety of observed data was used (e.g. traffic counts, journey time data and signal data).

The base year model performance was verified against WebTAG and Design Manual for Road and Bridges (DMRB) guidelines. These guidelines are based on TAG Unit M3.1 – Highway Assignment Modelling (DfT, 2014). Some key criteria are:

- Screenline Flow Validation – Difference between modelled flows and counts should be less than 5% of the counts (Table 1).
- Link Flows – GEH < 5 for individual flows and DMRB criteria (Table 2).
- Modelled times along routes should be within 15% of surveyed times (or 1 minute, if higher than 15%).

For the AM Peak Period, the 2011 modelled flows match the observed counts to a good level, with:

- 86% of all counts meeting the DMRB criteria.
- The cordon has a good fit with 84% of inbound counts and 97% of outbound counts matching the DMRB criteria.
- The ring road links also have a good match with 83% matching the DMRB and GEH<5 criteria (LMVR, SDG, 2015, paragraph 6.4).

The PM Peak Period count comparisons are slightly weaker than the AM, with:

- 83% of all counts meeting the DMRB criteria
- The inbound cordon has a very good fit with 100% of counts meeting the DMRB criteria
- The outbound direction has 77% meeting the DMRB criteria
- The ring road links also have a reasonable match with 75% matching the DMRB and GEH<5 criteria (LMVR, SDG, 2015, paragraph 6.5).

The SDG LMVR concluded with the following points (paragraphs 7.1 – 7.5):

- The updated model has taken the best available information available making use of the significant work done by the PRISM team in building base year matrices based on numerous data sources and done in line with government guidance. It also takes network information from the SATURN network model which has been developed over a number of years to test the impacts of various schemes on the city centre road network.
- A detailed audit of both models was undertaken before using the information with adjustments made where necessary to replicate the 2011 conditions.

- Following these initial checking stages, a model calibration was undertaken which has resulted in good levels of model calibration, with the model replicating observed counts and journey times to a good level (based upon WebTAG criteria – TAG Unit M3.1).
- The base year calibration has produced a robust 2011 model which can be used for testing the impacts of the proposed Metro schemes on the city centre in the AM and PM peak hours.
- The model has maintained links to the PRISM demand model so can be easily used as a starting point for the scheme forecasting.

5.4 Forecasting Approach

The forecast year highway models were, as stated above, created using PRISM forecast year matrices. The model was checked to ensure that there was consistency between the PRISM and the SATURN forecasts.

The SATURN model is a detailed highway assignment model covering the city centre (including the Ring Road). Base and future year demand matrices are cordoned from the regional PRISM model, which includes mode shift, trip generation and distribution models, and has been developed in accordance with WebTAG guidance on variable demand modelling.

The cordoning and segmentation process used in the base year model were used as a starting point. A pivot point approach was development to apply the growth implied by PRISM base and forecast year matrices. The growth from the PRISM model was applied to the SATURN model using the pivot point approach (with some redistribution to development zones).

As stated above, two modelled forecast years have been used: 2021 and 2031 based on the forecast inputs available for PRISM forecast years. The year 2021 has been used for the baseline year for the traffic model, as it is based on best available traffic data and information measured in the year 2011 and reflects the nearest temporal position to the opening year of the scheme, 2022. This approach has been consulted upon with BCC as its SATURN model is defined in these years. The year 2031 has been used to model a comparison ten years after the 2021 assessment.

An initial iteration of the future year SATURN model was provided by SDG to Mott MacDonald in October 2015. The initial model outputs helped shape the proposed LinSig models along the BEE track alignment. Optimised signal timings were then provided back to SDG in order to update the SATURN model.

Signals were updated to include lost time to general traffic where a stage is needed for the Metro to cross a junction. The following assumptions were made on the signal phasing:

- 10 trams per hour by direction
- Therefore 20 trams in both directions

It is assumed that the trams in each direction will not arrive at same time; therefore, a tram arrives every three minutes. This results in a worst case operation at the junctions as two tram phases will operate in each 6 minute period.

5.5 Do Minimum Forecast

The DM scenario represents the forecast situation with regards to development proposals and traffic characteristics in the proposed opening year of BEE, but without the BEE scheme itself. The DM scenario consists of the following network changes from the 2011 base year SATURN model:

- Anticipated and completed public transport network changes (including Midland Metro Line 1 extension to New Street Station, bus network changes and an increased frequency of stopping trains between Coventry and Wolverhampton)
- Committed and funded transport schemes
- HS2 network changes to be included in the 2021 and 2031 DM scenario (open year 2026, although network changes in place prior to opening)
- Significant development planned for Birmingham City Centre. Realistic assumptions made regarding trips.

The full DM network updates are shown in Table 5.1.

Table 5.1: Do Minimum Network Updates

Scheme	Description	2021	2031
City Centre Schemes			
Eastside	Improvements at junction of Cardigan Street/Jennens Road	✓	✓
Birmingham City Centre Interchange	Moor Street Queensway two-way for all traffic, modifications to junctions on Carrs Lane, Albert Street, Old Square, James Watt Queensway, Newton Street, Masshouse Lane, Lower Bull Street.	✓	✓
Holloway Circus	Left-slips on Holloway Head and Smallbrook Queensway and signalisation of Bristol Street approach	✓	✓
Metro to New St Station	Modifications to Colmore Circus Queensway and Corporation Street.	✓	✓
Paradise Circus	Re-arrangement of Paradise Circus Gyratory.	✓	✓
Broad St/Paradise Circus	Broad Street Public Transport only at the junction with Paradise Circus	✓	✓
Birmingham Gateway	New station car park arrangements. Access to car park at Navigation Street closed (egress only) and signalised access/egress on Hill Street.	✓	✓
Bath Row / Cregoe St	Signalisation of priority junction.	✓	✓
Navigation Street Link	Link road between Navigation Street and Holliday St. This is a complementary measure for the PT only movement from/ to Centenary Square.	✓	✓
Ring Road Schemes			
Bordesley Circus	Partial signalisation of roundabout with half-hamburger arrangement.	✓	✓
Haden Circus	Signalisation of roundabout, with half- hamburger arrangement including provision of slip road between Belgrave Middleway and Highgate Middleway.	✓	✓
Ashted Circus	Signalisation of junction	✓	✓
HS2 Scheme Network Changes			
Park Street	Closed between Masshouse Lane and Bordesley Street	✓	✓
New Canal Street	One-way southbound between HS2 taxi access on Curzon St and Banbury St	✓	✓
Fazeley Street	Stopped up, north of New Bartholomew street	✓	✓

Scheme	Description	2021	2031
Banbury Street	Stopped up, south of New Canal Street	✓	✓
Moor St Queensway	Moor St Queensway bus only between Carrs Lane and Albert Street	✗	✓
HS2 Mitigation Schemes			
Cardigan St/Curzon St	Signalisation of priority junction	✗	✓
Curzon Circle	Provision of left-slips from Curzon Street to Lawley Middleway and from Vauxhall Road to Lawley Middleway, as well as additional lanes on approaches to signalised junction.	✗	✓
Garrison Circus	Replacement of roundabout with signalised junction, including provision of left-slips from Watery Ln Middleway to Great Barr St, Watery Ln Middleway to Garrison Ln and from Garrison Ln to Watery Lane Middleway.	✗	✓
Southern Gateway Early Works			
As above	Ladywell Walk Closed to Traffic	✓	✓
As above	Improved junction to provide single phase pedestrian crossings at Smallbrook Queensway/Hill Street	✓	✓
As above	Junction changes on other roads including Thorpe St, Sherlock St and Barford St	✓	✓

Source: SDG (2016) Forecasting Assumptions

In addition to the schemes listed in Table 5.1, there is significant development planned for Birmingham City Centre, and the demand matrices used in the SATURN model.

As agreed with BCC, the DM model also consists of the following demand changes from the 2011 base year model:

- Arena Central
- Eastside development
- Curzon Street HS2 development
- Paradise Circus

For a detailed description of how the demand changes were calculated, see **Appendix E** (paragraph 21).

5.6 Do Something Forecast

The DS is the scenario in which the BEE is introduced to the public transport network, and the associated highway network changes are also implemented. The DS forecast includes all committed transport schemes (Chapter 5.5).

The DS scenario is defined by the following changes:

- Proposed track alignment
- Tram stop locations
- Bus Interchange
- Service specification (service patterns, fares, frequency and journey times)
- All associated highway capacity and traffic management measures implemented.

The DS SATURN model is based upon scheme design drawings provided to SDG by Mott MacDonald on the 8 March 2016. It is understood that further iterations of the BEE scheme design may be released with minor changes to the road layout (for example the signalisation of New Canal Street / Bordesley Street). The overall changes to the road network and re-routing of traffic will likely be insignificant.

5.7 Conclusion

In order to establish the effect of the BEE upon the local highway network, the Birmingham City Centre strategic highway model (based on SATURN software) was used. The SATURN model incorporates the demand outputs from PRISM and was used to derive AM and PM peak hour traffic flows for the following future scenarios:

- 2021 Do Minimum – without BEE
- 2021 Do Something – with BEE
- 2031 Do Minimum – without BEE
- 2031 Do Something – with BEE.

The Do Minimum scenario includes committed transport schemes and committed developments (see Table 5.1) for each future year, while comparison with the corresponding Do Something scenario allows the impacts of the BEE scheme to be identified.

The following chapter presents the results of the junction capacity assessments for all future-year scenarios for identified on-line and off-line junctions.

6 Impact on General Traffic

6.1 Introduction

It was agreed with BCC during the scoping for this TA that the assessment should include a number of online and offline (i.e. 'on-route' and 'off-route' respectively) junctions. The online junctions are summarised in Table 6.1. The offline junctions are summarised in Table 6.2.

Table 6.1: Key On-line Junctions Located along the BEE Route Alignment

Junction Reference	Junction	Existing	Proposed	Requires Capacity Assessment
1	Corporation Street / Bull Street	Signalised	Signalised	BEE has a direct impact on this junction.
2	High Street / Bull Street	Priority	Signalised	BEE has a direct impact on this junction.
4	Moor Street Queensway / Albert Street	Signalised	Signalised	BEE has a direct impact on this junction.
5	New Canal Street / Fazeley Street	Signalised	Signalised	BEE has a direct impact on this junction.
6	New Canal Street / Bordesley Street	Priority	Signalised	BEE has a direct impact on this junction.
8	Digbeth B4100 / Meriden Street	Signalised	Signalised	BEE has a direct impact on this junction.
11	Digbeth B4100 / Rea Street	Signalised	Signalised	Right-turn to be allowed from Rea Street (currently banned). BEE will have a direct impact on this junction.
12	High Street Deritend / Milk Street	Priority	Priority	BEE has a direct impact on this junction (the right-turn from High Street Deritend to be removed). The proposed tram stop is located immediately to the east of this junction.
13	High Street Deritend / Floodgate Street	Priority	Priority	This junction has a left in / left out arrangement. BEE may directly affect the operation of this junction.
16	High Street Deritend / Heath Mill Lane	Signalised	Signalised	BEE has a direct impact on this junction.
17	High Street Deritend / Alcester Street	Signalised	Signalised	BEE has a direct impact on this junction.
18	High Street Deritend / Adderley Street	Priority	Priority	BEE has a direct impact on this junction.

Source: Mott MacDonald

Table 6.2: Key Off-line Junctions Located Near the BEE Route Alignment

	Junction	Existing	Proposed
1	Moor Street Queensway / Masshouse Lane	Signalised	Signalised
2	Moor Street Queensway / James Watt Queensway (B4114)	Signalised	Signalised
3	Moat Lane Gyratory	Signalised	Signalised
4	Heath Mill Lane / Liverpool Street	Signalised	Signalised

Detailed assessments have been undertaken of these junctions using traffic data derived from the SATURN model outputs, and have been assessed using LinSig and / or Junctions 9 software packages, depending on the junction type.

6.2 Traffic Data

6.2.1 Introduction

The 2015 observed traffic data represented in this report has been collated by Sky High on behalf of Mott MacDonald and TfWM. The 2015 observed peak hour traffic flows are shown in **Appendix F**.

6.2.2 Surveys Undertaken

The traffic surveys were undertaken at 21 junctions in Birmingham City Centre and Birmingham Eastside. At each site, junction turning counts and queue surveys were undertaken. All surveys were undertaken using video footage. The junction turning counts (JTC) were reported in 15-minute time intervals, classified by mode.

Data collection was conducted over two days:
- Saturday 20 June 2015 (11:00-17:00)
- Tuesday 23 June 2015 (07:00-10:00 and 16:00-19:00).

The weekday data collection was conducted on a Tuesday to avoid any interference from weekend related traffic. The surveys were also undertaken during school term time to represent a neutral scenario. The methodology behind undertaking the traffic surveys for the purpose of the TA was agreed with BCC during the scoping exercise (BCC confirmed in an email dated 30 December 2015 to the Department for Transport responding to the EIA scoping opinion consultation that the scope of works had been agreed with TfWM and Mott MacDonald).

The surveyed sites are as follows:
- Bull Street / Dale End (on-line)
- Albert Street / New Meeting Street (on-line)
- Moor Street Queensway / Albert Street (on-line)
- New Canal Street / Fazeley Street (on-line)
- New Canal Street / Bordesley Street (on-line)
- Meriden Street / Coventry Street (on-line)
- Digbeth B4100 / Meriden Street (on-line)
- Digbeth B4100 / Mill Lane (on-line)
- Digbeth B4100 / Oxford Street (on-line)
- Digbeth B4100 / Rea Street (on-line)
- High Street Deritend / Milk Street (on-line)
- High Street Deritend / Floodgate Street (on-line)
- High Street Deritend / Stone Yard (on-line)

- High Street Deritend / Chapel House Street (on-line)
- High Street Deritend / Heath Mill Lane (on-line)
- High Street Deritend / Alcester Street (on-line)
- High Street Deritend / Adderley Street (on-line)
- Moor Street Queensway / Masshouse Lane (off-line)
- Moor Street Queensway / James Watt Queensway B4114 (off-line)
- Moat Lane Gyratory (off-line)
- Heath Mill Lane / Liverpool Street (off-line).

As stated, for the purpose of assessment, throughout much of the TA the route has been divided into three sections as follows (also see Figure 2.1):

- Section 1: Corporation Street to Eastside Park
- Section 2: Eastside Park to Meriden Street
- Section 3: Meriden Street to Adderley Street.

The same defined sections have been used in order to analyse the traffic data. The total junction turning counts for the three individual areas were then calculated to find the peak hour for the areas.

6.2.3 Derivation of Peak Period

Peak periods were derived from the 2015 observed traffic data. Table 6.3 presents the weekday AM peak data collected on Tuesday 23 June, 2015, showing the average junction turning count for each area and total average accumulated junction turning count for all surveyed sites.

Table 6.3: Weekday AM Peak Average On-line Junction Flows (PCUs)

Hour Period	Section 1	Section 2	Section 3	Total Average
07:00 – 08:00	691	397	1,041	866
07:15 – 08:15	759	450	1,174	973
07:30 – 08:30	812	502	1,273	1,055
07:45 – 08:45	822	550	1,308	1,086
08:00 – 09:00	836	573	**1,361**	1,126
08:15 – 09:15	**844**	585	1,360	**1,128**
08:30 – 09:30	841	**601**	1,354	1,125
08:45 – 09:45	819	590	1,330	1,104
09:00 – 10:00	818	573	1,299	1,081

Source: Mott MacDonald

Section 3 is the section with the highest amount of surveyed traffic, and this section has the highest average traffic flow between 08:00 and 09:00. Due to the fact the period 08:00 to 09:00 aligns with data in the SATURN model, it has been assumed that this is the peak hour for the junctions assessed for the BEE proposed scheme.

Table 6.4 presents the weekday PM peak data collected on Tuesday 23 June 2015, showing the average accumulated junction turning count for each area and total average accumulated junction turning count for all surveyed sites.

Table 6.4: Weekday PM Peak Average On-line Junction Flows (PCUs)

Hour Period	Section 1	Section 2	Section 3	Total Average
16:00 – 17:00	1,063	794	1,598	1,350
16:15 – 17:15	1,116	843	1,622	1,382
16:30 – 17:30	1,117	859	**1,624**	**1,385**
16:45 – 17:45	**1,120**	**875**	1,606	1,376
17:00 – 18:00	1,088	813	1,526	1,309
17:15 – 18:15	1,026	744	1,434	1,228
17:30 – 18:30	977	689	1,367	1,169
17:45 – 18:45	922	592	1,266	1,080
18:00 – 19:00	852	524	1,207	1,020

Source: Mott MacDonald

Table 6.4 shows different peak periods for the three identified sections. The total average, however, shows the peak period to be 16:30 – 17:30. This peak period will therefore be used for the purpose of the junction modelling at all junctions.

Table 6.5 shows the Saturday peak traffic data, collected on Saturday 20 June, 2015, showing the average accumulated junction turning count for each area and total average accumulated junction turning count for all surveyed sites.

Table 6.5: Saturday Peak Average

Hour Period	Section 1	Section 2	Section 3	Total Average
11:00 – 12:00	798	532	1,049	1,008
11:15 – 12:15	822	564	1,090	1,046
11:30 – 12:30	828	584	1,119	1,074
11:45 – 12:45	846	587	1,106	1,065
12:00 – 13:00	841	600	1,113	1,069
12:15 – 13:15	851	622	1,116	1,076
12:30 – 13:30	860	676	1,135	1,098
12:45 – 13:45	854	686	1,136	1,101
13:00 – 14:00	861	692	1,105	1,080
13:15 – 14:15	852	677	1,106	1,078
13:30 – 14:30	848	664	1,092	1,065
13:45 – 14:45	825	701	1,109	1,077
14:00 – 15:00	820	745	1,112	1,084
14:15 – 15:15	830	788	1,102	1,084

Hour Period	Section 1	Section 2	Section 3	Total Average
14:30 – 15:30	867	**831**	1,146	1,129
14:45 – 15:45	910	816	1,168	1,154
15:00 – 16:00	924	801	1,212	1,187
15:15 – 16:15	**938**	785	**1,222**	**1,195**
15:30 – 16:30	908	740	1,208	1,173
15:45 – 16:45	890	714	1,179	1,143
16:00 – 17:00	899	708	1,190	1,153

Source: Mott MacDonald

As shown in Table 6.5, the peak period for Saturday is 15:15 – 16:15. This peak period will therefore be used for the purpose of the junction modelling.

Automatic Traffic Counts (ATC) were also undertaken to help establish peak periods. This enabled comparison with the JTC data, and the comparison of all the peak periods is shown in Table 6.6.

Table 6.6: Peak Hour Summary

Peak Period	JTC	ATC
Weekday AM Peak	08:00 - 09:00	08.15 – 09:15
Weekday PM Peak	16:30 -17:30	16:30 – 17:30
Saturday Peak	15:15 – 16:15	14:45 – 15:45

Source: Mott MacDonald

The Saturday peak hour has been used to analyse the existing capacity of junctions and calibrate the base models, although due to the SATURN model only producing outputs for the weekday AM and PM peak hours the future scenario models will not consider the Saturday peak hour. This has been agreed with BCC. It is assumed that for future scenarios it is only necessary to analyse the weekday AM and PM periods due to the fact that the PM Peak period highlights the worst case scenario over the BEE route (this scenario has the most traffic).

The peak periods to be used in the 2015 observed junction capacity assessments are as follows:
- Weekday AM: 08:00–09:00
- Weekday PM: 16:30–17:30
- Saturday: 15:15–16:15.

The SATURN model peak periods are as follows:
- Weekday AM: 08:00–09:00
- Weekday PM: 17:00–18:00.

6.2.4 Traffic Flows for Forecast Junction Capacity Assessments

SATURN model data has been provided by SDG in order to assess the impact of the Birmingham Eastside Extension upon the local highway network. SATURN data was provided for the following future year scenarios:

- 2021 DM
- 2021 DS
- 2031 DM
- 2031 DS.

The SATURN model data was provided in PCUs, with the following PCU factors:

- Car Work – 1 PCU
- Car Non-Work – 1 PCU
- LGV – 1 PCU
- HGV – 2.5 PCUs
- Taxi – 1 PCU
- Bus – 2.5 PCUs

Therefore, for consistency, the PCU factors outlined above have been applied to the 2015 Observed turning counts. From this point forward, flows have been dealt with in PCUs.

It was acknowledged by SDG (in meetings with SDG/TfWM/BCC and in email correspondence) that the SATURN model shows some traffic avoiding High Street Deritend and travelling via Alcester Street and Bradford Street. In addition to this, Mill Lane, Stone Yard and Chapel House Street were not modelled in SATURN. SDG stated the following (in correspondence dated 19 April 2016):

> "The zonal system and network detail of the strategic SATURN model means that locations of the entry/ exit points of the traffic onto the network cannot be represented at the level of detail required for the junction modelling."
>
> "In addition the level of diversion away from High Street Deritend as a result of the Metro is likely to be currently overestimated in the SATURN model. This is particularly the case given that the signal timings and junction layouts are based on the initial designs which are currently being refined as part of the current task. The final design will address many of these issues including optimising the signal offsets to ensure that the traffic flows along High Street Deritend as efficiently as possible."

To address the above issue and make the SATURN data suitable for junction capacity assessments, traffic was redistributed at the following junctions based upon observed turning count proportions:

- Alcester Street
- Chapel House Street
- Stone Yard
- Rea Street
- Mill Lane

- Bradford Street

The redistribution did not impact any turning counts travelling eastbound on Digbeth (B4100) and High Street Deritend, or any junctions not included in the list above. This method also ensured that the amount of traffic entering and exiting the network remained the same as the SATURN output data. The redistributed SATURN data is used in the following methodology (therefore where SATURN data is referred to, this refers to the redistributed SATURN data).

6.2.4.1 Hybrid Approach

To ensure that the SATURN data was representative of actual traffic flows, it was agreed with BCC that a method which sought to incorporate the SATURN future year scenarios with 2015 observed traffic flows should be used where possible.

The 2011 SATURN data has been used to represent the base year assessment for this TA. The Birmingham City Centre Cordon surveys, which are undertaken biennially, have been assessed to determine the change in traffic volumes between 2011 and 2015.

A review of the Automatic Traffic Count (ATC) data from sites that form the Birmingham City Centre Cordon is summarised in Table 6.7.

Table 6.7: 2011 and 2015 Birmingham City Centre Cordon Site Data

Total Average Daily Two-Way Flow over Birmingham Cordon Sites (24hr)		
2011	2015	2011 to 2015 Birmingham Cordon Factor
245,591	233,781	0.952

Source: Birmingham City Centre Cordon

Table 2.7 shows traffic flows to decrease by a factor of 0.952 over the assessed period. The small change in traffic flows between 2011 and 2015 suggests that data from the 2011 Saturn model provides a reasonable representation of traffic flows in 2015. Applying the absolute traffic growth to the 2015 traffic flows is therefore considered appropriate (where there are minimal network changes).

There are two methodologies which were considered when incorporating the observed traffic flows in the SATURN model flows:

- Proportional – for a particular turning movement, calculating the percentage change between the 2011 SATURN data and future year SATURN data, and applying this to the corresponding turning movement in the 2015 surveyed data.
- Absolute – for a particular turning movement, calculating the difference (in PCUs) between the 2011 SATURN data and future year SATURN data, and adding this to the corresponding turning movement in the 2015 surveyed data.

After applying both methodologies to the given data, limitations were addressed for both methods. For the proportional method, the following was noted:

- An increase from, say, 1 PCUs to 10 PCUs in the SATURN data applied to an observed value of 10 PCUs would result in a forecast of 100 PCUs, whereas using the absolute method this would result in a forecast of 19 PCUs.
- This was observed frequently throughout the data, and the method also resulted in large differences in traffic exiting a junction and entering the next junction.

For the absolute method, the following was noted:

- Unlike the proportional method, the absolute method maintains balancing between junctions (traffic flows exiting a junction and entering the next junction are the same).
- For some turning movements, the method resulted in a negative flow. Specifically this occurred on 4.1% of the turning movements across all peaks and scenarios. Because of the above point and the relatively low occurrence, it was possible to use judgement and traffic flows at the surrounding junctions to decide on an appropriate flow.

On presenting these issues to BCC, and also noting that the absolute method has been used for the EDGE assessment, it was agreed that the absolute method would be used where possible to calculate the future year traffic flows. The calculated flows using the absolute method are referred to in the following Chapter as ‘hybrid’ flows.

In line with the rest of the TA, the route corridor has been divided into three sections in order to clearly explain the approach taken to generate the future year traffic flows for use in the junction capacity assessments.

6.2.4.2 Section 1 – Moor Street Queensway

Since the 2011 SATURN model was created, there have been significant network changes in Section 1 of the route as a result of the Birmingham Bus Mall. The network changes are as follows:

- 2011 configuration – Moor Street Queensway one-way northbound with segregated lanes for buses/taxis and general traffic.
- Current configuration – two-way operation along Moor Street Queensway between Moor Street and the junction with Masshouse Lane. One-way northbound between the Masshouse Lane and James Watt Queensway (B4144) junction.

Due to the significant network changes, no useful comparison could be made between the 2011 SATURN data and 2015 observed data Therefore, the traffic flows for all future year scenarios in Section 1 of the route were taken directly from the SATURN model. This has previously been agreed with BCC.

Minor balancing has been undertaken between junctions that are to be modelled in a LinSig network.

6.2.4.3 Section 2 and 3 – New Canal Street / Meriden Street / Digbeth (B4100) / High Street Deritend

The hybrid method has been applied in Sections 2 and 3 of the scheme corridor.

As a result of the hybrid approach, turning movements which are to be banned in the future year scenarios have initially been calculated as non-zero flows. These have been rectified individually once the method has been applied, and balancing has then been undertaken between these junctions. These turning movements include:

- New Canal Street (north of the junction with Fazeley Street) to be one-way southbound in the DM scenarios.
- New Canal Street (north of the junction with Fazeley Street) to be tram-only in the DS scenarios.
- No eastbound movements from Fazeley Street (west of the New Canal Street / Fazeley Street junction) in both the DM and DS scenarios.
- Right-turn from High Street Deritend to Milk Street included in the DM, banned in the DS.
- Right-turn from Rea Street to High Street Deritend included in the DS, banned in the DM.

6.3 Junction Modelling Methodology

Junction capacity assessments have been undertaken for a Base Year (2015) as well as the forecast years 2021 and 2031. LinSig Version 3 and PICADY (within Junctions 9) have been used to model the Base Year and future scenarios. These software programmes are approved by the Department for Transport.

LinSig is a modelling software package for assessing the capacity of signalised junctions. LinSig results refer to the Degree of Saturation (DoS) and Mean Maximum Queue (MMQ) in each lane of the approaches to the junctions. A DoS of 100% indicates that the lane in question is operating at its absolute capacity (point of saturation), whilst a DoS of 90% or less indicates that the lane is operating within its practical capacity. The Practical Reserve Capacity (PRC) is the spare overall junction capacity. It is a function of the DoS of the worst performing lane. A positive PRC indicates that a junction has spare capacity and may be able to accept more traffic. A negative PRC indicates that the junction is over capacity and is suffering from traffic congestion. A junction where the worst performing lane has a DoS of 90% has a PRC of 0%.

There are two priority junctions that need to be modelled on the BEE alignment, and these have been modelled using the industry standard software Junctions 9. Within the Junctions 9 software, the PICADY (Priority Intersection Capacity and Delay) module was used for the following junctions:

- Bull Street / Dale End (2015 Base Year and Do Minimum scenario)
- New Canal Street / Bordesley Street (2015 Base Year and Do Minimum scenario).

Junctions 9 uses a Ratio of Flow to Capacity (RFC) value to indicate the capacity of a junction. Arms with an RFC value of 0.85 or more are generally considered to be operating with a degree of constraint, while values over 1.00 are indicative of a link which is operating above its design standard. A maximum queue length is also recorded for each junction approach, which is recorded in units of PCUs.

Each measure is used to illustrate the existing operation of the junctions and the potential effects of increased traffic flows. Whilst in reality a junction will continue to operate when congestion is predicted, a congested junction would not be expected to clear demand as efficiently as an uncongested junction.

All 2015 Base Year junction models have been validated alongside the 2015 queue surveys, and the validation of the junction models can be found in **Appendix D**.

In order to effectively model the tram, where the tram runs on shared track at a signal junction, a flow of 58 PCUs was added to the traffic movement. This is based upon the following assumptions:

- 1 PCU length = 5.75m
- Tram length = 33m
- A typical tram will be equal to 5.74 PCUs in length
- The flows were input assuming 10 trams per hour (tph) on the BEE track alignment in each direction.

Where a tram runs on segregated track, no flows were input based upon the assumption that the tram will clear within the minimum green time. Furthermore, where trams run on segregated track, cycle times were adjusted based upon the following principles:

- One tram in each direction every six minutes (360 second cycle where trams run in separate phases, 180 second cycle time where they run in the same phase)
- Average cycle time = 90 seconds
- Therefore a tram in each direction once every four cycles (6 minutes).

In order to calculate the phase intergreens at the proposed junctions the software package quickGreen was used. quickGreen is a software tool to help signal engineers measure and calculate phase intergreens for traffic signal junctions.

Phase intergreens ensure sufficient clearance times between a stream of traffic stopping and a conflicting stream of traffic starting at a traffic signal junction. quickGreen uses the Department for Transport's Traffic Advisory Leaflet TAL 1/06 which describes the methodology for calculating intergreens. This involves determining conflict points between traffic movements and measuring relative distances traffic movements must travel to reach each conflict point from a scale drawing. TAL 1/06 can then be used to convert this information into intergreen values.

In order to calculate the intergreen for a tram phase, a methodology was adopted which sought to manually increase the conflict distance (by 20 metres) which resultantly increased the intergreen. This ensures a sufficient clearance time for the tram (which is significantly longer than general traffic).

The results of the future year junction models are presented in following sub-chapter (DM and DS results for the forecast years of 2021 and 2031).The full outputs of all the junction capacity assessments are available on request.

6.4 On-line Junctions

6.4.1 Introduction

The following chapter summarises the Do Minimum and Do Something junction modelling results for the on-line junctions. The signal timings (cycle times) have been taken from the 2015 Base Year assessments which are summarised in **Appendix D**. Where applicable, the LinSig assessments have been updated where geometric changes have occurred in the Do Minimum and Do Something scenarios.

6.4.2 Corporation Street / Bull Street

Bull Street is a one-way single carriageway road that provides access from High Street and Dale End in the south to Corporation Street in a north westerly direction. Bull Street is a bus and cycle only carriageway. The current BCCE runs from Bull Street to Corporation Street, operating across a newly signalised junction.

6.4.2.1 Do Minimum Assessment

The 2021 and 2031 DM results are shown in Table 6.8. Based on site observations, stages typically run for their minimum green time of seven seconds due to low demand, which has been reflected in the modelling. The key exception is when a tram approaches and in this case the stage green time will extend for longer until the tram has cleared the junction. For robustness, the minimum possible cycle time has been modelled, which represents a worst case scenario as it results in more inter-stage periods in the hour.

Table 6.8: Corporation Street / Bull Street DM Results

	AM 2021		AM 2031		PM 2021		PM 2031	
Movement	DoS (%)	MMQ (PCU)	DoS (%)	MMQ (PCU)	DoS (%)	MMQ (PCU)	DoS (%)	MMQ (PCU)
Bull Street (north)	Tram Only							
Bull Street (south)	57.8	3.2	56.7	3.1	61.9	3.6	61.9	3.6
Corporation Street	Tram Only							
Cycle Time (s)	51		51		51		51	
PRC (%)	55.6		58.8		45.4		45.4	

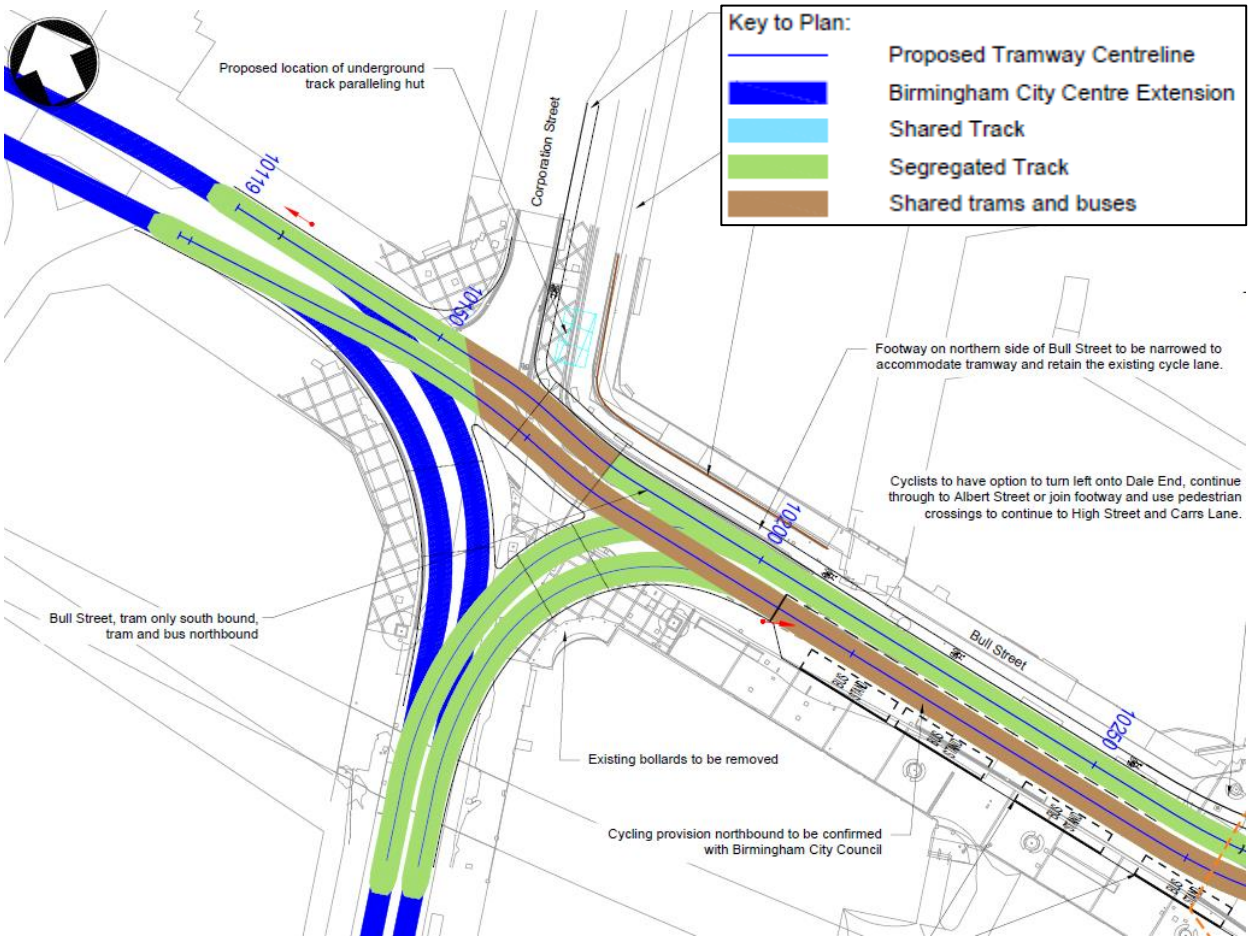
Source: LinSig V3

Table 6.8 shows that there are no capacity issues in all Do Minimum future year scenarios at the Corporation Street / Bull Street junction.

6.4.2.2 Do Something Assessment

The junction has recently been realigned as part of the BCCE, and the BEE will further the realignment. The BEE begins at the Corporation Street / Bull Street junction, diverging from the existing tram system. The junction is currently signalised, and will remain signalised upon the introduction of the BEE. The junction configuration is shown in Figure 6.1.

Figure 6.1: Do Something Corporation Street / Bull Street Junction Layout



Source: ES Volume 2 Technical Appendix A, MMD-300207-HS29-DRA-0000-0011

The junction will consist of shared and segregated use, with the outbound section of the BEE being segregated. The inbound side of the track will be a shared use track up to and beyond the Corporation Street junction.

Three pedestrian crossings are to be provided at the Corporation Street / Bull Street junction, with a central pedestrian refuge. The 2021 and 2031 DS results are shown in Table 6.9, which shows that there are no capacity issues in all Do Something future year scenarios.

Table 6.9: Corporation Street / Bull Street DS Results

Movement	AM 2021		AM 2031		PM 2021		PM 2031	
	DoS (%)	MMQ (PCU)	DoS (%)	MMQ (PCU)	DoS (%)	MMQ (PCU)	DoS (%)	MMQ (PCU)
Bull Street (north)	Tram Only							
Bull Street (south)	29.7	0.7	29.4	0.7	31.7	0.8	31.2	0.7
Corporation Street	Tram Only							
Cycle Time (s)	360 (90)[6]		360 (90)		360 (90)		360 (90)	
PRC (%)	203.2		205.6		183.8		188.1	

Source: LinSig V3

6.4.3 Bull Street / Dale End

The Bull Street / Dale End junction is a three-arm priority junction, with Bull Street and High Street comprising the major arm (one way movement from High Street to Bull Street).

6.4.3.1 Do Minimum Assessment

The DM assessment for Bull Street / Dale End has been undertaken using PICADY in the Junctions 9 software package. The 2021 and 2031 AM DM results are shown in Table 6.10, which shows no capacity issues in all Do Minimum future year scenarios.

Table 6.10: Bull Street / Dale End DM Results

Movement	AM 2021		AM 2031		PM 2021		PM 2031	
	RFC	Queue (PCU)	RFC	Queue (PCU)	RFC	Queue (PCU)	RFC	Queue (PCU)
High Street	Exit Only							
Dale End	0.16	0.4	0.16	0.4	0.17	0.3	0.18	0.4
Bull Street	0.35	1.2	0.38	1.3	0.38	1.3	0.49	2.0

Source: Junctions 9 (PICADY)

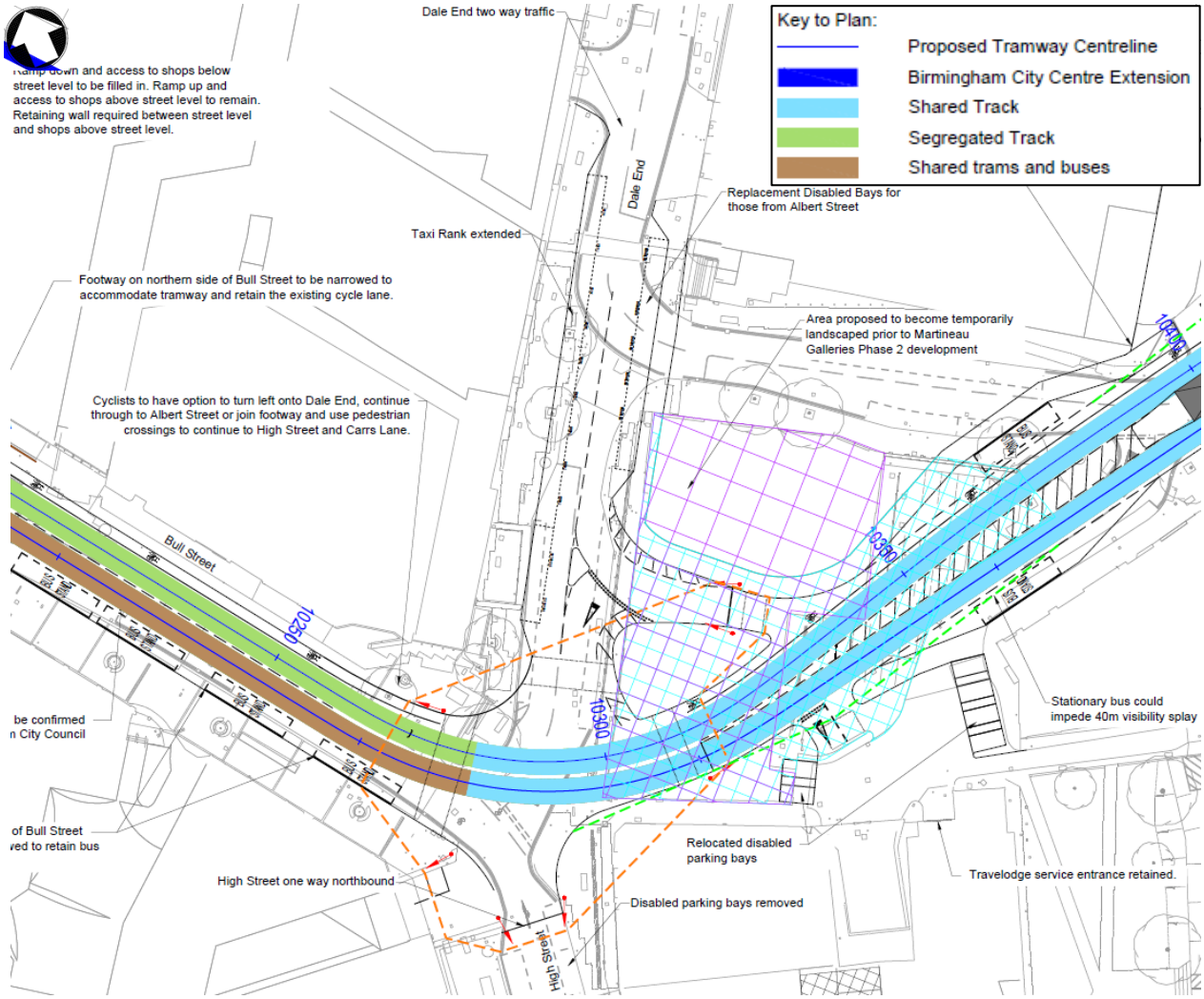
6.4.3.2 Do Something Assessment

The tram proposal results in a complete redesign of this junction, turning it into a five-arm signalised junction with pedestrian crossing facilities. The redesigned junction will allow for effective and efficient control of the tram and traffic interface whilst also providing safe crossing facilities for pedestrians across the busiest pedestrian crossing site along the route (see Chapter 11.4.1).

[6] The cycle time represents a tram phase in each direction every 6 minutes (4 x 90 second cycles; 360 seconds).

The tram will run to / from Bull Street and Moor Street Queensway via the New Alignment. There is also provision for a signalised service access which is currently a priority junction. The Do Something junction configuration is shown in Figure 6.2.

Figure 6.2: Do Something Bull Street / Dale End Junction Layout



Source: ES Volume 2 Technical Appendix A, MMD-300207-HS29-DRA-0000-0011

As a result of the junction redesign and signalisation, LinSig has been used to model the 2021 and 2031 DS scenarios. The results are shown in Table 6.11.

Table 6.11: Bull Street / Dale End DS Results

Movement	AM 2021		AM 2031		PM 2021		PM 2031	
	DoS (%)	MMQ (PCU)	DoS (%)	MMQ (PCU)	DoS (%)	MMQ (PCU)	DoS (%)	MMQ (PCU)
Bull Street	Tram/Cycle Only							
Dale End	12.0	0.6	7.4	0.4	50.3	2.8	12.0	0.6
New Alignment	57.4	4.5	55.4	4.6	58.6	4.7	59.4	4.7
High Street	57.8	9.3	55.6	8.3	58.2	9.4	59.0	9.5
Service Access	3.4	0.2	6.8	0.3	3.4	0.2	3.4	0.2
Cycle Time (s)	360 (90)		360 (90)		360 (90)		360 (90)	
PRC (%)	55.7		61.9		53.5		51.5	

Source: LinSig V3

Table 6.11 shows that there are no capacity issues at the Bull Street / Dale End junction in all Do Something future year scenarios. Queuing and delay at the junction will increase in comparison to the Do Minimum scenario though due to the signalisation of the junction. For example from the DM model scenarios there is a maximum queue of 2.0 PCUs (2031 PM peak), whereas there is a maximum modelled queue of 9.5 PCUs in the DS scenarios (2031 PM peak).

6.4.4 Moor Street Queensway / Albert Street

Moor Street Queensway is a dual carriageway, with a discontinuous bus lane. It connects Birmingham Moor Street Rail Station in the south to Moor Street Queensway / James Watt Queensway (B4114) in the north. A central reservation separates traffic, whilst also providing a safe crossing point for pedestrians at the Albert Street junction.

The northbound approach to the junction has three lanes, with the nearside lane dedicated for vehicles turning left into Albert Street. North of the junction on both sides of the road there are segregated bus lanes. Approaching the Albert Street / Moor Street Queensway junction in a southbound direction there are two vehicular lanes and one bus lane. The offside lane is dedicated for vehicles turning right onto Albert Street.

BCC have identified Moor Street Queensway for future restrictions to general traffic (making it bus and taxi only) between the Carrs Lane and Albert Street junctions. It is proposed the closure will take effect in 2026, therefore only the 2031 SATURN model run includes this (both the DM and DS scenarios).

Identified in a technical note produced by Atkins (2014[7]) regarding the restriction on Moor Street Queensway, the closure of Moor Street Queensway is expected to significantly reduce the number of vehicle trips in the city centre, particularly on High Street Deritend, New Canal Street and Bradford Street.

7 Atkins (2014) HS2 City Centre Modelling, Moor Street Queensway Closure Test, Technical Note

6.4.4.1 Do Minimum Assessment

The 2021 and 2031 DM results are shown in Table 6.12.

Table 6.12: Moor Street Queensway / Albert Street DM Results

Movement	AM 2021		AM 2031		PM 2021		PM 2031	
	DoS (%)	MMQ (PCU)	DoS (%)	MMQ (PCU)	DoS (%)	MMQ (PCU)	DoS (%)	MMQ (PCU)
Albert Street Left/Right	59.9	4.2	56.3	3.1	74.0	9.8	62.4	5.6
Moor Street Queensway (north) Ahead (Lane 1)	35.4	4.6	37.4	4.9	33.1	3.3	20.6	2.3
Moor Street Queensway (north) Right/Ahead (Lane 2/3)	47.7	4.2	63.1	7.8	45.3	4.5	34.1	3.3
Moor Street Queensway (south) Left/Ahead (Lane 1)	41.5	5.4	6.2	0.7	44.7	5.5	6.7	0.8
Moor Street Queensway (south) Ahead (Lane 2/3)	54.0	5.5	15.1	1.2	60.3	6.5	14.7	1.3
Cycle Time (s)	78		78		78		78	
PRC (%)	50.3		42.6		21.6		44.1	

Source: LinSig V3

Table 6.12 shows that there are no capacity issues in all Do Minimum future year scenarios at the Moor Street Queensway / Albert Street junction. The worst case modelled DM scenario for the Moor Street Queensway / Albert Street junction is the 2021 PM, with a PRC of 21.6%. There is a MMQ of 9.8 PCUs on Albert Street in this scenario.

6.4.4.2 Do Something Assessment

The Moor Street Queensway / Albert Street junction is currently a signalised three-arm junction. The proposed plans result in the closure of Albert Street, although this arm is replaced in the same location by the New Alignment towards the High Street / Bull Street junction (see **ES Volume 2 Technical Appendix A, MMD-300207-HS29-DRA-0000-0011).**

There is a proposed Bus Interchange outside Hotel La Tour to the east of the junction. Buses and trams are segregated at the Bus Interchange.

Currently a three-arm signalised junction, Moor Street Queensway / Albert Street will become a four-arm signalised junction with the following arms:

- Moor Street Queensway (north)
- Bus Interchange
- Moor Street Queensway (south)
- New Alignment (replacing Albert Street which will be closed as part of the proposals).

The phasing and staging of the junction has been reconfigured in accordance with the BEE proposal. The 2021 and 2031 DS results are shown in Table 6.13 which shows that there are no capacity issues in all Do Something future year scenarios.

Table 6.13: Moor Street Queensway / New Alignment DS Results

	AM 2021		AM 2031		PM 2021		PM 2031	
Movement	DoS (%)	MMQ (PCU)	DoS (%)	MMQ (PCU)	DoS (%)	MMQ (PCU)	DoS (%)	MMQ (PCU)
New Alignment	77.9	5.8	60.2	4.3	82.4	8.2	57.7	4.6
Moor Street Queensway (north) Ahead (Lane 1)	79.1	10.6	46.7	3.9	83.1	9.5	58.2	4.0
Moor Street Queensway (north) Ahead/Right (Lane 2)	79.1	10.6	46.5	3.9	83.0	9.5	58.3	4.0
Moor Street Queensway (south) Ahead/Left (Lane 1)	73.0	7.3	35.3	2.6	82.3	7.8	39.8	2.4
Moor Street Queensway (south) Ahead (Lane 2)	73.0	7.3	35.1	2.6	82.7	7.8	39.3	2.4
Moor Street Queensway (south) Ahead (Lane 3)	73.3	7.3	35.1	2.6	82.3	7.8	39.3	2.4
Bus Interchange (bus lane)	79.0	7.9	60.9	6.5	82.7	8.8	57.6	7.0
Bus Interchange (tram lane)	Tram Only							
Cycle Time (s)	360(90)		360(90)		360(90)		360(90)	
PRC (%)	13.7		47.7		8.4		54.3	

Source: LinSig V3

In comparing the DM and DS model results, the 2021 results show a deterioration in operation with the introduction of BEE (e.g. the PRC for the AM 2021 DM is 50.3%, which reduced to 13.7% in the AM 2021 DS scenario). In contrast, the 2031 DS (AM and PM peak) operate with a higher PRC when compared to the DM results. This is due to the change in traffic flows as a result of the closure of Moor Street Queensway (between Carrs Lane and Albert Street) to general traffic in 2026.

6.4.5 New Canal Street / Fazeley Street

This four-armed signalised junction provides access north to south along New Canal Street and east to west along Fazeley Street. There are no signalised pedestrian crossing facilities. Bartholomew Street is also accessible at this junction, with a junction 15m west of the junction along Fazeley Street.

6.4.5.1 Do Minimum Assessment

As part of the DM proposals and as a result of the development of the HS2 station, Fazeley Street (west) will become one-way in a westbound direction. Fazeley Street will provide access to the HS2 station only. The 2021 and 2031 DM results are shown in Table 6.14, which shows that there are no capacity issues in all Do Minimum future year scenarios.

Table 6.14: New Canal Street / Fazeley Street DM Results

Movement	AM 2021		AM 2031		PM 2021		PM 2031	
	DoS (%)	MMQ (PCU)	DoS (%)	MMQ (PCU)	DoS (%)	MMQ (PCU)	DoS (%)	MMQ (PCU)
New Canal Street (north)	48.5	6.3	56.0	7.8	50.6	7.4	63.8	10.4
Fazeley Street (east)	47.5	3.7	53.7	3.6	52.1	5.3	65.7	5.2
New Canal Street (south)	4.8	0.2	1.4	0.0	20.6	1.1	3.3	0.1
Fazeley Street (west)	Exit Only							
Cycle Time (s)	68		68		73		73	
PRC (%)	85.6		60.8		72.7		37.0	

Source: LinSig V3

The junction operates under most constraint in the 2031 PM scenario, with a PRC of 37.0%. There is a MMQ of 10.4 PCUs modelled on the New Canal Street (north) arm, which is the access through the HS2 Curzon Street Station.

6.4.5.2 Do Something Assessment

The existing junction format will remain, although the northern arm (New Canal Street) will be tram-only. The staging of the junction has been reconfigured accordingly, with tram phases running every 6 minutes in each direction. The 2021 and 2031 DS results are shown in Table 6.15, which shows that there are no capacity issues in all Do Minimum future year scenarios.

Table 6.15: New Canal Street / Fazeley Street 2021 DS Results

Movement	AM 2021		AM 2031		PM 2021		PM 2031	
	DoS (%)	MMQ (PCU)	DoS (%)	MMQ (PCU)	DoS (%)	MMQ (PCU)	DoS (%)	MMQ (PCU)
New Canal Street (north)	Tram Only							
Fazeley Street (east)	22.8	2.7	16.5	1.8	27.5	3.3	28.3	3.7
New Canal Street (south)	22.7	2.6	16.4	1.5	27.6	3.7	28.3	3.0
Fazeley Street (west)	Exit Only							
Cycle Time (s)	360 (90)		360 (90)		360 (90)		360 (90)	
PRC (%)	294.6		445.6		226.2		217.6	

Source: LinSig V3

Due to the reconfiguration of the junction and banning of traffic movements (from New Canal Street north which is proposed to be tram only) the junction operates significantly better in the DS scenario when compared to the DM modelled scenarios.

6.4.6 New Canal Street / Bordesley Street

The existing junction is a priority crossroads with New Canal Street at the northern arm, Bordesley Street running east to west and Meriden Street to the south.

All movements are allowed at all arms, with Bordesley Street traffic giving way to New Canal Street / Meriden Street.

6.4.6.1 Do Minimum Assessment

The 2021 and 2031 DM results are shown in Table 6.16.

Table 6.16: New Canal Street / Bordesley Street DM Results

	AM 2021		AM 2031		PM 2021		PM 2031	
Movement	RFC	Queue (PCU)	RFC	Queue (PCU)	RFC	Queue (PCU)	RFC	Queue (PCU)
New Canal Street (north)	0.20	0.5	0.59	2.0	0.68	2.6	0.92	9.6
Fazeley Street (east)	0.12	0.1	0.13	0.2	0.39	0.6	0.42	0.7
New Canal Street (south)	0.21	0.0	0.02	0.0	0.02	0.0	0.02	0.0
Fazeley Street (west)	0.02	0.3	0.44	0.8	0.29	0.4	0.51	1.0

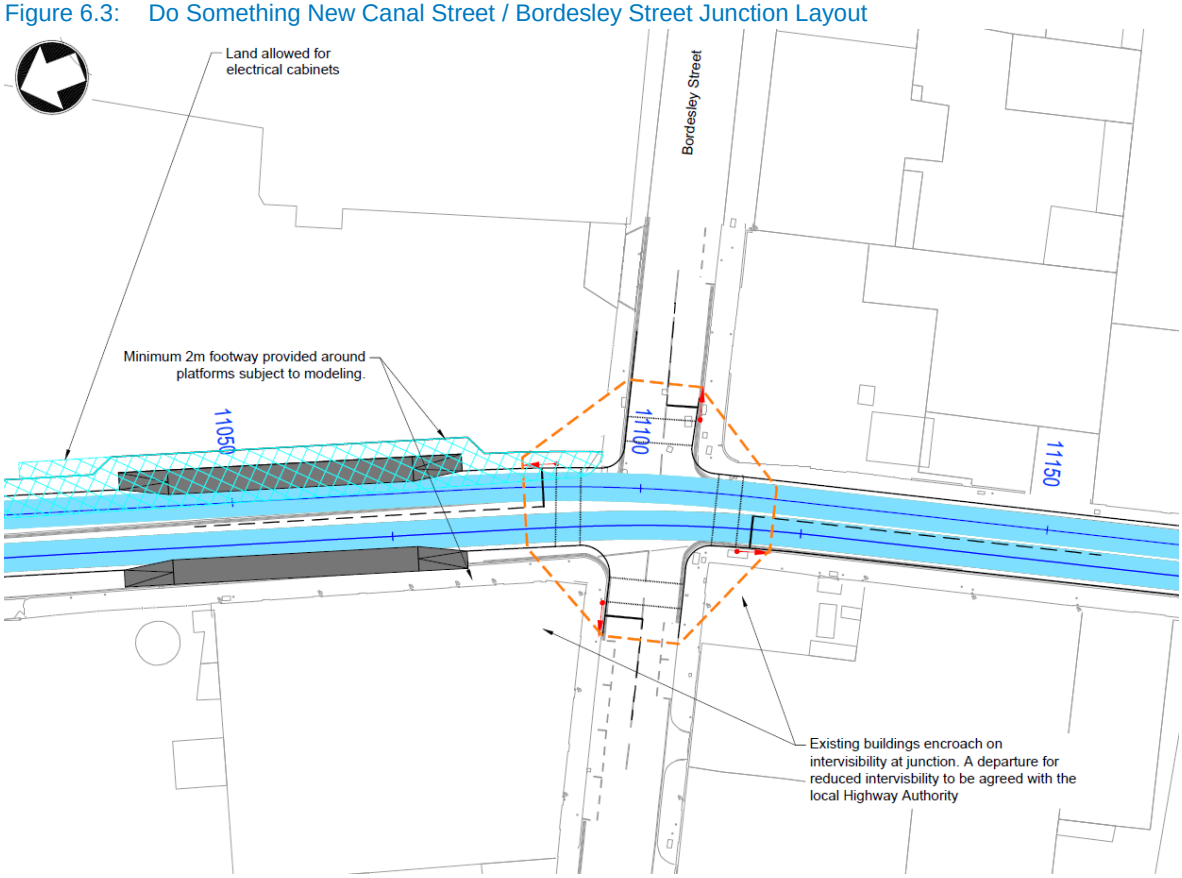
Source: Junctions 9 (PICADY)

Table 6.16 shows the New Canal Street / Bordesley Street junction to work within capacity in the 2021 AM and PM scenarios and the 2031 AM scenario. The New Canal Street (north) arm of the junction has an RFC of 0.92 in the 2031 PM scenario, and a queue of 9.6 PCUs.

6.4.6.2 Do Something Assessment

The New Canal Street / Bordesley Street junction is to be reconfigured as a signalised junction in the DS scenario. This is due to safety concerns with locating the tram stops within proximity to a priority junction. Figure 6.3 shows the proposed junction configuration and location of the tram stops.

Figure 6.3: Do Something New Canal Street / Bordesley Street Junction Layout



Source: ES Volume 2 Technical Appendix A, MMD-300207-HS29-DRA-0000-0014

The 2021 and 2031 DS results are shown in Table 6.17, which shows the New Canal Street / Bordesley Street junction to operate within capacity in all Do Something future year scenarios.

Table 6.17: New Canal Street / Bordesley Street DS Results

	AM 2021		AM 2031		PM 2021		PM 2031	
Movement	**DoS (%)**	**Queue (PCU)**	**DoS (%)**	**Queue (PCU)**	**DoS (%)**	**Queue (PCU)**	**DoS (%)**	**Queue (PCU)**
New Canal Street	65.5	10.4	72.2	10.1	60.852.9	8.3	74.7	11.1
Bordesley Street (east)	44.7	1.5	58.7	1.8	42.5	3.9	64.4	4.4
Meriden Street	58.4	7.9	65.8	8.9	24.0	2.9	51.6	3.7
Bordesley Street (west)	55.8	3.8	60.8	3.3		2.4	31.9	3.1
Cycle Time (s)	360 (90)		360 (90)		360 (90)		360 (90)	
PRC (%)	37.3		24.6		48.0		20.5	

Source: LinSig V3

The junction operates under most constraint in the 2031 PM scenario, with a PRC of 20.5%. There is a MMQ of 11.1 PCUs in this scenario (on New Canal Street), which is not expected to block back into another junction.

6.4.7 Digbeth B4100 / Meriden Street

Digbeth (B4100) / Meriden Street is a three-arm priority junction, with Meriden Street being a left-in, left-out arrangement. The junction is signalised.

6.4.7.1 Do Minimum Assessment

The 2021 and 2031 DM results are shown in Table 6.18, which shows the Digbeth (B4100) / Meriden Street junction to operate within capacity in all Do Minimum future year scenarios.

Table 6.18: Digbeth B4100 / Meriden Street DM Results

	AM 2021		AM 2031		PM 2021		PM 2031	
Movement	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
Digbeth B4100 (west) Ahead and Left (Lane 1)	52.1	6.1	60.7	8.4	56.3	6.4	60.2	6.6
Digbeth B4100 (west) Ahead (Lane 2/3)	40.7	2.9	48.6	4.7	42.3	3.0	50.8	3.7
Meriden Street	79.8	4.0	65.7	4.1	70.0	4.4	79.6	3.8
Cycle Time (s)	180		180		165		165	
PRC (%)	12.8		37.0		28.5		13.1	

Source: LinSig V3

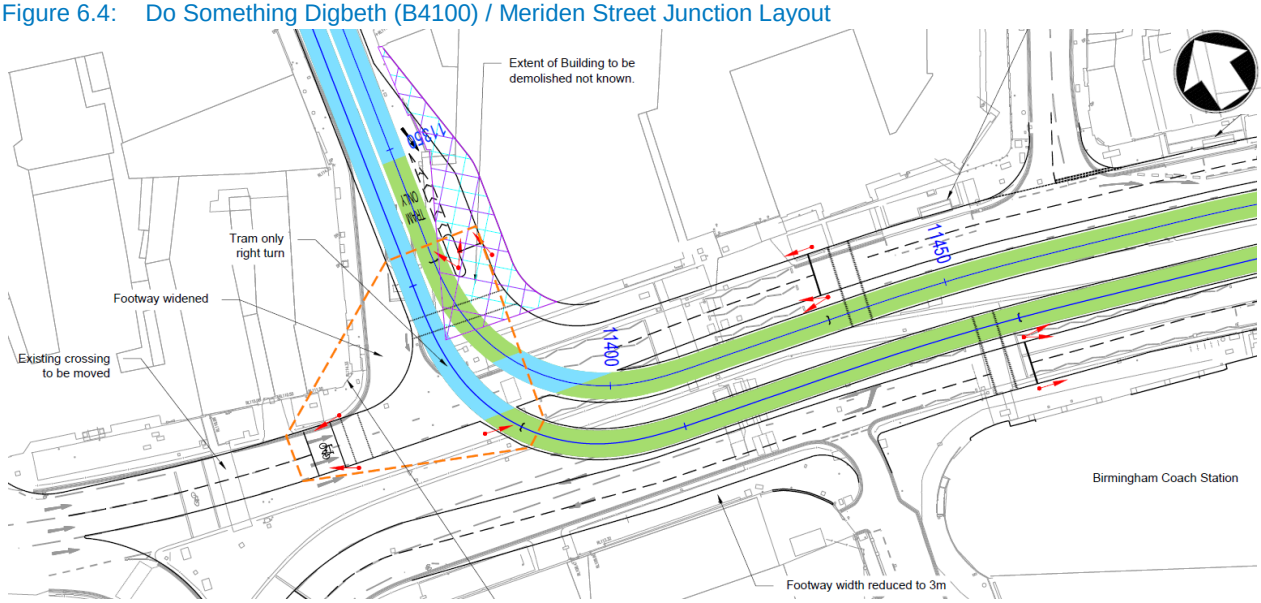
The AM 2021 scenario operates under most constraint, with a PRC of 12.8%. There is a MMQ of 6.1 PCUs modelled in this scenario, which will block back into the Moat Lane gyratory and block vehicles entering the gyratory from Allison Street.

6.4.7.2 Do Something Assessment

The junction will remain signalised although with two-lanes at the Meriden Street stop line (one for the tram and one for vehicles). The flared lane for vehicular traffic is provided on safety grounds to direct general traffic away from the segregated tramway. A signalised pedestrian crossing is also to be included as part of the BEE scheme.

Figure 6.4 shows the proposed junction configuration.

Figure 6.4: Do Something Digbeth (B4100) / Meriden Street Junction Layout



Source: ES Volume 2 Technical Appendix A, MMD-300207-HS29-DRA-0000-0015

The 2021 and 2031 DS results are shown in Table 6.19, which shows the Digbeth (B4100) / Meriden Street junction to operate within capacity in all Do Something future year scenarios.

Table 6.19: Digbeth B4100 / Meriden Street 2021 DS Results

	AM 2021		AM 2031		PM 2021		PM 2031	
Movement	**DoS (%)**	**Queue (PCU)**	**DoS (%)**	**Queue (PCU)**	**DoS (%)**	**Queue (PCU)**	**DoS (%)**	**Queue (PCU)**
Digbeth B4100 (west) Ahead and Left (Lane 1)	55.3	3.6	57.7	4.5	36.9	1.7	37.5	1.7
Digbeth B4100 (west) Ahead (Lane 2)	45.2	7.3	59.0	9.9	49.6	9.1	52.5	10.0
Meriden Street	41.4	7.0	53.8	9.4	46.7	9.0	49.0	9.6
Cycle Time (s)	180 (90)		180 (90)		180 (90)		180 (90)	
PRC (%)	62.8		52.6		81.3		71.4	

Source: LinSig V3

There are generally larger modelled queues in comparison to the DM model results, which are also expected to block back into Allison Street. Due to the stop line being moved closer to Meriden Street, the effect of the blocking back into the Moat Lane gyratory is minimised.

6.4.8 Digbeth B4100 / Rea Street

The Digbeth (B4100) / Rea Street junction provides access to Rea Street from Digbeth (B4100) in the west and High Street Deritend in the east. Rea Street is left-turn only onto Digbeth (B4100).

The traffic controller for this junction includes the junction of High Street Deritend / Milk Street. The LinSig assessment of Rea Street was therefore modelled alongside the High Street Deritend / Milk Street (signalised) and High Street Deritend / Floodgate Street (priority) junctions.

6.4.8.1 Do Minimum Assessment

The 2021 and 2031 DM results are shown in Table 6.20, which shows the Digbeth (B4100) / Rea Street junction to operate within capacity in all Do Minimum future year scenarios.

Table 6.20: Digbeth B4100 / Rea Street DM Results

	AM 2021		AM 2031		PM 2021		PM 2031	
Movement	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
High Street Deritend (east) Left/Ahead (Lane 1)	53.5	5.1	39.7	4.5	40.6	3.0	40.6	3.0
High Street Deritend (east) Ahead (Lane 2/3)	71.6	7.1	38.8	3.6	61.1	5.2	61.1	5.2
High Street Deritend (east) Right/U-Turn (Lane 4)	48.4	3.3	56.2	3.6	57.9	3.5	57.9	3.5
Rea Street Left	4.6	0.4	4.3	0.3	8.5	0.8	8.5	0.8
Digbeth (B4100 west) Ahead/Left (Lane 1)	7.7	0.6	7.4	0.6	4.5	0.3	4.5	0.3
Digbeth (B4100 west) Ahead (Lane 2/3)	43.2	3.0	59.9	4.5	58.3	4.3	58.3	4.3
Digbeth (B4100 west) Right/U-Turn(Lane 4)	69.1	9.0	57.9	5.1	62.8	7.3	62.8	7.3
Cycle Time (s)	83/61		83/61		77/61		77/61	
PRC (%)	25.7		50.1		43.2		23.8	

Source: LinSig V3

The junction operates under the highest degree of constraint in the 2031 PM scenario with a PRC of 23.8%, and a worst case MMQ of 7.3 PCUs (on the right-turn segregated lane into Rea Street). A queue of 7.3 will not block the ahead traffic on Digbeth (B4100), neither will the MMQ of 9.0 PCUs on this lane (AM 2021).

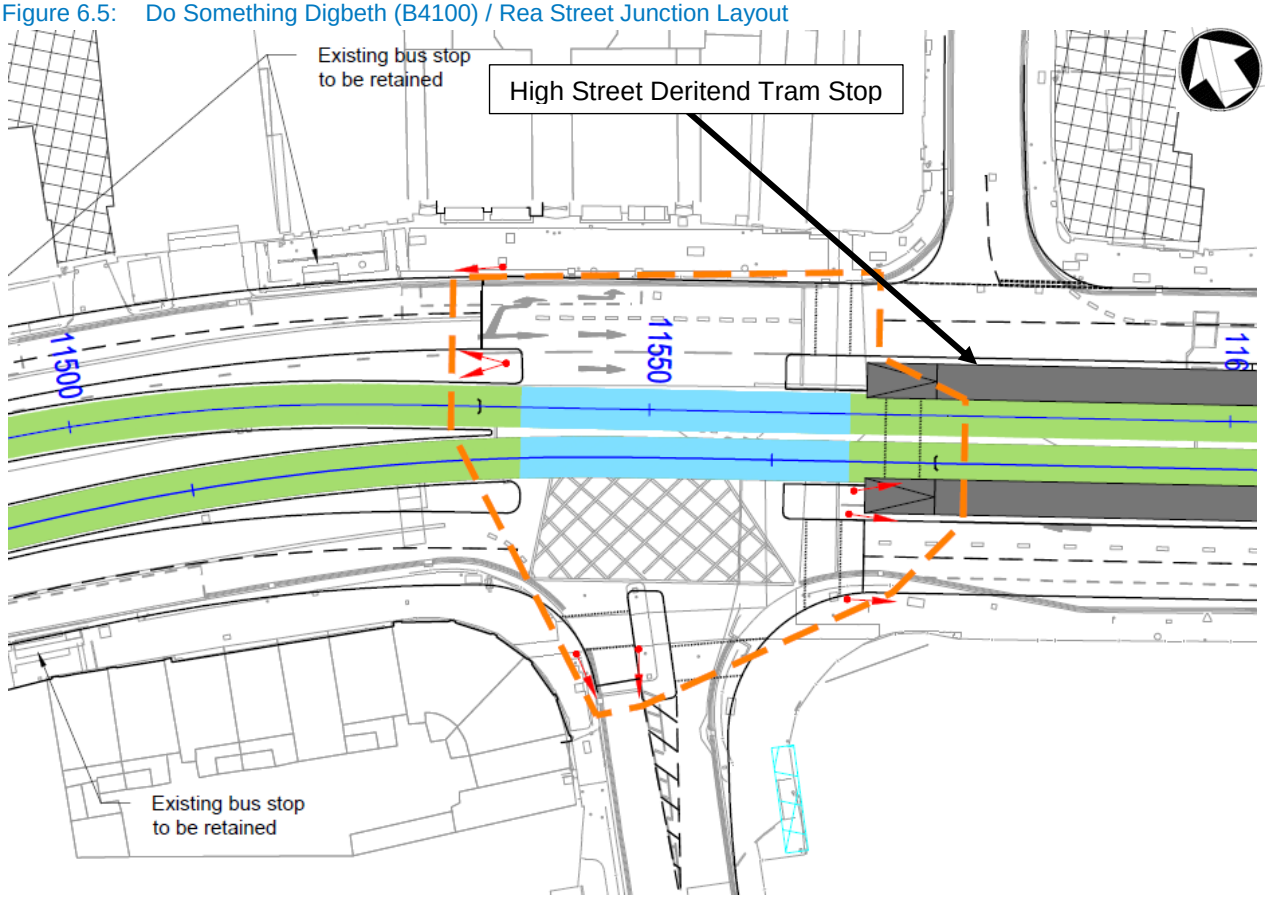
6.4.8.2 Do Something Assessment

The junction with Rea Street will remain similar in form, albeit with reduced lane capacity along Digbeth (B4100). The track alignment runs through the two offside lanes along Digbeth (B4100), therefore reducing capacity for vehicular traffic in either direction.

The final tram stop is located directly east of the Rea Street junction (shown in Figure 6.5). The right-turn and movement from High Street Deritend into Milk Street is banned in the DS scenario due to the reconfiguration of the junction. Figure 6.5 shows the Do Something junction configuration.

The pedestrian crossing across Rea Street will become a staggered crossing. This ensures there are no all-red stages for traffic to allow pedestrian movements, therefore increasing green time for traffic stages.

Figure 6.5: Do Something Digbeth (B4100) / Rea Street Junction Layout



Source: ES Volume 2 Technical Appendix A, MMD-300207-HS29-DRA-0000-0016

The 2021 AM and PM peak DS results are shown in Table 6.21, which shows the Digbeth (B4100) / Rea Street junction to operate within capacity in all modelled scenarios.

Table 6.21: Digbeth B4100 / Rea Street DS Results

Movement	AM 2021		AM 2031		PM 2021		PM 2031	
	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
High Street Deritend (east) Left/Ahead (Lane 1)	43.4	4.1	51.6	4.7	64.0	5.9	68.7	7.1
High Street Deritend (east) Ahead (Lane 2)	49.4	5.6	57.0	6.4	61.7	6.6	72.4	8.9
Rea Street	36.3	1.7	29.1	1.3	38.4	1.8	40.3	1.9
Digbeth (B4100 west) Ahead/Left (Lane 1)	49.5	8.2	58.1	10.4	65.3	12.4	72.1	14.3
Digbeth (B4100 west) Ahead/Right (Lane 2)	40.8	6.1	50.9	8.4	58.4	10.0	67.7	12.3
Cycle Time (s)	180 (90)		180 (90)		180 (90)		180 (90)	
PRC (%)	81.7		54.8		37.8		24.3	

Source: LinSig V3

In the most constrained scenario (2031 PM), there are queues of 14.3 and 12.3 PCUs in the nearside and offside lanes respectively (for vehicles leaving Birmingham City Centre). These queues will not block back past Oxford Street, as was the case without the proposed mitigation.

6.4.9 High Street Deritend / Milk Street

The High Street Deritend junction with Milk Street is a three-arm signalised junction allowing movements in all directions. Milk Street is a one-way street with vehicles travelling north, access from Milk Street to High Street Deritend is therefore restricted.

In the DS scenario, the right-turn from High Street Deritend to Milk Street is banned due to the reconfiguration of the junction and location of the tram stop.

This junction is included in the LinSig model for Rea Street as the junctions operate from the same signal controller.

6.4.10 High Street Deritend / Floodgate Street

Floodgate Street is a three-arm priority junction, with Floodgate Street being a left-in / left-out arrangement. Floodgate Street is located 50m south east of Milk Street, and the LinSig assessment of the junctions Digbeth B4100 / Rea Street and High Street Deritend / Milk Street shown above include this priority junction.

6.4.10.1 Do Minimum Assessment

The 2021 and 2031 DM results are shown in Table 6.22, which shows the High Street Deritend / Floodgate Street junction to operate within capacity in the Do Minimum future year scenarios.

Table 6.22: High Street Deritend / Floodgate Street DM Results

	AM 2021		AM 2031		PM 2021		PM 2031	
Movement	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
Floodgate Street	13.8	0.2	39.1	0.9	26.7	0.5	58.2	2.4

Source: LinSig V3

6.4.10.2 Do Something Assessment

The junction will remain in the same format in the DS scenario, although the lane capacity on High Street Deritend will reduce from three lanes to two. The 2021 and 20 DS results are shown in Table 6.23, which shows the High Street Deritend / Floodgate Street junction to operate within capacity in the Do Something future year scenarios. There is an overall reduction in queueing in comparison to the Do Minimum scenario.

Table 6.23: High Street Deritend / Floodgate Street DS Results

	AM 2021		AM 2031		PM 2021		PM 2031	
Movement	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
Floodgate Street	8.9	0.0	16.3	0.1	36.0	0.3	50.1	0.5

Source: LinSig V3

6.4.11 High Street Deritend / Heath Mill Lane

The Heath Mill Lane junction is a three arm signalised junction providing movement in all directions. There is a left-turn only lane approaching Heath Mill Lane from the west (along Heath Mill Lane), and similarly a right-turn only lane approaching Heath Mill Lane from the east (along Heath Mill Lane).

6.4.11.1 Do Minimum Assessment

As part of the Bullring Trading Estate development, a signalised pedestrian crossing is proposed to be installed at High Street Deritend / Heath Mill Lane junction (on the High Street Deritend west arm). This will run in two phases, and has been included in the DM LinSig model (with the staging updated to incorporate the pedestrian crossing). The 2021 and 2031 DM results are shown in Table 6.24, which shows the High Street Deritend / Heath Mill Lane junction to operate within capacity in the Do Minimum future year scenarios.

Table 6.24: High Street Deritend / Heath Mill Lane DM Results

Movement	AM 2021		AM 2031		PM 2021		PM 2031	
	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
Heath Mill Lane Left/Right	51.9	8.1	56.0	8.2	71.3	12.4	82.5	14.6
High Street Deritend (east) Ahead (Lane 1)	34.8	3.9	29.7	3.4	20.3	2.3	31.6	3.8
High Street Deritend (east) Ahead (Lane 2/3)	52.1	5.5	47.5	4.8	37.0	3.8	49.4	5.2
High Street Deritend (east) Right/U-Turn (Lane 4)	50.1	5.8	57.7	5.9	68.8	9.6	78.8	10.0
High Street Deritend (west) Ahead/Left (Lane 1)	30.1	3.9	40.3	6.1	28.9	4.0	20.0	3.0
High Street Deritend (west) Ahead (Lane 2)	49.8	8.4	57.7	12.0	70.9	14.4	80.8	21.0
High Street Deritend (west) ahead (Lane 3)	49.8	8.4	57.7	12.0	71.0	14.5	80.9	21.0
Cycle Time (s)	113		113		117		117	
PRC (%)	72.6		56.0		26.3		9.1	

Source: LinSig V3

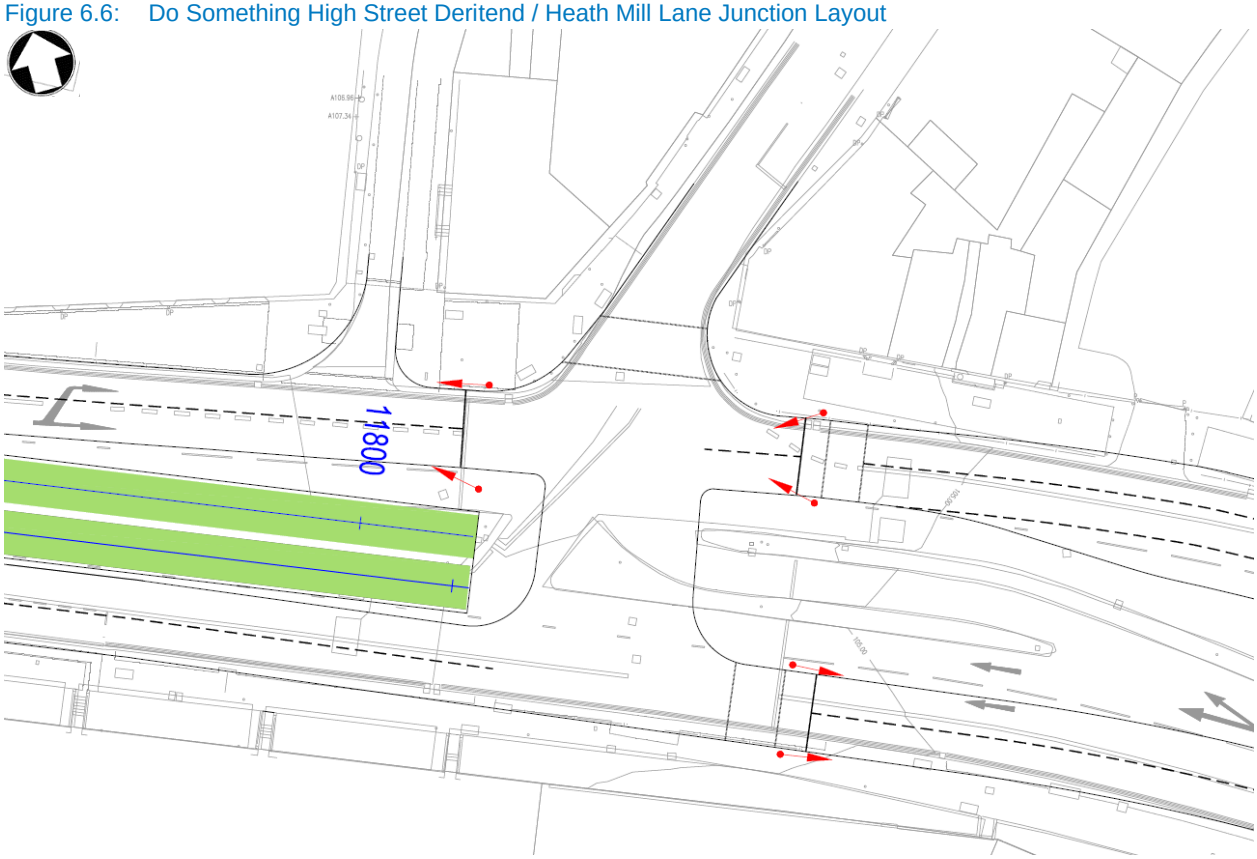
In the most constrained scenario (2031 PM) there is significant queueing for eastbound traffic leaving Birmingham City Centre. The modelled queues will block back past the existing pedestrian crossing between Heath Mill Lane and Floodgate Street, although the queue is not expected to block back past the Floodgate Street junction.

6.4.11.2 Do Something Assessment

The BEE proposes to remodel this junction to allow for the tram and associated highway works east of the junction allowing for a future tram extension. As is the case for much of High Street Deritend, the capacity of each carriageway is reduced from three to two lanes on all approaches to this junction.

The segregated right-turn facility onto Heath Mill Lane is removed. The right-turn movement is still allowed in the proposed design, although not via a segregated lane. Figure 6.6 shows the proposed junction configuration.

Figure 6.6: Do Something High Street Deritend / Heath Mill Lane Junction Layout



Source: ES Volume 2 Technical Appendix A, MMD-300207-HS29-DRA-0000-0017

The 2021 and 2031 DS results are shown in Table 6.25, which shows the High Street Deritend / Heath Mill Lane junction to operate within capacity all future scenarios.

Table 6.25: High Street Deritend / Heath Mill Lane DS Results

	AM 2021		AM 2031		PM 2021		PM 2031	
Movement	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
High Street Deritend (west) Ahead/Left (Lane 1)	60.4	7.4	61.2	9.0	68.2	10.3	69.7	11.7
High Street Deritend (west) Ahead (Lane 2)	42.8	5.4	61.1	10.0	71.2	11.9	71.7	13.2
Heath Mill Lane	58.3	6.6	60.4	5.4	61.1	3.8	56.2	2.9
High Street Deritend (east) Ahead (Lane 1)	60.7	7.5	59.8	6.8	58.6	10.5	67.2	11.6
High Street Deritend (east) Ahead/Right (Lane 2)	56.8	6.9	55.2	7.5	54.2	9.2	60.2	10.0

Movement	AM 2021		AM 2031		PM 2021		PM 2031	
	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
Cycle Time (s)	90		90		90		90	
PRC (%)	48.2		47.0		26.3		25.5	

Source: LinSig V3

It can be observed in comparison to the DM results that queueing is reduced in the DS assessment, and is not expected to block back past the pedestrian crossing.

6.4.12 High Street Deritend / Alcester Street

The Alcester Street junction is a three-arm signalised junction providing access to and from all directions. For vehicles travelling from Alcester Street onto High Street Deritend the single lane widens to create left and right-turn lanes at the signalised junction.

There is also a signalised right-turn only lane on High Street Deritend (west) onto Alcester Street, as well as an ahead and left-turn lane on the eastern approach onto Alcester Street. The LinSig model for Alcester Street also includes the priority junction with Adderley Street as they are in close proximity.

6.4.12.1 Do Minimum Assessment

The 2021 and 2031 DM results are shown in Table 6.26, which shows the High Street Deritend / Alcester Street junction to operate within capacity in the Do Minimum future year scenarios.

Table 6.26: High Street Deritend / Alcester Street DM Results

Movement	AM 2021		AM 2031		PM 2021		PM 2031	
	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
High Street Deritend (west) Ahead (Lane 1)	34.4	4.2	56.7	7.7	63.1	8.4	82.5	13.2
High Street Deritend (west) Ahead (Lane 2)	34.5	4.2	56.9	7.7	63.2	8.5	82.6	13.3
High Street Deritend (west) Ahead/Right (Lane 3/4)	45.9	4.5	62.4	8.3	72.6	9.1	85.2	14.1
High Street Deritend (east) Ahead/Left (Lane 1)	40.2	4.9	44.5	5.5	37.2	4.4	56.6	7.4
High Street Deritend (east) Ahead (Lane 2)	56.8	8.0	57.3	8.2	46.7	6.0	66.8	9.9
High Street Deritend (east) Ahead/U-Turn (Lane 3)	58.5	8.9	59.0	9.0	48.7	6.7	68.4	10.9
Alcester Street Left/Right	57.0	5.2	63.4	6.9	72.8	9.7	84.3	13.5
Cycle Time (s)	88		88		88		88	

Movement	AM 2021		AM 2031		PM 2021		PM 2031	
	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
PRC (%)	53.9		41.9		23.6		5.6	

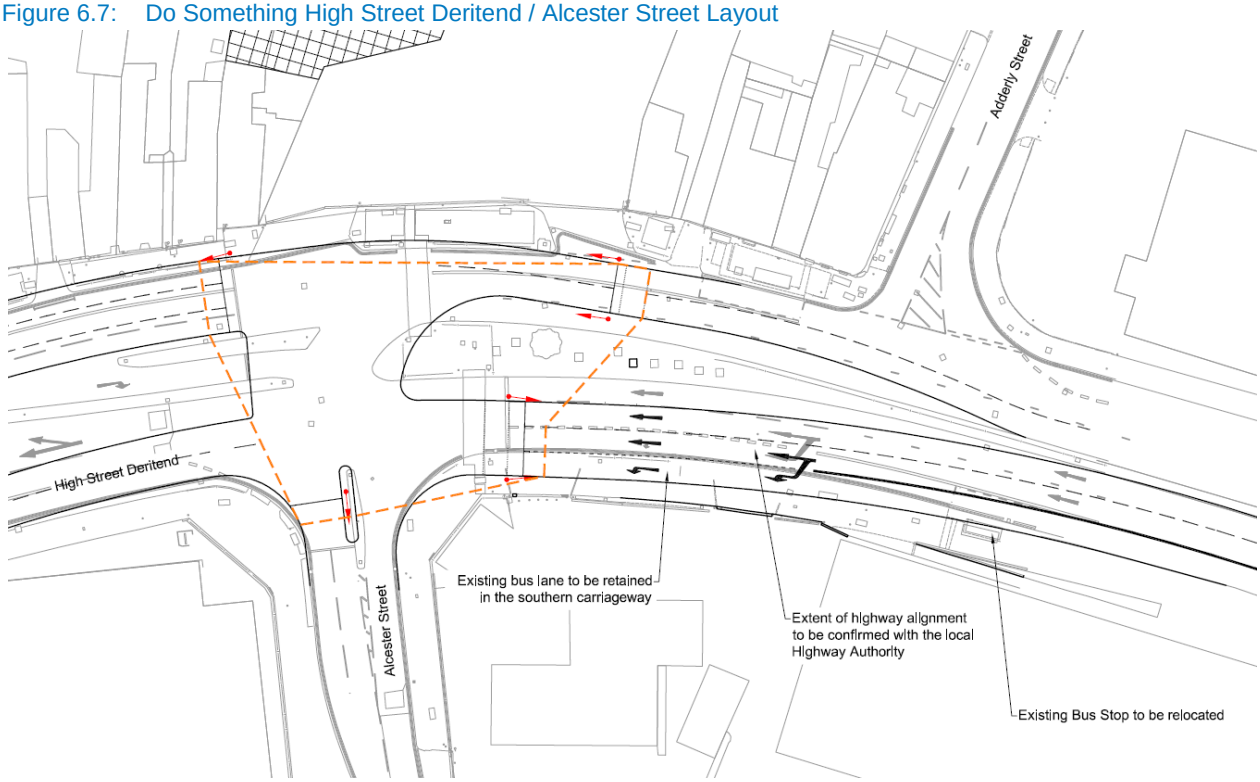
Source: LinSig V3

In the most constrained scenario (2031 PM) there is a PRC of 5.6%, with modelled queues of up to 14.1 PCUs. The queues are expected to block back on High Street Deritend into the Heath Mill Lane junction.

6.4.12.2 Do Something Assessment

The highway works associated with the BEE result in a reconfiguration of the eastern arm of the High Street Deritend / Alcester Street junction. There will be three lanes at the stop line, with the nearside lane being a left-only into Alcester Street.

Figure 6.7: Do Something High Street Deritend / Alcester Street Layout



Source: ES Volume 2 Technical Appendix A, MMD-300207-HS29-DRA-0000-0017

The 2021 and 2031 DS results are shown in Table 6.27, which shows the High Street Deritend / Alcester Street junction to operate within capacity in all future scenario.

Table 6.27: High Street Deritend / Alcester Street DS Results

Movement	AM 2021		AM 2031		PM 2021		PM 2031	
	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
High Street Deritend (west) Ahead (Lane 1)	27.7	1.4	39.8	2.8	65.8	4.7	83.5	14.5
High Street Deritend (west) Ahead/Right (Lane 2/3)	60.4	12.5	60.1	16.3	69.9	16.7	82.9	15.5
High Street Deritend (east) Ahead/Left (Lane 1/2)	42.2	4.5	42.6	4.0	75.7	8.1	80.7	8.7
High Street Deritend (east) Ahead (Lane 3)	32.8	4.4	41.0	5.4	71.4	8.3	85.6	10.6
Alcester Street Left/Right	59.6	6.1	60.3	7.9	74.7	14.7	88.1	22.1
Cycle Time (s)	90		90		90		90	
PRC (%)	49.1		49.4		18.3		2.1	

Source: LinSig V3

In the most constrained scenario (2031 PM) there is a PRC of 2.1%, with modelled queues of up to 22.1 PCUs on Alcester Street.

The modelled queues on High Street Deritend (west) are expected to block back into the Heath Mill Lane junction, although not past the stop line.

6.4.13 High Street Deritend / Adderley Street

The Adderley Street junction is a priority junction providing access to and from Adderley Street from High Street Deritend. Adderley Street can be accessed by eastbound traffic on High Street Deritend, and consequently vehicles are restricted to a left-turn only from Adderley Street.

The DS proposal sees the three-lane High Street Deritend being reduced to two lanes, but the junction operation remains the same. This junction was included in the LinSig assessment of High Street Deritend / Alcester Street.

6.4.13.1 Do Minimum Assessment

The 2021 and 2031 DM results are shown in Table 6.22, which shows the High Street Deritend / Adderley Street junction to operate within capacity in the Do Minimum future year scenarios.

Table 6.28: High Street Deritend / Adderley Street DM Results

Movement	AM 2021		AM 2031		PM 2021		PM 2031	
	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
Adderley Street	23.1	0.5	9.1	0.3	26.0	0.9	51.7	2.6

Source: LinSig V3

6.4.13.2 Do Something Assessment

The junction will remain in the same format in the DS scenario, although the lane capacity on High Street Deritend will reduce from three lanes to two. The 2021 and 2031 DS results are shown in Table 6.23, which shows the High Street Deritend / Adderley Street junction to operate within capacity in the Do Something future year scenarios.

Table 6.29: High Street Deritend / Adderley Street DS Results

Movement	AM 2021		AM 2031		PM 2021		PM 2031	
	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
Adderley Street	20.2	0.1	13.5	0.1	61.2	2.8	50.9	2.7

Source: LinSig V3

6.5 Off-line Junctions

6.5.1 Moor Street Queensway / Masshouse Lane

Moor Street Queensway operates a one-way system at this junction, as does Masshouse Lane. There is a central bus-only lane on Masshouse Lane which allows buses to go ahead over Moor Street Queensway onto The Priory Queensway.

6.5.1.1 Do Minimum Assessment

Table 6.30 shows the 2021 and 2031 DM LinSig results for Moor Street Queensway / Masshouse Lane.

Table 6.30: Moor Street Queensway / Masshouse Lane DM

Movement	AM 2021		AM 2031		PM 2021		PM 2031	
	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
Priory Queensway	89.2	11.2	92.7	12.3	74.3	9.6	66.8	8.7
Masshouse Lane Ahead/Left	92.1	22.5	91.1	22.0	76.6	10.4	68.9	8.5
Masshouse Lane Right	72.7	7.7	65.3	10.1	35.5	2.6	57.2	5.8
Moor Street Queensway Left	90.5	13.1	89.6	12.7	74.3	11.0	66.8	10.2
Moor Street Queensway	64.2	7.6	10.7	0.5	71.8	8.3	15.0	0.7

Movement	AM 2021		AM 2031		PM 2021		PM 2031	
	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
Ahead (Lane 2)								
Moor Street Queensway Ahead (Lane 3)	65.6	8.2	14.4	0.7	72.9	8.9	18.1	0.9
Cycle Time (s)	100		100		108		108	
PRC (%)	-2.3		-3.0		17.5		30.6	

Source: LinSig V3

Table 6.30 shows the junction to operate over capacity in the 2021 and 2031 AM Peak periods, with PRCs of -2.3% and -3.0% respectively.

The left-turn lane on Masshouse Lane to Moor Street Queensway operates with a degree of saturation of 92.1% and 91.1% in the 2021 and 2031 AM Peak periods respectively. The re-routing impacts due to the closure of Park Street (as a result of HS2) which forces traffic to route via Masshouse Lane which contributes to this.

Furthermore, the left-turn into Priory Queensway from Moor Street Queensway has a worst case modelled queue of up to 13.1 PCUs (2021 AM). This is not expected to block back into the Moor Street Queensway / Albert Street junction.

6.5.1.2 Do Something Assessment

The Moor Street Queensway / Masshouse Lane junction will not be reconfigured as part of the BEE proposals.

Table 6.31 shows the 2021 and 2031 DS LinSig results for Moor Street Queensway / Masshouse Lane, which shows the junction to operate within capacity in the Do Something future year scenarios.

Table 6.31: Moor Street Queensway / Masshouse Lane DS

Movement	AM 2021		AM 2031		PM 2021		PM 2031	
	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
Priory Queensway	77.1	7.7	82.4	7.8	71.8	8.2	57.8	6.1
Masshouse Lane Ahead/Left	67.2	9.6	36.2	3.8	68.5	9.9	41.8	4.3
Masshouse Lane Right	78.0	11.3	82.2	13.2	30.1	2.8	53.6	7.7
Moor Street Queensway Left	79.3	6.9	78.3	7.1	67.6	6.5	57.2	6.2
Moor Street Queensway Ahead (Lane 2)	77.6	7.4	1.1	1.1	44.9	5.8	17.7	0.8
Moor Street Queensway Ahead (Lane 3)	76.6	7.1	1.0	1.0	44.1	5.6	15.9	0.7
Cycle Time (s)	100		100		108		108	

Movement	AM 2021		AM 2031		PM 2021		PM 2031	
	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
PRC (%)	13.4		9.3		25.3		55.7	

Source: LinSig V3

The introduction of the tram and the resultant traffic re-routing impacts shows an improvement of junction capacity at the Moor Street Queensway / Masshouse Lane junction in all future year scenarios.

6.5.2 Moor Street Queensway / James Watt Queensway (B4114)

The Moor Street Queensway / James Watt Queensway (B4114) junction is a four arm signalised junctions providing vehicles accessing from Moor Street Queensway with the option to travel in all directions. Moor Street Queensway though operates a one-way system here, as does Park Street (east of the junction).The Moor Street Queensway / James Watt Queensway (B4114) junction will not be reconfigured as part of the BEE proposals. This junction has been assessed within the LinSig model for the Moor Street Queensway / Albert Street junction.

6.5.2.1 Do Minimum Assessment

Table 6.32 shows the 2021 and 2031 DM LinSig results for Moor Street Queensway / James Watt Queensway (B4114), which shows the junction to operate within capacity in the Do Minimum future year scenarios.

Table 6.32: Moor Street Queensway / James Watt Queensway (B4114) Street DM

Movement	AM 2021		AM 2031		PM 2021		PM 2031	
	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
James Watt Queensway (B4114) Left/Ahead	52.4	8.8	67.1	10.7	30.1	4.5	38.4	6.2
James Watt Queensway (B4114) Ahead	54.7	10.2	70.3	13.1	32.7	5.6	34.9	6.4
Jennens Road Left (Lane 1)	54.9	5.9	69.1	10.6	34.1	2.7	41.1	4.3
Jennens Road Left (Lane 2)	57.1	6.6	70.7	11.6	37.2	3.1	43.8	4.9
Moor Street Queensway Left (Lane 1)	22.2	2.8	10.2	1.1	14.8	1.8	2.8	0.3
Moor Street Queensway Left (Lane 2)	24.7	3.3	13.0	1.6	17.6	2.4	7.0	0.8
Moor Street Queensway Ahead/Right (Lane 3)	73.0	10.8	76.8	10.2	48.9	9.1	59.8	9.7
Cycle Time (s)	100		100		110		110	
PRC (%)	23.3		17.1		84.0		50.5	

Source: LinSig V3

6.5.2.2 Do Something Assessment

The Moor Street Queensway / James Watt Queensway (B4114) junction will not be reconfigured as part of the BEE proposals.

Table 6.33 shows the 2021 and 2031 DS LinSig results for Moor Street Queensway / James Watt Queensway (B4114), which shows the junction to operate within capacity in the Do Something future year scenarios.

Table 6.33: Moor Street Queensway / James Watt Queensway (B4114) Street DS

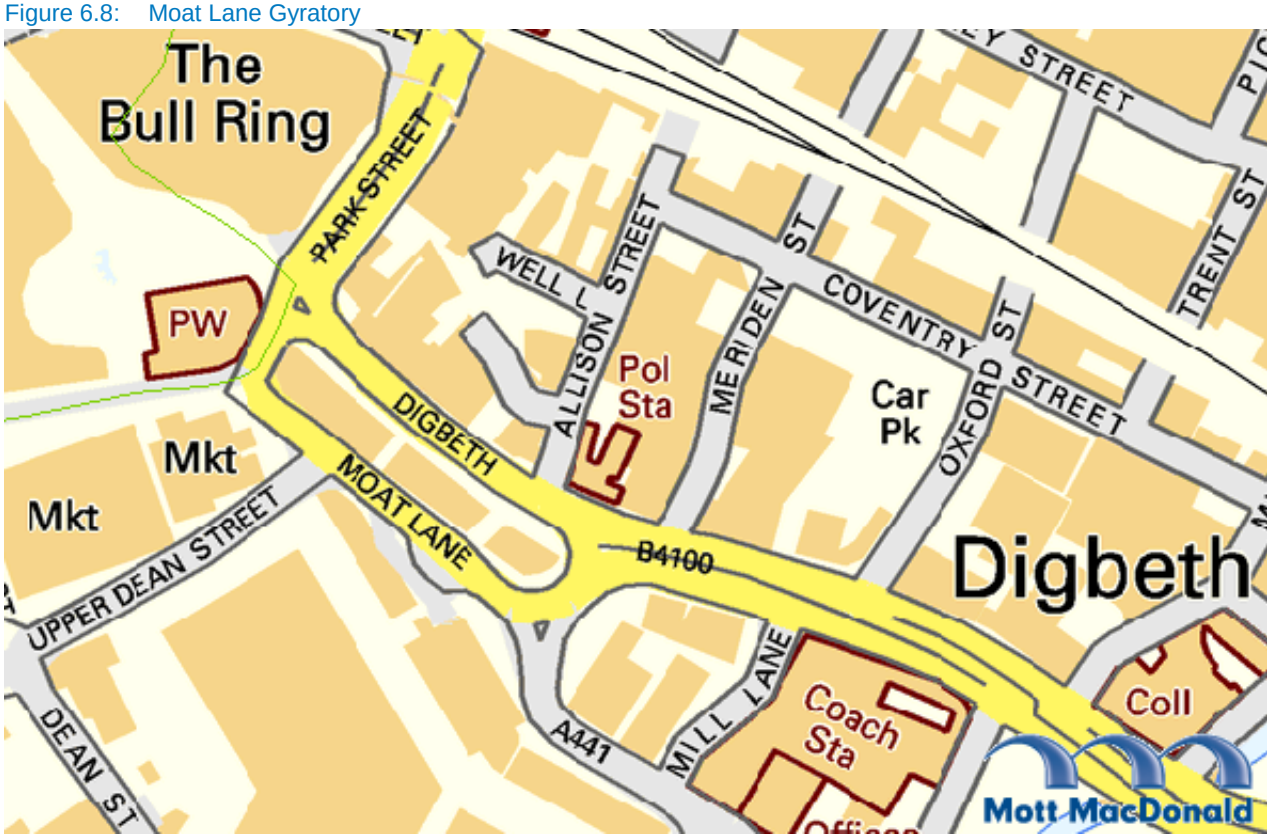
	AM 2021		AM 2031		PM 2021		PM 2031	
Movement	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
James Watt Queensway (B4114) Left/Ahead	60.9	9.6	59.6	9.3	32.3	5.5	31.9	5.0
James Watt Queensway (B4114) Ahead	62.9	11.0	62.9	11.5	34.4	6.5	35.0	6.4
Jennens Road Left (Lane 1)	56.5	8.6	59.7	9.2	41.8	5.0	36.0	4.9
Jennens Road Left (Lane 2)	58.4	9.5	61.5	10.3	44.5	5.7	38.0	5.6
Moor Street Queensway Left (Lane 1)	27.7	2.6	19.5	2.3	13.8	1.6	7.6	0.9
Moor Street Queensway Left (Lane 2)	27.2	2.6	20.2	2.5	14.3	1.7	9.3	1.1
Moor Street Queensway Ahead/Right (Lane 3)	68.7	8.5	70.5	8.0	64.6	8.6	56.9	6.8
Cycle Time (s)	100		100		110		110	
PRC (%)	31.0		27.7		50.9		58.1	

Source: LinSig V3

6.5.3 Moat Lane Gyratory

West of the Meriden Street / Digbeth B4100 junction is the Moat Lane signalised gyratory, providing access to Digbeth (B4100) from the west. The Moat Lane gyratory can be seen in Figure 6.8 and discontinuously comprises three lanes.

Figure 6.8: Moat Lane Gyratory



Source: Spectrum/Mott MacDonald

6.5.3.1 Do Minimum Assessment

Table 6.34 shows the 2021 and 2031 DM results for the Moat Lane gyratory, which shows the junctions comprising the Moat Lane Gyratory and Digbeth (B4100) to operate within capacity in the Do Minimum future year scenarios. A description of how the cycle times were derived at this junction is shown in **Appendix D.15**.

Table 6.34: Moat Lane Gyratory DM Results

	AM 2021		AM 2031		PM 2021		PM 2031	
Movement	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
Digbeth B4100 (east) Ahead (Lane 1)	74.0	5.1	67.7	6.7	71.2	6.0	80.9	8.8
Digbeth B4100 (east) Ahead (Lane 2)	74.9	5.5	6.7	0.5	19.8	1.4	11.0	0.8
Digbeth B4100 (east) Ahead (Lane 3)	79.0	6.1	9.2	0.7	21.9	1.5	13.3	1.0

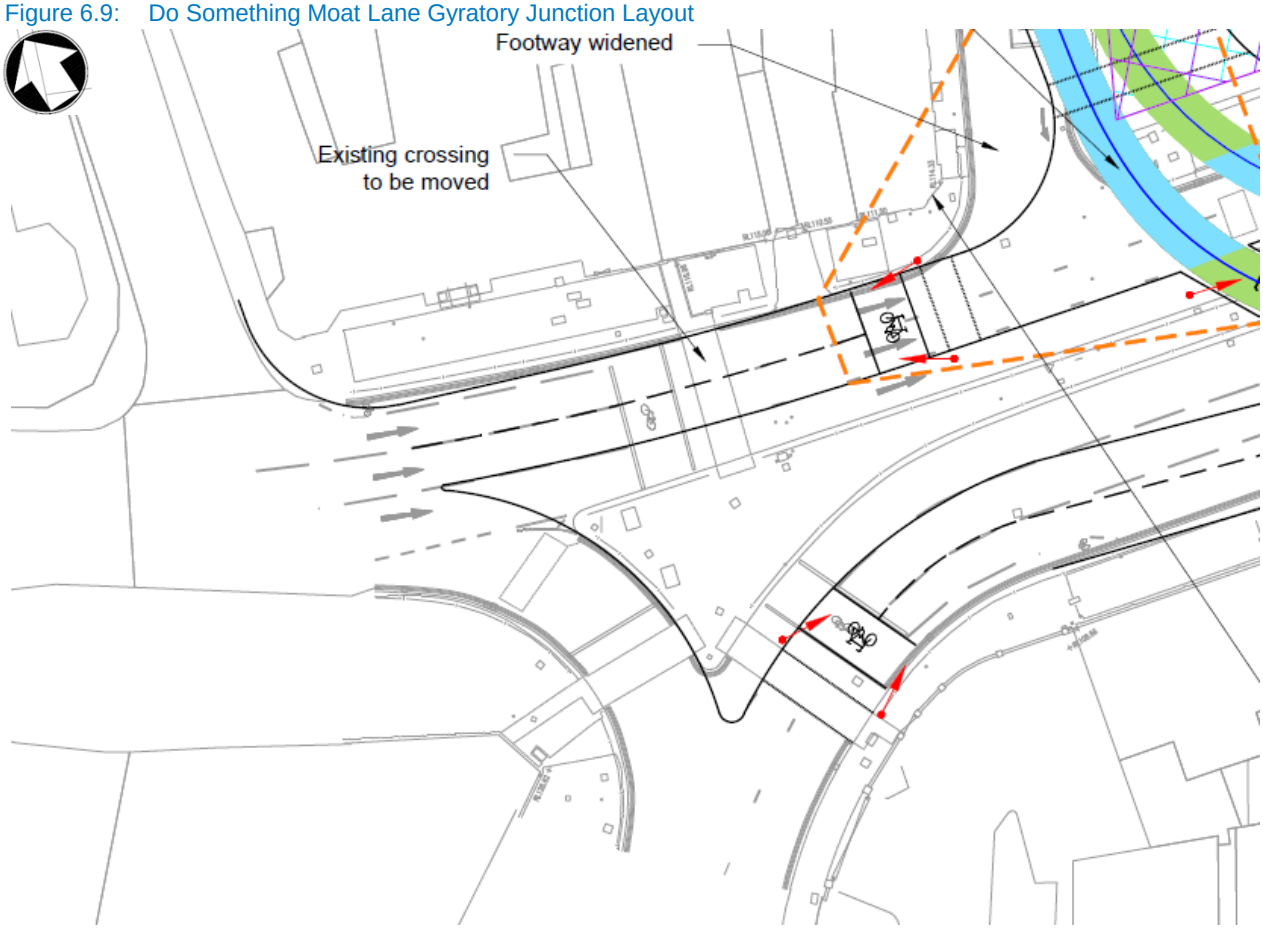
Movement	AM 2021		AM 2031		PM 2021		PM 2031	
	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
Cycle Time (s)		180		180		165		165
PRC (%)		13.9		32.9		26.5		11.3
Digbeth B4100 (west) Ahead and Left (Lane 1)	52.1	6.1	60.7	8.4	56.3	6.4	60.2	6.6
Digbeth B4100 (west) Ahead (Lane 2/3)	40.7	2.9	48.6	4.7	42.3	3.0	50.8	3.7
Digbeth B4100 (west) Right-turn (Lane 4)	33.5	3.3	66.8	7.1	72.2	7.6	80.0	8.3
Cycle Time (s)	180		180		165		165	
PRC (%)	72.7		34.8		24.7		12.6	

Source: LinSig V3

6.5.3.2 Do Something Assessment

The Moat Lane Gyratory itself will not be reconfigured as part of the BEE proposals, although the location of pedestrian crossings at the Digbeth (B4100) will change to improve intervisibility at the junction. The proposed junction layout is shown in Figure 6.9.

Figure 6.9: Do Something Moat Lane Gyratory Junction Layout



Source: ES Volume 2 Technical Appendix A, MMD-300207-HS29-DRA-0000-0015

Table 6.35 shows the 2021 and 2031 DS results for the Moat Lane gyratory, which shows the junctions comprising of the Moat Lane Gyratory and Digbeth (B4100) to operate within capacity in the Do Something future year scenarios.

Table 6.35: Moat Lane Gyratory DS Results

	AM 2021		AM 2031		PM 2021		PM 2031	
Movement	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
Digbeth B4100 (east) Ahead (Lane 1)	14.8	2.6	18.1	2.5	12.7	1.5	20.6	3.0
Digbeth B4100 (east) Ahead (Lane 2)	14.4	2.5	16.2	2.2	13.0	1.5	20.4	3.0
Cycle Time (s)		180 (90)		180 (90)		180 (90)		180 (90)
PRC (%)		508.2		397.3		593.2		337.1

Movement	AM 2021		AM 2031		PM 2021		PM 2031	
	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
Digbeth B4100 (west) Ahead and Left (Lane 1)	45.2	7.3	59.0	9.9	49.6	9.1	52.5	10.0
Digbeth B4100 (west) Ahead (Lane 2)	41.4	7.0	53.8	9.4	46.7	9.0	49.0	9.6
Cycle Time (s)		360 (90)		360 (90)		360 (90)		360 (90)
PRC (%)		62.8		52.6		81.3		71.4
Moat Lane Ahead (Lane 1)	30.0	3.2	17.7	2.2	52.3	2.9	25.4	2.5
Moat Lane Ahead (Lane 2)	30.0	3.3	17.7	2.2	52.3	2.9	25.4	2.5
Cycle Time (s)	180 (90)		180 (90)		180 (90)		180 (90)	
PRC (%)	200.0		407.6		72.2		254.8	

Source: LinSig V3

There are generally larger modelled queues in comparison to the DM model results, which are also expected to block back into Allison Street. Due to the stop line being moved closer to Meriden Street, the effect of the blocking back into the Moat Lane gyratory is minimised.

Queues of up to 10.0 PCUs are modelled on the ahead movement (leaving the Moat Lane Gyratory). Allison Street is a priority junction with a left-in, left-out arrangement and the traffic flow on this arm is relatively low (a maximum of 264 PCUs, modelled in the 2031 AM scenario). The blocking back is therefore not considered as an issue worth providing mitigation for.

6.5.4 Heath Mill Lane / Liverpool Street

Finally, the Heath Mill Lane / Liverpool Street four-arm signalised junction (including Great Barr Street on the north-eastern arm and Fazeley Street on the north-western) has also been designated as an off-line junction which will be impacted by the track alignment of the BEE.

6.5.4.1 Do Minimum Assessment

The 2021 and 2031 DM results are shown in Table 6.36, which shows the Heath Mill Lane / Liverpool Street junction to operate within capacity in all Do Minimum scenarios.

Table 6.36: Heath Mill Lane / Liverpool Street DM Results

Movement	AM 2021		AM 2031		PM 2021		PM 2031	
	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
Great Barr Street	84.1	10.1	84.7	8.6	86.6	11.3	85.3	12.0
Liverpool Street	83.7	3.5	70.6	2.4	5.9	0.5	6.3	0.5
Heath Mill Lane	80.6	5.9	79.1	6.8	88.3	10.3	85.8	9.2

Movement	AM 2021		AM 2031		PM 2021		PM 2031	
	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
Fazeley Street	80.1	6.4	77.8	6.2	86.7	10.5	89.1	10.7
Cycle Time (s)	54		54		69		69	
PRC (%)	7.0		6.3		1.9		1.0	

Source: LinSig V3

6.5.4.2 Do Something Assessment

It is proposed that the signalling at the Heath Mill Lane / Liverpool Street junction is reconfigured in order to improve capacity at the junction. It is proposed that the cycle time is increased to 90 seconds, and an indicative arrow for on Great Barr Street for the right-turn movement is introduced.

The 2021 and 2031 DS results with the proposed changes to the signalling are shown in Table 6.37.

Table 6.37: Heath Mill Lane / Liverpool Street DS Results

Movement	AM 2021		AM 2031		PM 2021		PM 2031	
	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
Great Barr Street	96.8	25.9	77.1	15.5	79.3	11.2	67.7	8.8
Liverpool Street	87.5	5.7	64.7	3.5	5.0	0.6	18.2	2.4
Heath Mill Lane	79.3	11.8	57.7	5.9	68.5	10.2	57.4	7.8
Fazeley Street	80.4	10.9	77.3	10.5	79.5	12.7	69.9	10.0
Cycle Time (s)	90		90		90		90	
PRC (%)	-7.6		16.4		13.2		28.7	

Source: LinSig V3

Table 6.37 shows the junction to operate over capacity in the 2021 AM Peak Do Something scenario.

In this scenario there is a modelled queue of 25.9 PCUs (Great Barr Street). This queue is expected to block back past the Great Barr Street / Glover Street junction. Most vehicles should clear during the cycle in which they arrive; however, some vehicles towards the back of the queue may have to wait for a second cycle to pass through the junction. Whilst the junction will be congested, the impact on traffic is not deemed to be severe.

The proposed reconfiguration of the signalling at this junction improves capacity to an extent, although to further improve capacity geometric changes to the junction would need to be implemented. Highway realignment is not considered feasible at this junction due to land constraints, and impacts on businesses and nearby heritage assets.

The improvement in junction capacity between the 2021 and 2031 scenarios could be attributed to HS2 implementing complimentary works to the ring road, thus re-routing traffic.

6.6 Summary

Extensive traffic modelling work has been undertaken, along with detailed assessments of the identified on-line and off-line junctions. The purpose of the assessments is to identify what impact the proposed BEE will have on highway capacity and general traffic.

The effect of the BEE has been determined using the Birmingham city centre strategic highway model which was built using industry standard modelling software, SATURN.

Individual junction capacity assessments were then undertaken using the industry standard LinSig and Junctions 9 (PICADY) software packages. The Do Minimum (DM) scenario represents the expected situation with regards to committed developments and traffic characteristics, and the Do Something (DS) scenario takes the DM and incorporates the BEE proposals.

Chapter 6.2.4 details the methodology used to derive the junction turning counts for use in the junction capacity assessments using a hybrid of SATURN model and observed turning counts.

The on-line junctions were assessed and it was identified that all of the junctions would operate within capacity in the future year DS scenarios.

Furthermore, an assessment was also undertaken to identify the impacts of the BEE proposals on off-line junctions. In total, four junctions across Birmingham City Centre and Birmingham Eastside were identified. Of these junctions, only Heath Mill Lane / Liverpool Street was identified to operate over capacity within one or more of the future year DS scenarios.

It is proposed that the signalling is reconfigured at the Heath Mill Lane / Liverpool Street junction in order to improve capacity.

Whilst capacity improves with the reconfigured signalling, the 2021 DS AM Peak scenario continues to operate over capacity with a PRC of -7.6%.

With the proposed signal changes at the Heath Mill Lane / Liverpool Street junction, in the 2021 AM DS scenario there is still significant queueing, with a modelled queues of 25.9 PCUs (Great Barr Street). Highway realignment is not considered feasible at this junction due to land constraints, and impacts on businesses and nearby heritage assets.

7 Impact on Bus Services

7.1 Introduction

Buses are an integral part of the existing public transport infrastructure in Birmingham. Two of the three sections identified along the route in this study incorporate major bus routes, and the proposed BEE will have a direct interface with buses in both cases.

Buses provided 275.1 million journeys in the West Midlands in 2014/15. National Express West Midlands / Coventry is the main service operator in the area, accounting for 78.2% of bus service km during 2014/15 (West Midlands Travel Trends, 2015).

TfWM are responsible for the delivery of public transport across Birmingham, working in partnership with Local Authorities, service operators and other organisations in order to improve the quality of bus services in Birmingham and the West Midlands. TfWM have an extensive range of partnership agreements with 12 bus operators, including National Express West Midlands and Arriva.

The bus network in the city centre is constantly under review and changes regularly depending on travel patterns, highways alterations, congestion and commercial demands among other factors. TfWM have a significant say in which services operate where within the city centre through the Statutory Quality Partnership Scheme (SQPS) and the Bus Alliance, although ultimately decisions are made on a commercial basis for the operators.

The Birmingham SQPS which is the biggest of its kind in the UK and aims to improve the quality of the bus network in Birmingham City Centre (over an area covering 95 bus stops/stands). This covers multi-million pound investments in bus infrastructure and requires all bus operators who enter the city centre to improve their quality standards. This includes TfWM working in partnership with bus operators to develop and introduce smartcard multi-operator ticketing to create an integrated public transport offer between the bus, rail and metro modes.

“Transforming Bus Travel”, a document published by TfWM (April 2014 to March 2015), highlights a vision for promoting and improving bus provision and giving priority for the passenger. Increased mobility is important for a prosperous society and economy, and TfWM state that where possible bus services should link to rail and tram networks.

It is understood that the existing Birmingham City Centre bus network may be subject to change due to a new study commissioned by TfWM, which will review both commercial and subsidised services. At the time of preparation of the TA, this study had not been completed, although the “City Centre Bus Strategy” is due to be released in 2016.

This chapter details the existing bus provision, how it will be affected with the introduction of the tram and, where necessary, suggests a viable set of alternative bus routings that could be introduced once the tram is in operation. In accordance with the methodology adopted by this TA, the proposed BEE route has been split into three sections enabling effective analysis of the impact on bus services and bus stops.

7.2 SPRINT

BCCs Birmingham Connected paper highlights aspirations for increased rail-based rapid transit in the long-term (such as BEE and EDGE). The ‘SPRINT’ (a new bus rapid transit system for Birmingham) scheme though is seen as a mass transit mode capable of more widespread and quicker implementation in the near future.

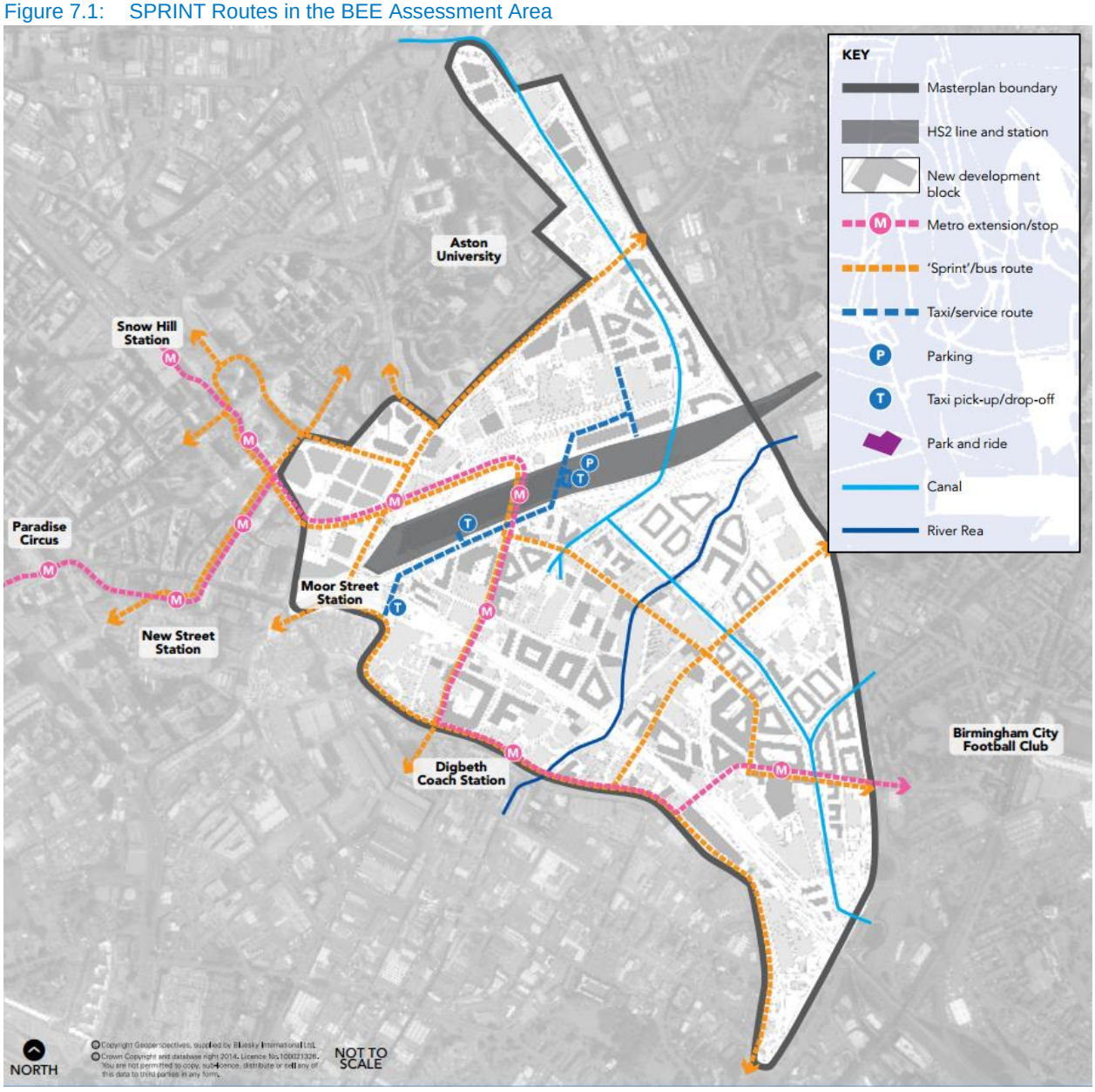
SPRINT will provide a fast service with purpose built vehicles and passenger facilities. SPRINT vehicles run without overhead lines or tracks, and are described by TfWM as “the bus that thinks it is a tram”. Along with heavy rail and metro, SPRINT will provide a comprehensive transport network across Birmingham and the West Midlands. Routes are to be aligned to major roads and park & ride schemes, to reduce reliance on cars into the city centre. The scheme is part of BCCs £800 million aspirational 'Vision for Movement' strategy, and the SPRINT scheme is to serve the BEE Bus Interchange (with a SPRINT stop proposed within the proposed Interchange).

The Birmingham Connected White Paper (2014) states that in some cases the Midland Metro remains very much the preferred ultimate choice for certain corridors, although a successful SPRINT service would provide a sound business case for ‘conversion’ to Metro at a later date (page 21). The vehicles operating the original SPRINT service can subsequently transferred to existing or new SPRINT services.

The first SPRINT service to operate in the West Midlands is to be funded by the support of the GBS LEP. It will operate from Birmingham City Centre to Quinton (via Broad Street, Five Ways and Hagley Road). The scheme is set to open in 2018 and will cost £12 million. A further £50 million has been earmarked to implement a route to the airport by 2021.

Future SPRINT services will run on the high capacity links, and within the Curzon HS2 Masterplan area includes Moor Street Queensway, Jennens Road and High Street Deritend. Figure 7.1 provides details of the proposed SPRINT routes and other public transport routes in the BEE assessment area (as identified in the Curzon Masterplan).

Figure 7.1: SPRINT Routes in the BEE Assessment Area



Source: Curzon HS2 Masterplan (2015)

The proposed scheme, as stated, provides a SPRINT stop at the Bus Interchange, providing an interchange opportunity between bus, heavy rail and Metro.

As agreed with BCC during the scoping stage, SPRINT will not be assessed as part of this TA.

7.3 Summary of Bus Services within the Study Area

The bus network in Birmingham is constantly adapting to the ever-changing built environment in Birmingham City Centre. TfWM encourages operators to change services on a set date (Network Stability Periods every 4-6 weeks) in order to keep a co-ordinated network in operation.

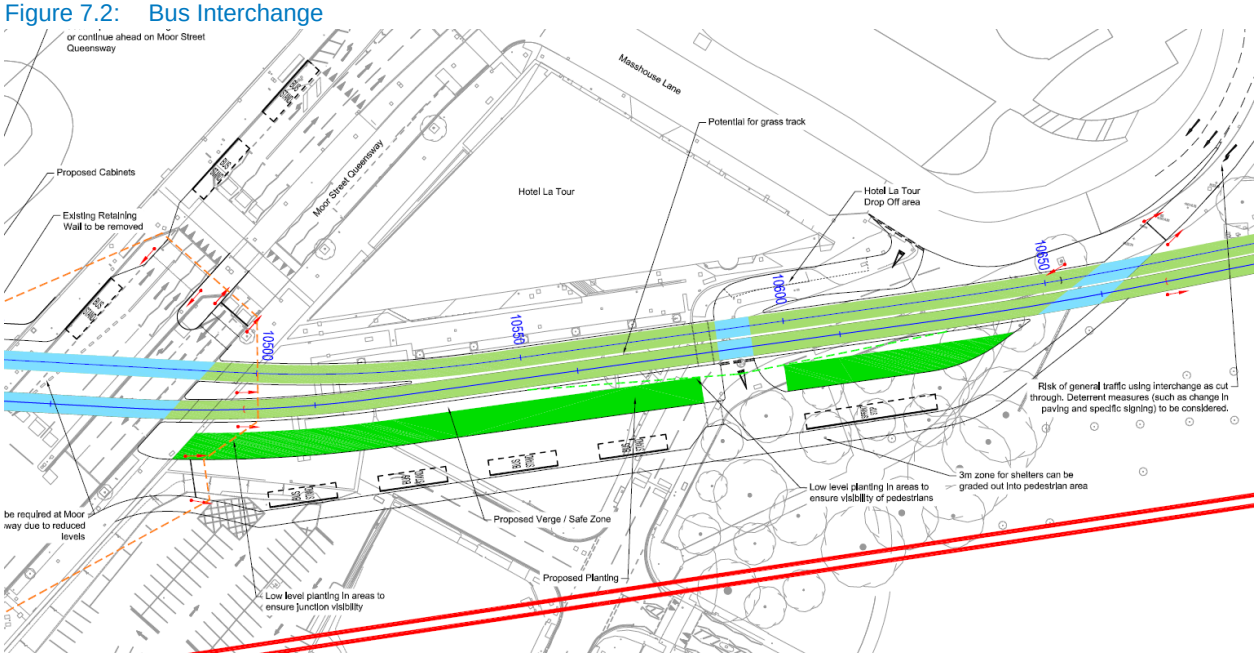
The BEE offers an opportunity for TfWM, BCC and bus service operators to revise and implement improved services with increased connectivity to other modes of transport. Where bus diversions have been agreed with TfWM with the introduction of the BEE, these have been incorporated into the SATURN model.

Appendix G shows the timetable information of the existing bus services which run along any section of the route.

7.4 Proposed Bus Interchange

As part of the BEE proposals it is planned to provide a new Bus Interchange facility. This is shown in Figure 7.2. This will accommodate bus stops that are directly affected by the BEE route alignment.

Figure 7.2: Bus Interchange



Source: ES Volume 2 Technical Appendix A, MMD-300207-HS29-DRA-0000-0012

The Bus Interchange is located to the east of Moor Street Queensway. It will provide segregated stops for BEE in both directions, as well as providing four stops for buses and one stop for SPRINT. Access to the Interchange will be via Park Street for buses and SPRINT. Egress will be onto Moor Street Queensway. To

prevent the risk of general traffic using the Interchange as a cut through, deterrent measures (such as a change in paving and specific signing) will be considered.

A drop off area will be provided so that Hotel La Tour can be serviced as existing. Egress from the Hotel La Tour drop off area will be in the form of a priority junction with Masshouse Lane.

7.5 Section 1 Corporation Street to Eastside Park

7.5.1 Bus Services

There are a large number of services operating within Section 1, as shown in **Appendix G.**

The BEE diverges from the BCCE at the Corporation Street / Bull Street junction. Buses currently operate in a northbound direction on Bull Street (south of the Corporation Street / Bull Street junction), following the one-way system in a northbound direction onto Corporation Street.

The inbound side of the track on Bull Street will be shared use track (buses and trams). The roads at this junction form a one-way system, so services will be unaffected along Bull Street and Corporation Street by the introduction of the BEE.

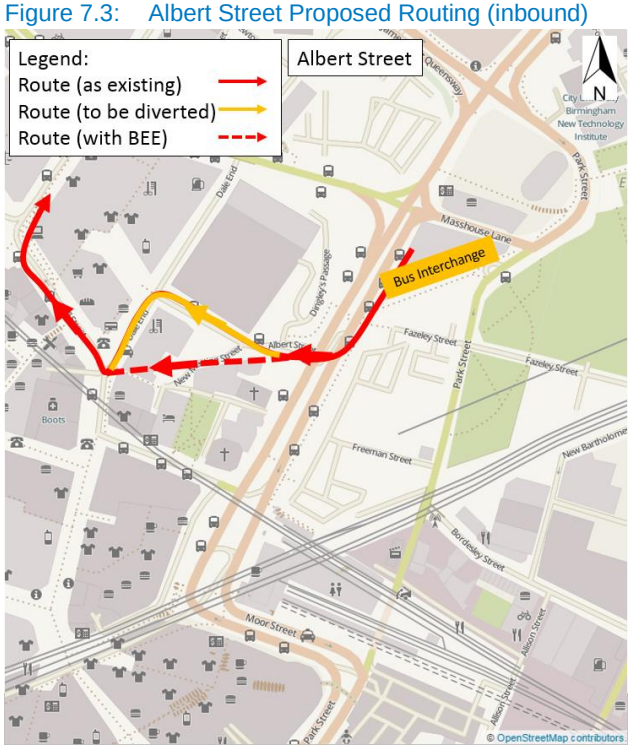
The planned closure of Albert Street to vehicular traffic will impact bus services using this route. Currently, bus services access Albert Street in two ways via:

- Carrs Lane, High Street and Dale End
- Moor Street Queensway

There is currently a frequency of 58 buses per hour in both the AM and PM peak hours travelling on Albert Street (eastbound) and 29 buses per hour travelling on Albert Street in a westbound direction.

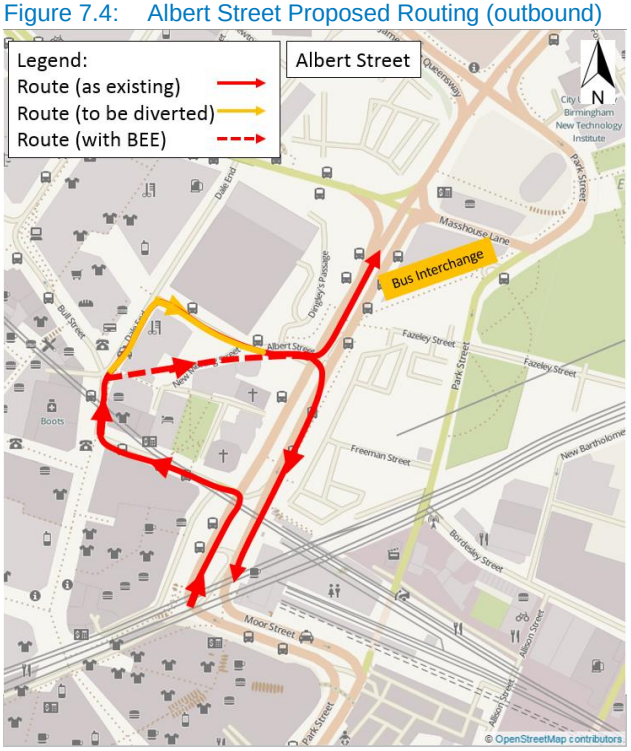
During a meeting with TfWM representatives on the 15 February 2016, it was stated that all bus services currently operating on Albert Street will operate along the new alignment once the BEE is operational (see Figure 7.3 and Figure 7.4).

Figure 7.3: Albert Street Proposed Routing (inbound)



Source: © OpenStreetMap Contributors

Figure 7.4: Albert Street Proposed Routing (outbound)

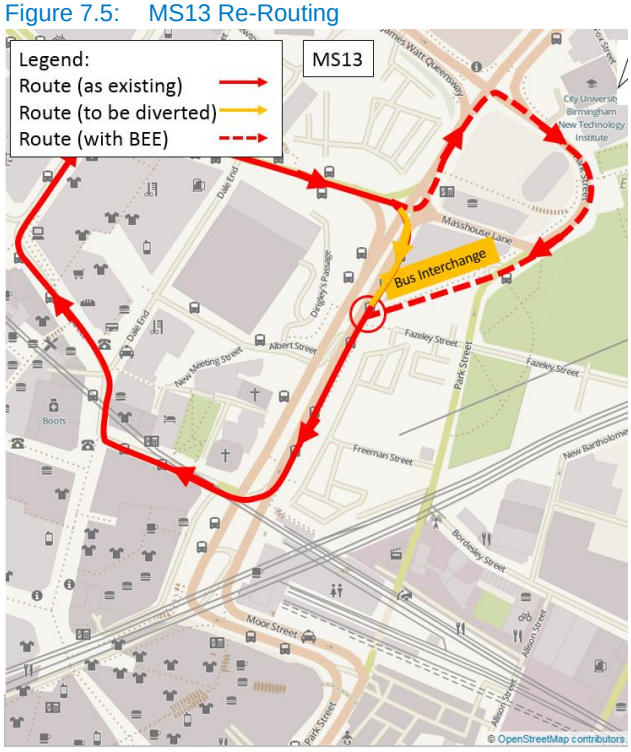


Source: © OpenStreetMap Contributors

The Moor Street Queensway / Albert Street junction is currently signalised, and the development proposals include a fourth arm to the junction (Bus Interchange). Buses may be impacted in terms of waiting times at this junction to allow priority to trams and for the extra signal stages to run as a result of the junction reconfiguration.

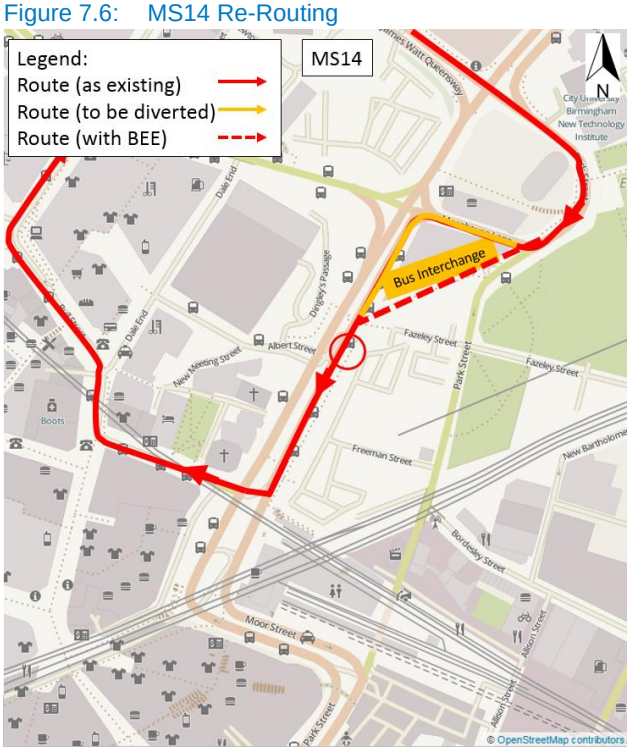
Buses that serve bus stops MS13 and MS14 on Moor Street Queensway (southbound) are directly impacted by the BEE scheme and are to be relocated to the Bus Interchange. There is a current frequency of 12 buses per hour in the AM and PM Peak at MS13, and 41 buses per hour in the AM and PM Peak at MS14. The re-routing implications can be seen in Figure 7.5 and Figure 7.6 for MS13 and MS14 respectively.

Figure 7.5: MS13 Re-Routing



Source: © OpenStreetMap Contributors

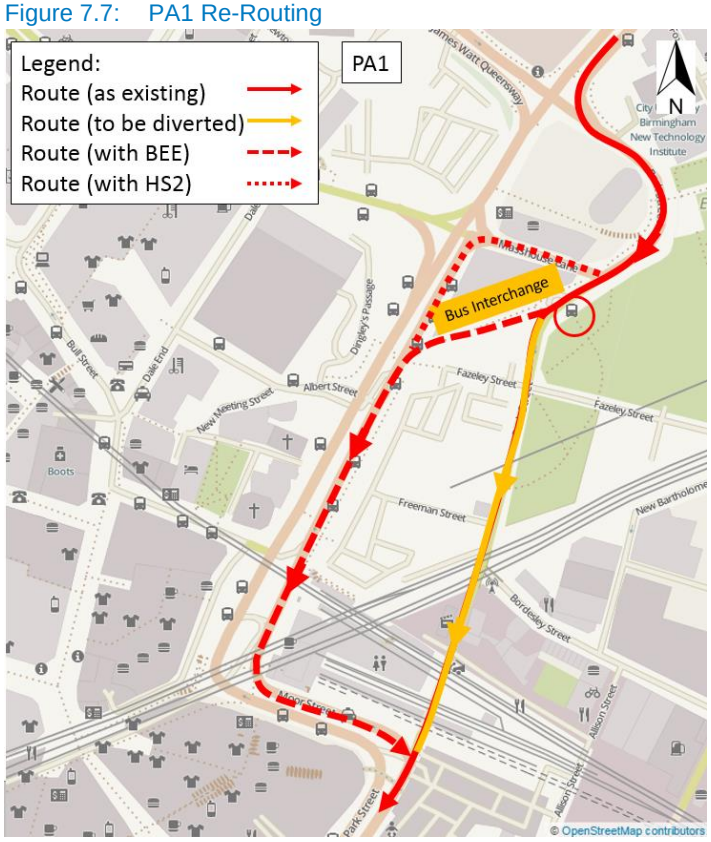
Figure 7.6: MS14 Re-Routing



Source: © OpenStreetMap Contributors

Finally, directly east of the proposed track alignment at the Bus Interchange lies an existing bus stop (PA1). The bus stop on Park Street (PA1) is to be removed as part of the BEE proposal, and Park Street is to be closed south of this bus stop as a result of the HS2 proposal. Following discussions with TfWM on the 15 February 2016 it was agreed bus stop PA1 is to be relocated to the Bus Interchange once the BEE is operational. Figure 7.7 shows the re-routing of services currently serving bus stop PA1.

Figure 7.7: PA1 Re-Routing



Source: © OpenStreetMap Contributors

Bus services on Moor Street Queensway (northbound) are unaffected by the BEE scheme.

Services operate to the east of the Bus Interchange on Park Street. There is a current frequency of 38 buses per hour in the AM and PM Peak serving bus stop PA1. Whilst TfWM are currently in discussions with bus operators regarding the BEE proposals, for the purpose of the TA it has been agreed with a TfWM representative that services in the Do Minimum scenario will re-route via Masshouse Lane. In the Do Something scenario, services will re-route via the Bus Interchange.

The Curzon HS2 Masterplan also states that in order to improve connectivity, Moor Street Queensway is proposed to be closed to traffic between Carrs Lane and Albert Street (to be introduced when HS2 opens in 2026). Buses, taxis and cyclists will be able to use the route, and the closure will allow significant public realm improvements whilst providing a direct route between Moor Street and Curzon Street Stations and the rest of the city centre. The closure of Moor Street Queensway is expected to significantly reduce the number of trips in the city centre[8].

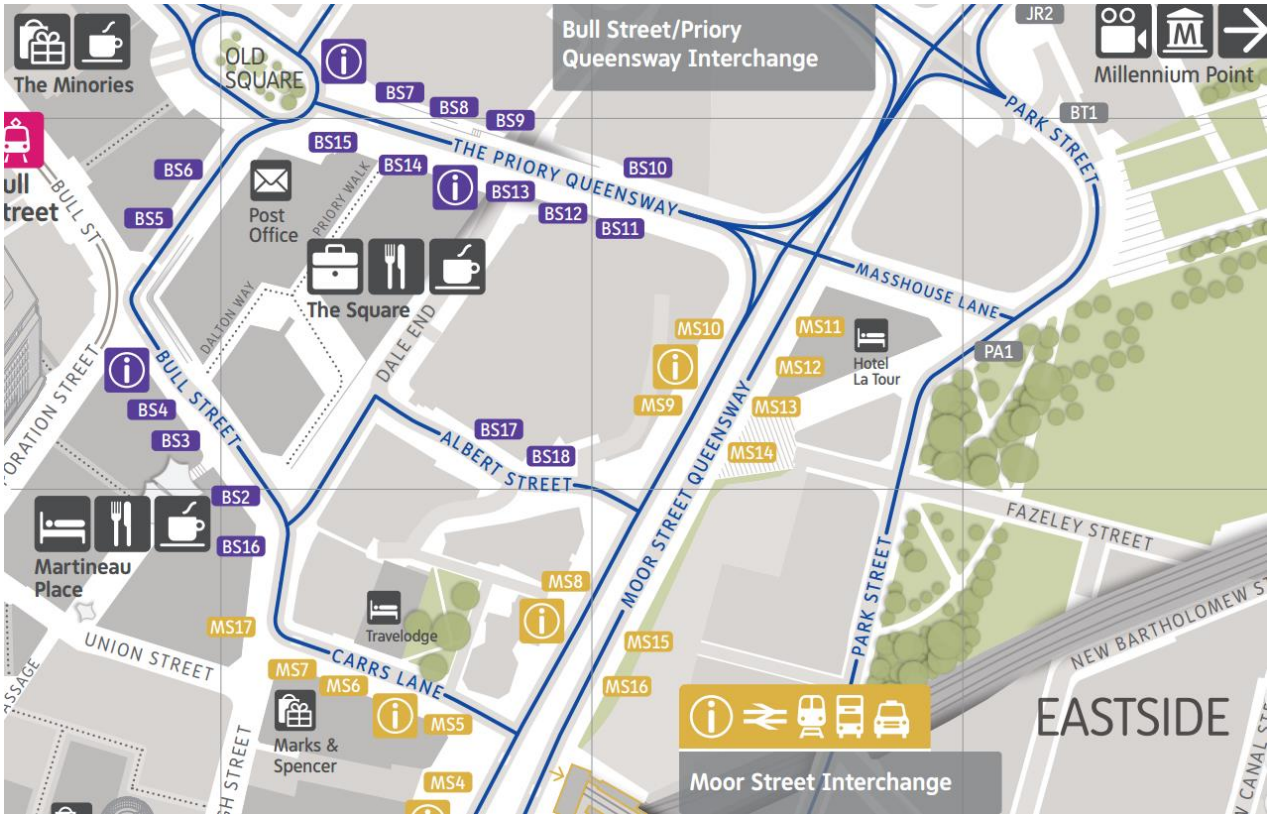
8 Atkins (2014) HS2 City Centre Modelling, Moor Street Queensway Closure Test, Technical Note

In discussions with TfWM it was agreed that the volume of services identified in Section 1 of the study area (see Figure 2.1) can be accommodated within the BEE proposals, albeit with some re-routing required. The SATURN model includes the proposed bus re-routings, and therefore the junction capacity assessment results summarised in Chapter 6 demonstrate that the junctions affected by the re-routing of bus services will continue to operate within capacity in the Do Something future year scenarios.

7.5.2 Bus Stops

Figure 7.8 shows the location of bus stops along the BEE route within Section 1**.**

Figure 7.8: Section 1 Bus Stops



Source: Network West Midlands / City ID - Birmingham City Centre Public Transport Guide (29 May 2016)

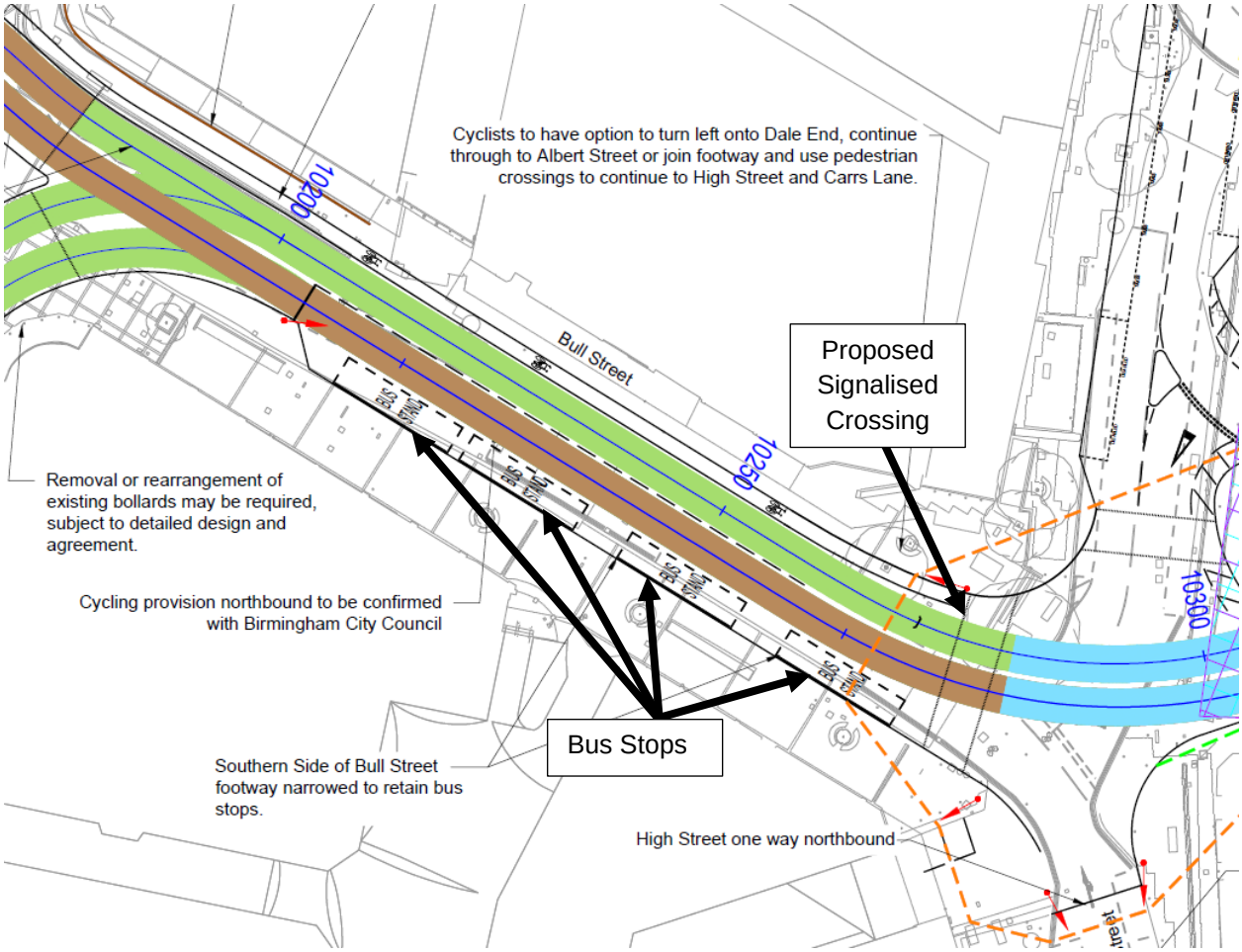
Two bus stops (BS5 and BS6) are located north west of the junction on Corporation Street. These bus stops are unaffected by the BEE scheme.

There are three bus stops located between the Corporation Street / Bull Street and Bull Street / Dale End junctions (bus stops BS2, BS3 and BS4), directly on the BEE track alignment. All services accessing these stops access Bull Street via Carrs Lane and High Street. All three stands have seating and are sheltered. There is currently provision for five buses across these three bus stands along Bull Street (highlighted with

designated road markings). These three bus stops located directly on the alignment on Bull Street serve 40 buses per hour (BS2 - 12 buses per hour; BS3 - 18 buses per hour; BS4 - 10 buses per hour).

TfWM stated that the three bus stands on Bull Street could accommodate up to 45 buses per hour. However, practically managing 45 services over three stops could be problematic. It would likely result in buses waiting to dock, blocking the tram going towards Colmore Circus. Therefore as part of the BEE proposals an additional bus stop has been included, although resulting in the removal of an uncontrolled pedestrian crossing. This is shown in Figure 7.9.

Figure 7.9: Proposed Bus Stops on Bull Street



Source: ES Volume 2 Technical Appendix A, MMD-300207-HS29-DRA-0000-0011

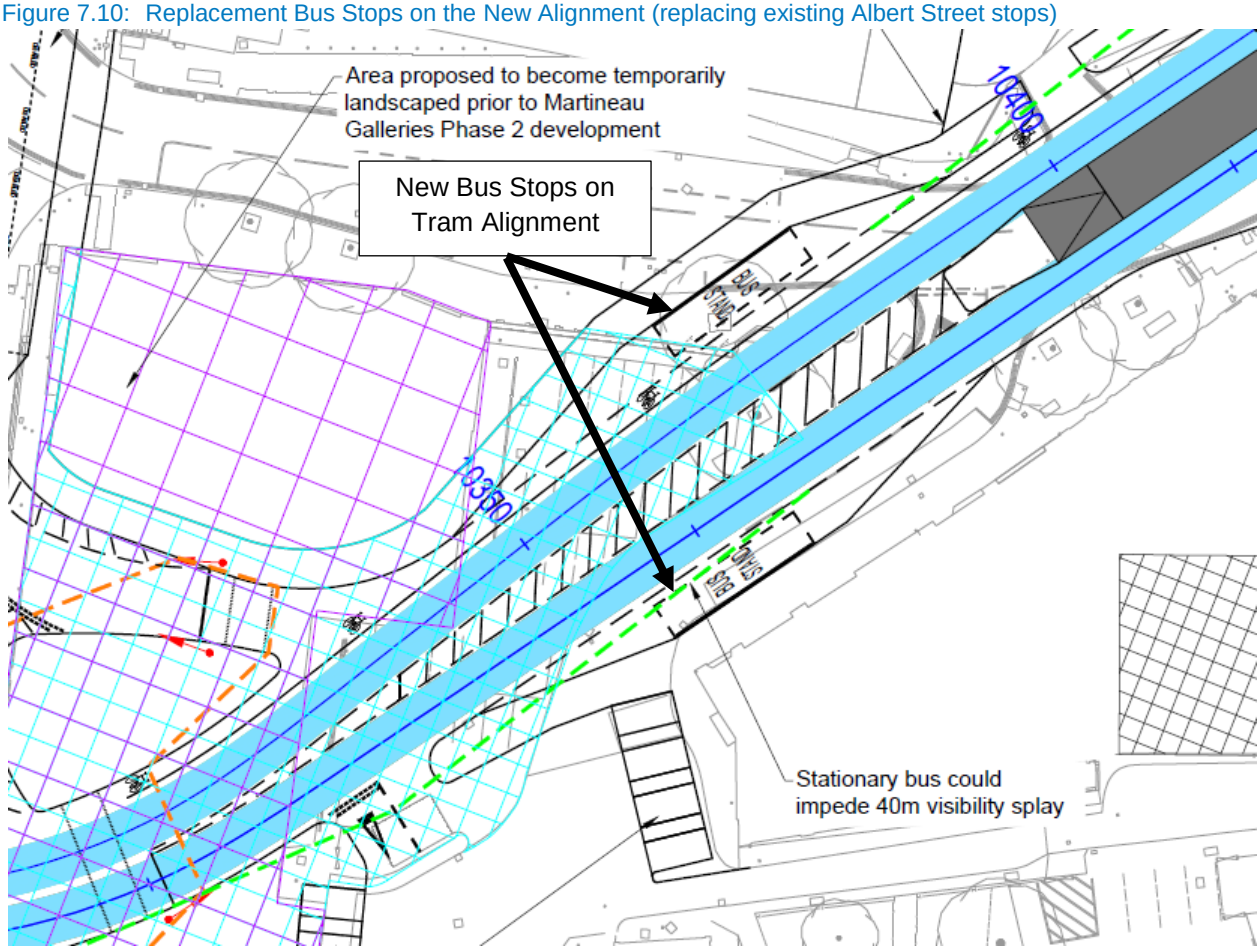
To compensate for the removal of this crossing the existing uncontrolled crossing on the southern end of Bull Street (immediately to the north of Dale End) will be signalised and provide a much safer facility for pedestrians to cross at this location.

Bus stop BS16 on High Street will be unaffected due to the one-way nature of the road system in this location and indirect interaction with BEE.

The bus stops on Carrs Lane (MS5, MS6 and MS6) will be unaffected by BEE.

Furthermore, Albert Street is to be closed as part of the BEE proposed scheme, resulting in the closure of two bus stops (BS17 and BS18). Whilst these stops are not currently in use, two replacement bus stops are to be located on the new track alignment as shown in Figure 7.10.

Figure 7.10: Replacement Bus Stops on the New Alignment (replacing existing Albert Street stops)

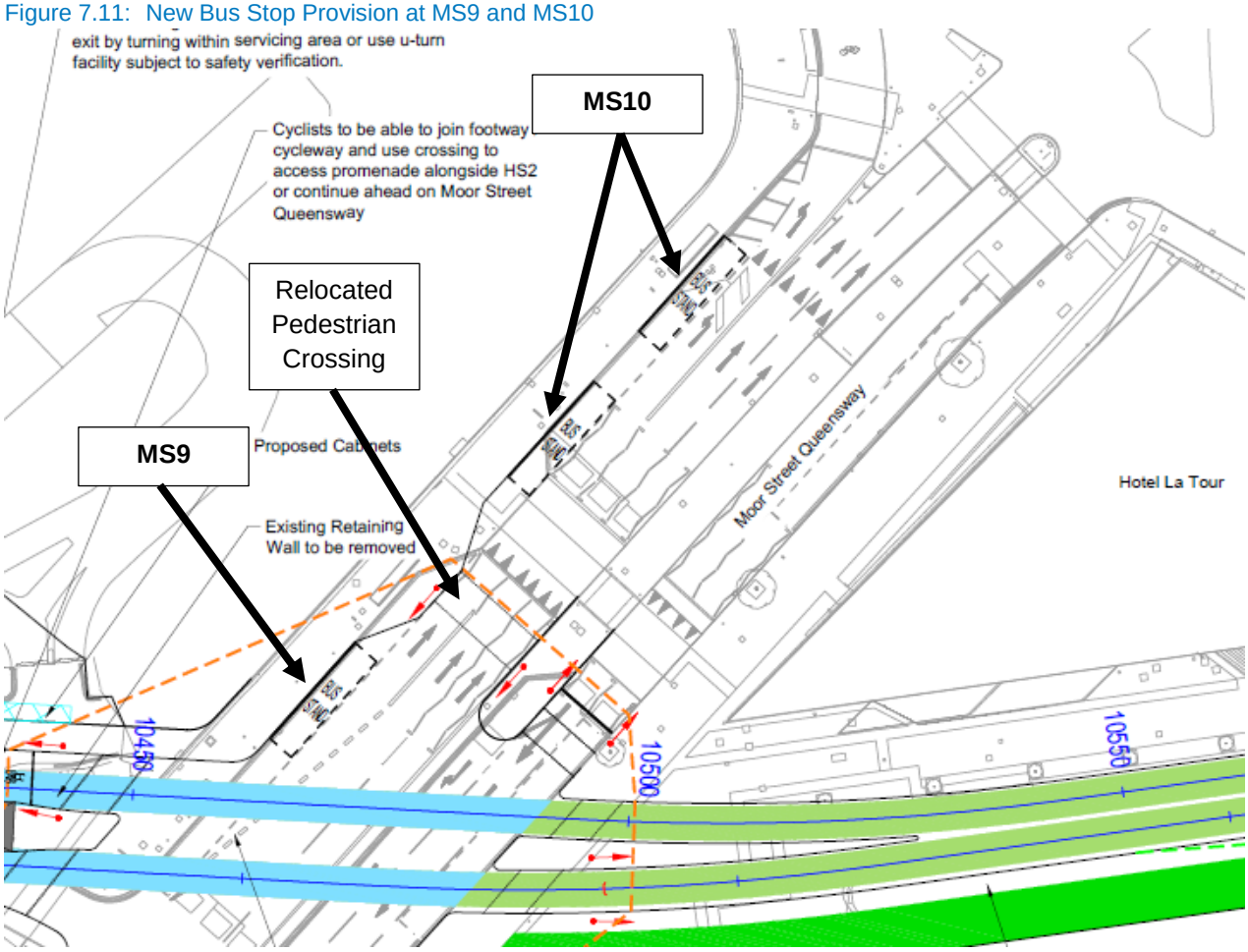


Source: ES Volume 2 Technical Appendix A, MMD-300207-HS29-DRA-0000-0012

Nine bus stops are located in both directions along Moor Street Queensway in close proximity to the junction with Albert Street. Bus stops MS9, MS13 and MS14 directly conflict with the proposed BEE track alignment.

MS9 is located on the west side of Moor Street Queensway, directly north of the junction with Albert Street and provides capacity for two buses. The BEE proposals reduce capacity at MS9 to one bus. To mitigate this, the BEE scheme accommodates space for two buses at MS10 and a single bus at MS9. This is shown in Figure 7.11.

Figure 7.11: New Bus Stop Provision at MS9 and MS10



Source: ES Volume 2 Technical Appendix A, MMD-300207-HS29-DRA-0000-0012

To accommodate these changes, the existing pedestrian crossing between the existing MS9 and MS10 stops is proposed to be moved in a southerly direction. Bus stop capacity at MS9 and MS10 will therefore remain as existing. The junction capacity assessments for the Moor Street Queensway junction which are summarised in Section 6 of this report show that the junction will operate within capacity and that blocking back from the crossing will not occur.

MS13 and MS14 are to be relocated to the proposed Bus Interchange. Four bus stands will be provided at the Bus Interchange, with access via Park Street. A SPRINT bus stand will also be provided.

7.6 Section 2 Eastside Park to Meriden Street

7.6.1 Bus Services

No bus services operate along Section 2, therefore no assessment has been undertaken.

7.6.2 Bus Stops

There are no bus stops along Section 2, therefore no assessment has been undertaken.

7.7 Section 3: Meriden Street to Adderley Street

7.7.1 Bus Services

Section 3 (Digbeth B4100 and High Street Deritend) provides one of the major routes in and out of the city centre. Digbeth (B4100) and High Street Deritend currently comprises of six lanes:

- Two vehicular lanes in each direction
- One bus lane in each direction

The BEE proposal results in the tram occupying the two offside lanes, leaving two lanes for vehicular traffic and bus traffic. Bus lane provision is therefore removed.

The most frequent services to operate along Digbeth (B4100) are the 97 NXWM service (Birmingham to Chelmsley Wood via Meadway), and the 50 NXWM service (Birmingham to Druids Heath via Moseley). Both services operate services with a frequency of 5 minutes at peak times.

Service 97A operates a 24 hour bus service to and from Birmingham Airport. The 97 and 97A services operate along Digbeth (B4100) and High Street Deritend up to the Heath Mill Lane junction (both services operate along Heath Mill Lane). Access to and from Heath Mill Lane for these services remains as part of the BEE proposals.

Services such as the 50, 50A and 150 operate along Digbeth (B4100) and access Bradford Street via Rea Street. The Rea Street junction is to be reconfigured as part of the BEE proposals, although existing movements will remain (and a right-turn from Rea Street is to be introduced).

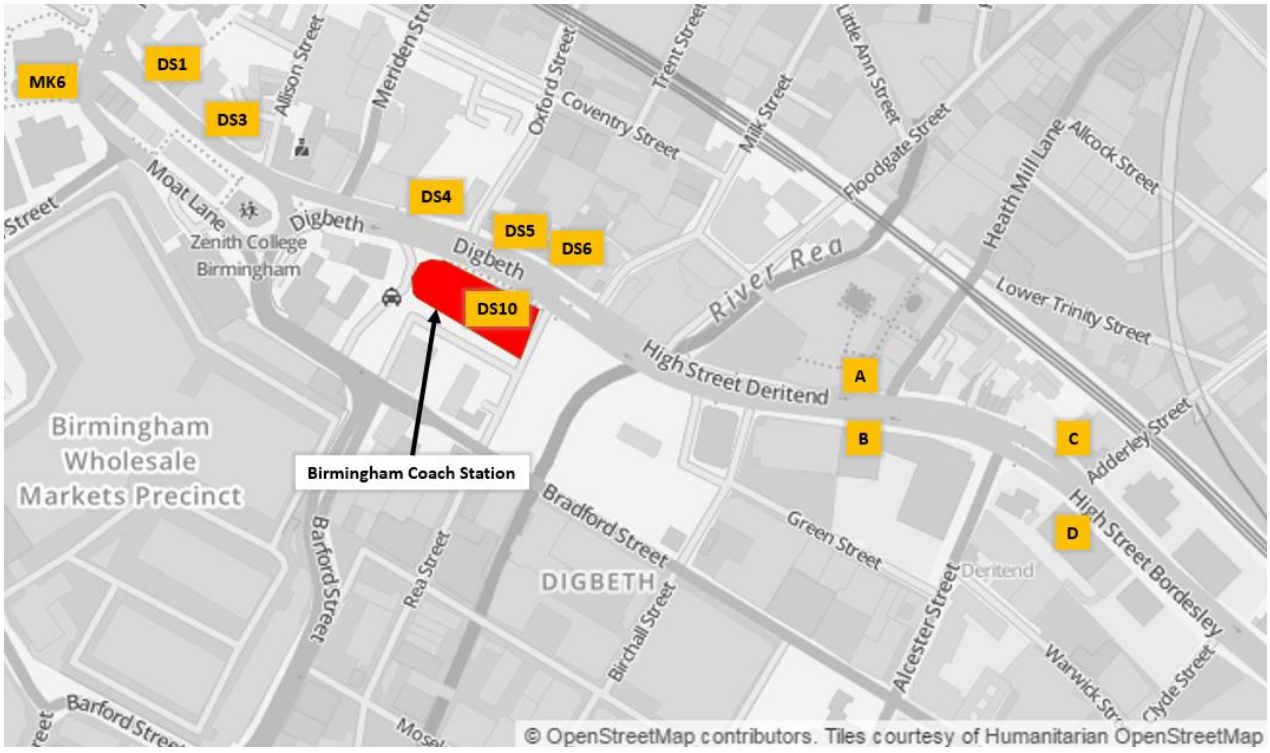
Digbeth (B4100) and High Street Deritend both have flows of over 100 bph in either direction at peak times, with some services operating 24 hours a day. Section 3 is therefore a major part of Birmingham's bus network. The removal of the bus lanes could have an impact on buses and general traffic along Digbeth (B4100) and High Street Deritend (see Chapter 6 for future scenario junction capacity assessments), but the bus stops will be on street, so buses should not be significantly delayed when exiting the bus stop.

7.7.2 Bus Stops

There are nine bus stops on Digbeth (B4100) and High Street Deritend along the length of the proposed track alignment and proposed highway works. These are as follows (with given references shown in Figure 7.12):

- DS4
- DS5
- DS6
- DS10
- 'Adjacent to Gibb Street' (A)
- 'Opposite Gibb Street' (B)
- 'Adjacent to Adderley Street' (C)
- 'Opposite Adderley Street' (D)

Figure 7.12: Bus Stops in Section 3



Source: © OpenStreetMap Contributors

All of the bus stops along Digbeth (B4100) and High Street Deritend are currently sheltered stops with bench seating provided for passengers. All of the bus stops are to be retained, although the bus stop 'adjacent to Adderley Street' is to be relocated due to the associated highway works east of the track alignment.

The three bus stops on the Moat Lane gyratory are to be retained.

7.8 Impact on Buses from Construction

During construction of the inbound track between High Street / Dale End and Corporation Street and the construction of the Corporation Street / Bull Street junction, it is unlikely that buses will be able to remain on their current routes and diversion of all services is likely to be required (this will need to be discussed with the relevant bus operators and Local Highway Authority).

Similarly, during construction work on Albert Street, buses using the Dale End / Albert Street route will need to be diverted.

It should be possible to retain the existing bus routes on Moor Street Queensway, Digbeth (B4100) and High Street Deritend during construction, although some temporary lane reallocation will be necessary.

Re-routing and associated temporary relocation of bus stops will need to be agreed with the bus companies in advance, and information provided to bus passengers. See Chapter 17 for a more detailed description of the impacts from construction.

7.9 Summary

Buses currently form the primary method of public transport in the West Midlands with nearly one million bus journeys per day. It is important that such levels of public transport use remain, and the introduction of the tram system will increase public transport patronage.

Birmingham Connected states buses will have an important role to play in the future transport system. Buses will need to respond to the development of other public transport networks, providing a ‘feeder’ into these modes. The introduction of the SPRINT network will further increase connectivity between transport modes across the West Midlands, also providing interchanges with the BEE at the Bus Interchange.

With the implementation of the BEE:

- Bus stop provision on Bull Street is to be reduced from kerb-space for five buses to three (although the three existing shelters are to remain). Bus services will not be affected as bus stop BS16 can be utilised for the excess capacity.
- Bus stops MS13 and MS14 on Moor Street Queensway are to be relocated to the Bus Interchange, and bus stop MS9 is to be relocated to bus stop MS10 (currently disused). Bus services will not be negatively affected by these changes.
- Bus services using Park Street (south of the PA1 bus stop) will be diverted via Masshouse Lane and Moor Street Queensway as part of the HS2 proposal, where Park Street will be closed to general traffic. Once the BEE is operational, bus stop PA1 will be relocated to the Bus Interchange. Further services that operate on Park Street may also operate through the Bus Interchange.
- All bus stops are to be retained along Digbeth (B4100), High Street Deritend and on the Moat Lane Gyratory.

- Bus lanes along Digbeth (B4100) and High Street Deritend are to be removed, reducing the vehicular traffic lanes from 3 to 2. The bus stops will remain on street, and therefore, the buses should not be delayed significantly than if the bus stops were in bus laybys.

The closure of Moor Street Queensway to general traffic (a committed transport scheme to be put in place in 2026) will improve bus service efficiency along Moor Street Queensway. City centre traffic will reduce as a result of the traffic restrictions, and the reliability and efficiency of the bus network will be improved as a result of these changes (with bus service speed increasing on average 1mph along Moor Street Queensway).

It is noted that the operation of bus services in Birmingham and the West Midlands is de-regulated with the majority of the services operating commercially. Bus routings for commercial services are ultimately determined by bus operating companies, although TfWM have a significant say in which services operate where through the SQPS and the Bus Alliance.

All services are reviewed by the operators and TfWM and will evolve to serve the changing nature of Birmingham City Centre and its commercial environment. TfWM have already had brief discussions with National Express about the BEE proposals, specifically regarding the changes to bus stop locations and re-routings around the Bus Interchange.

It is not expected that the proposed highway modifications as a result of BEE will lead to the withdrawal of any bus services. Where existing bus stops are impacted, provision has been sought elsewhere, and where service routes are impacted, diversions have been proposed.

8 Impact on Light Rail

8.1 Introduction

This chapter addresses the impact of the BEE scheme upon the existing light rail network and the policy implications of the development.

8.2 Impact on Existing Operations

As explained in Chapter 3.4, the number of trams operating between Snow Hill Rail Station and the junction between Corporation Street / Bull Street where BEE diverges from BCCE will remain the same. Therefore, there will not be an increase or decrease in trams operating on other parts of the tram network following the introduction of BEE.

The junction capacity assessments summarised in Chapter 6 also demonstrate that in capacity terms the Corporation Street / Bull Street junction will operate within capacity for the 2021 and 2031 Do Something scenarios.

8.3 Impact of Constructing BEE

The construction of the BEE will have an impact upon the existing light rail operations in Birmingham City Centre. Where the BEE scheme diverges from the BCCE scheme, there is a direct interaction at the Corporation Street / Bull Street junction between the two tramways. The BCCE scheme, though, has built in passive provision for a delta junction at Corporation Street / Bull Street which will assist in minimising disruption during construction. During construction at this junction, it is proposed that the BCCE will have to terminate at the Bull Street stop, and the EDGE route will have to terminate at the Grand Central stop (to allow for sufficient turn-back facilities and the prevention of trams running on the opposite side of the road). This disruption is proposed to last for 14 weeks, although the passive provision already constructed at the delta junction as part of the BCCE may assist in minimising this time.

8.4 Summary

The proposed Midland Metro developments align clearly with transport strategy and policy in Birmingham. In addition to the current network expansion, the BEE scheme and the scheme linking Centenary Square / EDGE will significantly enhance the capacity of Birmingham's transport infrastructure.

Extending the tram along the proposed route will increase public transport access from the Eastside area into the existing employment, leisure and transport hubs. This is backed up by the Initial Outline Business Case (SDG, 2015, paragraph 4.7) which states that the BEE is forecast to carry around 4 million passengers in 2031. This in turn has the potential to attract investment, people and businesses into the Eastside area; physically, socially and economically, thereby improving the area. Coupled with the HS2 development, and further extensions of the Metro line, this extension has the potential to transform Birmingham's Eastside.

Linking transport hubs is also highlighted as an important part of future public transport (WMLTP3). The BEE will significantly enhance the opportunity to link light rail with heavy rail (HS2), buses / coaches (Bus Interchange and the Birmingham Coach Station) and walking / cycling.

The delta junction at Corporation Street / Bull Street (currently part of the BCCE) has been constructed in a way to minimise disruption during the construction phase of the BEE. During construction at this junction, it is proposed that the BCCE will have to terminate at the Bull Street stop, and the EDGE route will have to terminate at the Grand Central stop. This disruption is proposed to last for 14 weeks.

During operation, there will not be an increase or decrease in trams operating on other parts of the tram network following the introduction of BEE. The junction capacity assessments summarised in Chapter 6 also demonstrate that in capacity terms the Corporation Street / Bull Street junction will operate within capacity for the 2021 and 2031 Do Something scenarios.

9 Impact on Heavy Rail

9.1 Introduction

Birmingham New Street Station is the busiest interchange station outside of London, with over 170,000 passengers daily. New Street Station is the hub of the West Midlands rail network, and a hub of the national rail system. Other Birmingham City Centre stations include Moor Street and Snow Hill. The proposed track alignment of the BEE runs directly through the proposed HS2 site, providing an efficient interchange for HS2 passengers.

This chapter addresses the impact of the BEE route upon the heavy rail network in Birmingham.

9.2 Existing Baseline

Currently, Arriva Trains, London Midland, Virgin Trains and Cross Country provide services from New Street Station.

Destinations from New Street Station are wide ranging:

- Cross Country 785 mile route - Aberdeen to Penzance (destinations including Newcastle, York, Sheffield and Bristol)
- West Coast Mainline (destinations including London Euston, Manchester, Edinburgh and Glasgow)
- Regional and Local lines including destinations of Leicester, Coventry and Nottingham (operated by London Midland and Cross Country)
- Europe can also be accessed via London, although future heavy rail proposals will significantly improve this link.

Constructed in 1854, New Street Station has recently undergone a £550 million redevelopment, and recently become the terminus of the BCCE Midland Metro line with a new tram stop on Stephenson Street.

Rail patronage increased between 2013/14 – 2014/15 by 4.7% to 50.8 million which is the greatest increase amongst Passenger Transport Executive (PTE) areas nationally. Key stations which have accounted for these figures include Birmingham Moor Street and Birmingham Snow Hill Stations. Improved park & ride facilities at many of the stations serving Birmingham City Centre may also have led to the increase in rail passenger patronage (for example 223 free parking spaces were added to the existing 789 parking spaces at Stourbridge Junction Station)[9].

Birmingham Moor Street is increasing in importance, and is now the terminus for many Chiltern Rail services from London Marylebone. Moor Street is also served by London Midland who run local services on the Snow Hill Line. Moor Street is not connected to New Street Station via rail, although there is a 350m walk for passengers via a new direct walkway constructed in 2013. Moor Street Station is also on the site adjacent to the proposed HS2 terminal, which will allow for improved connectivity in the future.

9 West Midlands Integrated Transport Authority (2015) West Midlands Travel Trends

Birmingham Snow Hill Station is a rail and tram station in Birmingham City Centre, and was once the main station of the Great Western Railway; rivalling Birmingham New Street Station. Most trains now using Snow Hill are local services operated by London Midland (destinations including Worcester, Kidderminster, Wolverhampton, Solihull and Stratford-upon-Avon). Similarly to Moor Street, the Chiltern Rail service to London Marylebone stops here.

9.3 Future Schemes

The proposed HS2 line from London to Birmingham is set to be completed in 2026, reaching Crewe by 2027 and will be fully completed in 2033. HS2 is the biggest national transport scheme in decades, and the proposed BEE would link the HS2 Station to the recently redeveloped New Street Station and Snow Hill Station.

Significant heavy rail investment in the Curzon area has triggered a Curzon HS2 Masterplan formally adopted by BCC in August 2015. Curzon Street Station will act as a catalyst for regeneration in Birmingham's Eastside, unlocking regeneration potential. The Masterplan seeks to ensure the station is fully integrated into the urban fabric of the city centre, requiring high quality walking, cycling and public transport connections continuing into and throughout the City. The BEE can therefore be seen as a key proposal within the Masterplan and the Curzon Street Masterplan Transport Strategy (AECOM, 2015, see Chapter 4.4.4).

Significant national, local and economic benefits are predicted as a result of HS2, with 26,000 jobs to be provided in Birmingham and Solihull alone. A £4bn increase in economic output per year is also predicted for Birmingham, meaning it is vital the wider Metropolitan area can access the benefits of such development.

The Movement for Growth document (see Chapter 4) identifies the transport infrastructure needed to enhance accessibility to the proposed HS2 interchange. This includes rail, tram, buses and SPRINT. Movement for Growth states that improved connections, including via the Midland Metro network, will help unlock the full economic potential of HS2.

At Snow Hill Station, following the initial upgrade of the Midland Metro line, the station is also set for a £400 million upgrade (as stated in Birmingham Connected). Routes to Moseley and Kings Heath, Sutton Coldfield via Walmley and Tamworth are proposed to be reopened and upgraded.

9.4 Impact of Construction on Heavy Rail

The construction of the infrastructure for HS2 is expected to commence in 2017 and be completed by 2026. Construction is therefore expected to be ongoing throughout the construction of the Metro extension. This will apply particularly to the HS2 terminus buildings, viaduct structures, utility diversions and access infrastructure. If the current programmes for construction are adhered to, construction of HS2 will be on site well in advance of the Metro extension and the management of traffic for construction to the east and south of Moor Street will already be well established. Traffic management proposals for the Metro

extension will have to fit in with that already in place for the HS2 development, and particular consideration will need to be given to maintaining access for the construction of both projects.

9.5 Summary

During the construction phase there will be an interaction with the HS2 construction site, and particular consideration will be given to maintaining access for the construction of both projects. There will be no negative impacts upon heavy rail services due to the construction and operation of the BEE.

The BEE will directly interface with the proposed HS2 terminal at Curzon Street, and through current infrastructure, will link the HS2 terminal with New Street Station and Snow Hill Station. Moor Street Station is also in close proximity to the BEE at the Moor Street Queensway junction and the Bus Interchange. The linkage between Birmingham's stations is important, and the BEE along with the current BCCE has the capability to integrate all stations.

Interchange opportunities will also be vital in delivering passengers to Birmingham's rail stations via the Midland Metro. This will offer a high quality and reliable public transport alternative to the car, and improved connectivity between stations and transport modes will significantly improve what the public transport network has to offer. All impacts of the BEE on heavy rail are therefore positive.

10 Impact on Coaches

10.1 Introduction

This chapter addresses the impact of the BEE scheme upon the coach network in Birmingham, with specific regard to Birmingham Coach Station located directly along the BEE route.

10.2 Birmingham Coach Station

The Birmingham Coach Station is located along Digbeth (B4100) at the Mill Lane junction. The coach station underwent a £15 million redevelopment and was reopened in 2009 as the hub of the National Express inter-city network, with the company's head office also being located here.

10 services operate from 16 stands at the coach station as listed below, along with further services offered to Belfast and Dublin by National Express's sister company Eurolines:

- 210 - Route West Midlands to Heathrow Gatwick Airports
- 303 - Coaches between Manchester, Birmingham, Oxford and the South Coast
- 320 - Route Leeds Sheffield to Birmingham South West
- 325 - Coaches between Manchester and Birmingham
- 409 - Coaches between Shrewsbury, Telford and London
- 410 - Coaches between Birmingham and London
- 538 - Coaches between Scotland, Manchester and Birmingham
- 570 - Route Blackpool to Birmingham and London
- 590 - Route Glasgow to London and Heathrow Airport
- 777 - Route Birmingham to Stansted Airport

Current access to Birmingham Coach Station is from Bradford Street. The BEE track alignment does not run on Bradford Street and there will be no impact upon access.

Coaches exit the Birmingham Coach Station site on Rea Street at an exit-only junction. The site exit is unaffected by the BEE proposal. The existing signalised junction with Digbeth (B4100) and Rea Street directly north of the site exit will remain. The junction will operate similarly to the existing junction and services will be unaffected.

A passenger drop-off point and taxi rank are located along Mill Lane (a one-way road with access from Bradford Street and exit on Digbeth B4100). The Digbeth (B4100) junction with Mill Lane will also remain in place as part of the BEE proposals. The junction will operate as existing and services will be unaffected.

Pedestrian crossing facilities providing access to the Birmingham Coach Station will remain as part of the BEE proposals.

There will be no negative impact of the scheme upon the coach station. Furthermore, the Initial Outline Business Case (SDG, 2015, page 18) demonstrated that there would be increased patronage on the BEE on the High Street Deritend route as opposed to the Fazeley Street route option as this option is better connected to the coach station, an important transport hub in the area. The provision of an interchange

between the Midland Metro and the Birmingham Coach Station is therefore seen as a major advantage of the BEE.

10.3 Summary

All site access junctions for Birmingham Coach Station as well as the Digbeth (B4100) / Mill Lane taxi service and drop-off point will not be negatively impacted by the BEE track alignment.

The impact of the BEE on Birmingham Coach Station is therefore positive. The location of the tram stop in relation to Birmingham Coach Station will allow inbound coach passengers to easily reach the city centre, Wolverhampton and West Bromwich among other stops on the Midland Metro network.

Outbound passengers in the City will also be better connected, allowing for a more efficient public transport route to the coach station. Passengers will find National Express destinations such as Heathrow and Stansted airport, London and Manchester more accessible.

The location of Birmingham Coach Station will provide the means to create an interchange hub between the Midland Metro, the bus network and the coach network. The IOBC published by SDG furthers this, stating that the BEE will create an “important transport hub” with Birmingham Coach Station.

The Bus Interchange will also provide capacity for coaches to serve the demand for the HS2 terminal station. The impact of BEE upon Birmingham Coach Station and the current coach network in Birmingham is therefore positive.

11 Impact on Walking and Cycling

11.1 Introduction

This chapter assesses the existing and proposed walking and cycling provision along the BEE route alignment. This is assessed in line with existing local and national policy.

For the purpose of this assessment, pedestrian surveys were undertaken in the following locations (agreed with BCC during the scoping exercise):

- Bull Street
- Digbeth (B4100)
- High Street Deritend

Pedestrian surveys were undertaken in the following periods (full pedestrian survey outputs are available on request):

- Saturday 20 June 2015 (11:00-17:00)
- Tuesday 23 June 2015 (07:00-10:00 and 16:00-19:00)

The pedestrian surveys provided an indication of the existing pedestrian footfall along much of the route. Further to this, an existing pedestrian survey undertaken by Arup (2015) has been utilised for an assessment of Moor Street Queensway.

As part of the junction turning counts that were undertaken to support this TA (see Chapter 6), cyclist movements were recorded for each movement at the junction.

11.2 Active Modes Policies and Initiatives

Walking underpins all elements of a transport system, with all journeys involving walking to a certain extent for able-bodied persons. In Birmingham this is certainly the case, with walking currently required between the three major rail stations for connecting services (Moor Street, New Street and Snow Hill Stations).

When considering pedestrians, it is important to consider those with restricted mobility, including the disabled, the elderly, and those with small children. Integration between walking and the public transport network is therefore essential, and pedestrian access to public transport needs to be an integral part of public transport proposals.

The WMLTP3 places significant emphasis on improving the public transport network, although proposals relating to active travel including the enhanced provision for cycling and walking are considerably weighted. The delivery of the BEE therefore needs to integrate these modes of transport in order to satisfy these requirements.

The Birmingham Cycle Revolution (BCR) is a 20-year initiative encouraging people to cycle in and around the City, making Birmingham healthier, greener, safer and less congested. Currently only 2% of journeys in Birmingham are made by bicycle. BCR's vision is to make cycling an everyday mode of transport, with the aim for 5% of all trips in Birmingham to be by bicycle by 2023 (rising to 10% in 2033). BCR are currently

focusing on improving popular routes into the city centre, upgrading towpaths on canals, developing local links to cycle routes and providing secure cycle parking hubs.

Smarter Choices is also an initiative aimed at promoting safer, healthier and smarter travel choices. BCC has made a pledge to reduce CO_2 emissions, protect the most vulnerable citizens and encourage healthier lifestyles. Smarter Choices does this by providing road safety education and cycle training courses, encouraging walking to school / work and showcasing public transport methods.

The Smarter Choices and BCR initiatives tie into the Sustainable City's Cycling Strategy 2011-2015 for Birmingham (Bike Birmingham). This provides a strategy to encourage cycling in Birmingham, building on the Climate Change Strategy. Cycling is stated to support five priorities for Birmingham:

- Succeeding economically
- Staying safe in a clean, green city
- Be healthy
- Enjoy a high quality of life
- Make a contribution

The BEE underpins the active modes policies and initiatives identified, and will play an important role in supporting active modes in Birmingham and the West Midlands. This is thought to create a well-connected, efficient and walkable city.

11.3 Connectivity

The proposed BEE will provide four more stops to the existing Midland Metro system. Three of these tram stops will provide connections with different modes of public transport. The first stop in an outbound direction is located directly west of the Moor Street Queensway Bus Mall and the proposed Bus Interchange (see Chapter 7 for more details). Moor Street Station is also within easy walking distance (approximately 280m).

The tram then travels through the proposed HS2 Station (with a stop on New Canal Street). This will ensure vital connectivity to HS2, and will also provide additional sustainable access to Birmingham City University.

The tram stop on located at the New Canal Street / Bordesley Street junction provides access to the light industrial and retail area within its vicinity.

The terminus tram stop on High Street Deritend will also improve connectivity between transport modes as it is located adjacent to the Birmingham Coach Station. The tram stop is also in the catchment area of the Custard Factory and South & City College Birmingham.

11.4 Pedestrian Impact

Pedestrians are well served by existing networks on and around the proposed BEE route as detailed in the forthcoming chapter (also see **Appendix C**).

Where possible, signalised pedestrian crossings will remain or be introduced to provide safe crossing points across the highway and the track alignment.

The Equality Act 2010 requires that all new developments are fully accessible to all, including those with limited mobility, audio or visual disability. The BEE scheme will be fully compliant with the Equality Act 2010. The proposed tram stops and the Bus Interchange will be carefully designed in order to incorporate full accessibility to the platforms and the trams.

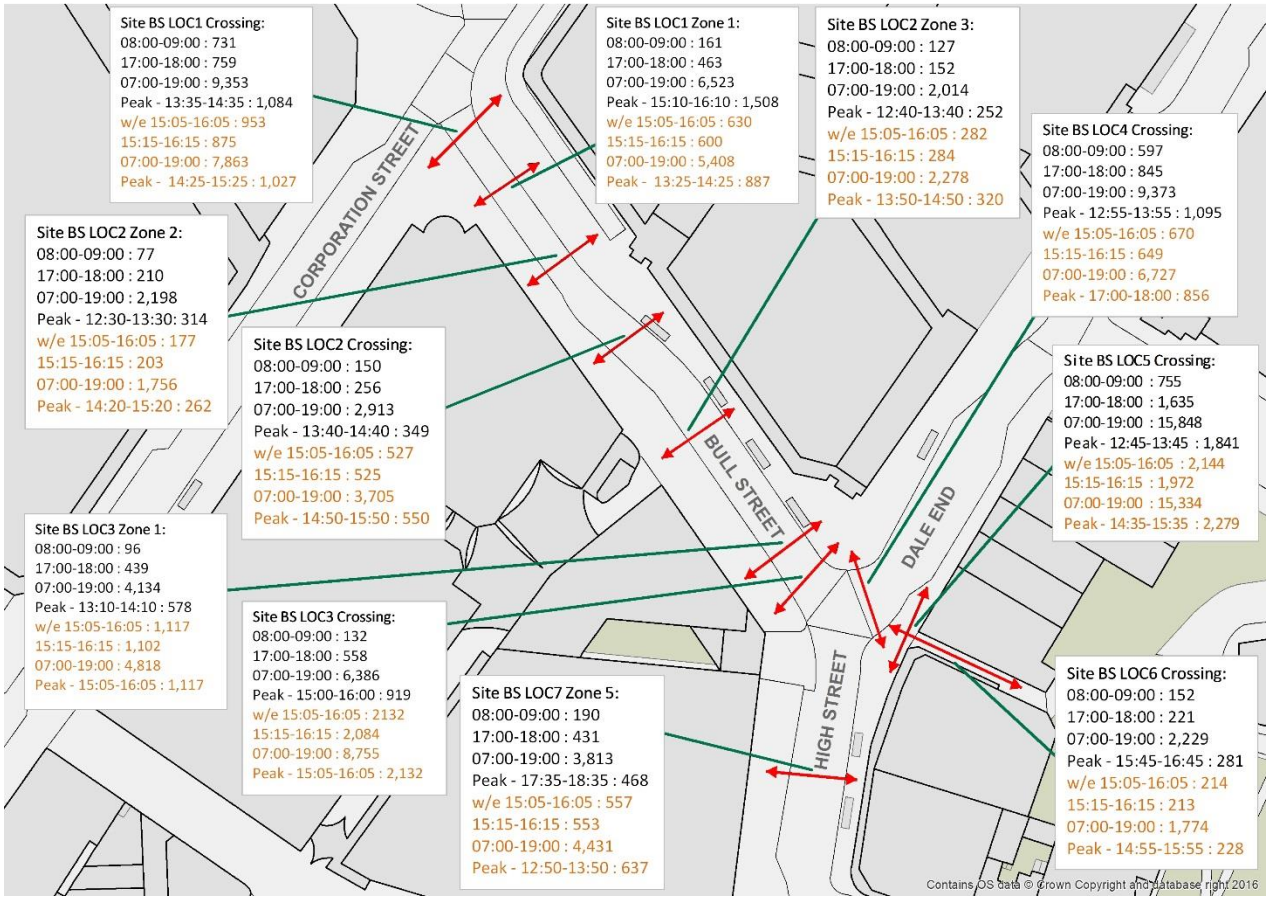
This chapter details the impacts of the proposed scheme on pedestrian facilities, on a section by section basis. This chapter also makes reference to pedestrian surveys undertaken along the route.

Figures 11.1 to 11.3 summarise the surveyed pedestrian flows. The diagrams show the surveyed pedestrian flows for the weekday (shown in black) and weekend (shown in yellow). Peak hour and total surveyed pedestrian flows are shown for each site.

11.4.1 Section 1: Corporation Street to Eastside Park

Figure 11.1 shows a summary of the pedestrian surveys along Bull Street and High Street.

Figure 11.1: Pedestrian Surveys undertaken along Bull Street / High Street



Source: Mott MacDonald 2016

The existing infrastructure in Section 1 at the Corporation Street / Bull Street junction comprises of wide pedestrian footways with retail facilities on either side of the highway. Current pedestrian provision recently installed as part of the BCCE is in the form of three signalised pedestrian crossings (with a central pedestrian refuge). It must be noted that when the surveys were undertaken (20 and 23 June 2015), only one of three pedestrian crossings was in use (due to the BCCE construction). The results of the survey show 1,084 two-way crossings in the peak hour (13:35-14:35) at this signalised crossing (BSLOC1 on Figure 11.1).

Pedestrian facilities at this junction will not be compromised due to the installation of the tram, and the signalised pedestrian crossings remain in place. It should be noted however that the existing signalised pedestrian crossing located on the Bull Street arm of the Bull Street/Corporation Street junction is proposed to be re-located adjacent to the Bull Street/Dale End junction.

Along Bull Street there is a dropped-kerb crossing for pedestrians (BS LOC2 on Figure 11.1). Figure 11.1 shows 349 two-way pedestrian crossings in the weekday peak hour (13:40-14:40), and 550 in the Saturday peak hour (14:50-15:50). Pedestrians were also surveyed crossing Bull Street in four locations where no pedestrian crossing facilities are provided. There was a maximum two-way peak of 1,117 crossings across all the non-designated zones (BS LOC3 Zone 1 on Figure 11.1). Appropriate signage may be required along Bull Street to direct pedestrians to the designated crossing points.

At the Bull Street / Dale End junction there is currently a dropped-kerb crossing for pedestrians on the Bull Street arm (BS LOC3 on Figure 11.1). The junction is currently a three-arm priority junction, although with the introduction of the BEE it will become signalised.

The proposed signalisation of the Bull Street / Dale End junction will provide for safe pedestrian crossings across the proposed track alignment (where currently 919 pedestrians cross in the peak weekday hour, (15:50-16:50), and 2,132 pedestrians cross in the Saturday peak hour, 15:05-16:05, on the Bull Street arm of the junction – see Figure 11.1).

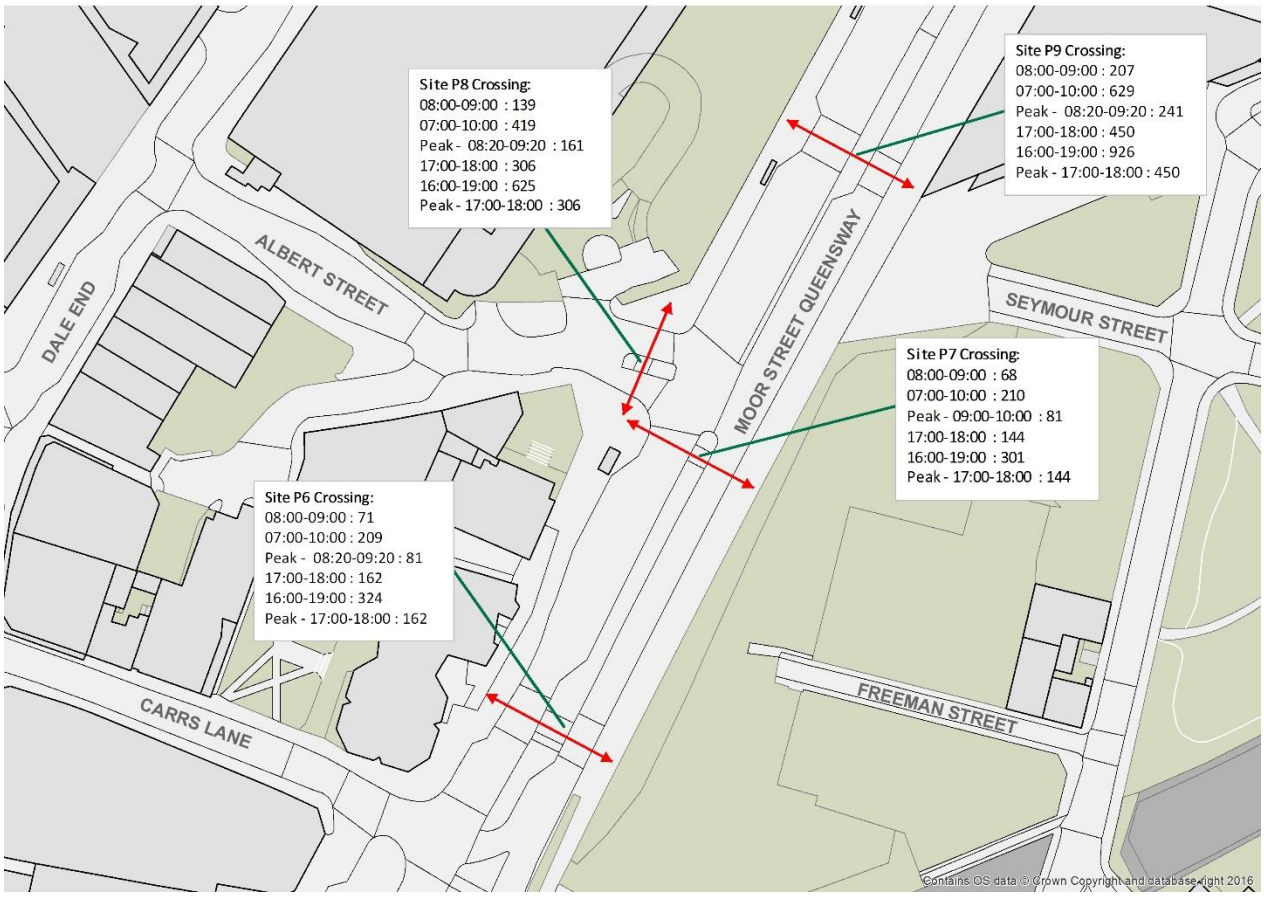
There is currently a segregated pedestrian and cycle lane from the Bull Street / Dale End junction to New Meeting Street. The proposed track alignment runs between the junctions and as a result a new shared use road is to be introduced.

The new alignment travels along an existing pedestrian footway. The pedestrian footway at this location is the busiest surveyed pedestrian crossing, with 1,841 two-way pedestrian crossings in the weekday peak hour, and 2,297 in the Saturday peak hour (12:45-13:45 and 15:05-16:05 respectively; see Figure 11.1). However, as stated, a new shared use road will be introduced at this location.

Figure 11.2 shows a summary of the pedestrian surveys along Moor Street Queensway.

The surveyed pedestrian crossings are the crossings that will be directly impacted by the BEE track alignment. There are further pedestrian crossings located along Moor Street Queensway at the Carrs Lane, Masshouse Lane and Jennens Road junctions.

Figure 11.2: Pedestrian Surveys undertaken along Moor Street Queensway



Source: Mott MacDonald 2016

Figure 11.2 shows the two-way pedestrian crossing flows along Moor Street Queensway. Figure 11.2 shows the surveyed sites on Moor Street Queensway have generally low two-way flows in comparison to Bull Street and High Street Deritend (Figure 11.1 and Figure 11.3 respectively).

Moor Street Queensway is situated within close proximity to the Bus Interchange and the proposed HS2 interchange. Pedestrian footfall will therefore increase once the developments are in operation.

In regard to HS2, the Curzon Street Masterplan Transport Strategy (AECOM, 2015) states that nearly all HS2 passengers must cross Moor Street Queensway, with around 50% expected to go towards New Street Station and the retail heart of the city centre (page 10). Nearly 3,400 pedestrians per hour will therefore cross the southbound carriageway of Moor Street Queensway, and over 3,500 at the four other crossing places as a result of the HS2 proposals without the additional demand generated by the Curzon Street Masterplan proposals.

The Curzon Street Masterplan Transport Strategy (AECOM, 2015) further states the issue of how people cross Moor Street Queensway and then walk to their intermediate or final destinations has not been effectively addressed as part of the HS2 proposals (page 10). As a result, as part of the Masterplan proposals, it is proposed that Moor Street Queensway closes to vehicular traffic between Carrs Lane and Albert Street.

The Moor Street Queensway / Albert Street junction is currently a signalised junction and will remain signalised as part of the BEE proposals. There are currently signalised pedestrian crossings on Albert Street and on the southern arm of Moor Street Queensway. This crossing had a surveyed peak hour flow of 144 two-way pedestrian crossings (17:00-18:00, Site P7 on Figure 11.2).

There is a signalised pedestrian crossing across Albert Street at the Moor Street Queensway / Albert Street junction. This crossing had a surveyed peak hour flow of 306 two-way pedestrian crossings (Site P8 on Figure 11.2).

Wide footways and signalised crossings currently allow for the safe management of pedestrians. Moor Street Queensway also contains designated cycle provision, with cyclists signposted to use the bus lanes.

To the east of the Moor Street Queensway / Albert Street junction is a pedestrianised area (outside the Hotel La Tour entrance). The BEE proposals result in the removal of much of the pedestrian area in order to accommodate the Bus Interchange, although new pedestrian facilities are embedded into the proposals, including a signalised pedestrian crossing across the new alignment (directly east of Moor Street Queensway).

The track alignment will not conflict with existing pedestrian and cycling provision in Eastside Park. There is also a planned walkway adjacent to the track alignment from Hotel La Tour to the HS2 tram stop on New Canal Street.

11.4.2 Section 2: Eastside Park to Meriden Street

There are pedestrian footways on all arms of the New Canal Street / Fazeley Street junction. The junction is signalised for vehicles, although there are no pedestrian crossing phases. Dropped-kerbs provide pedestrian crossing facilities at this junction.

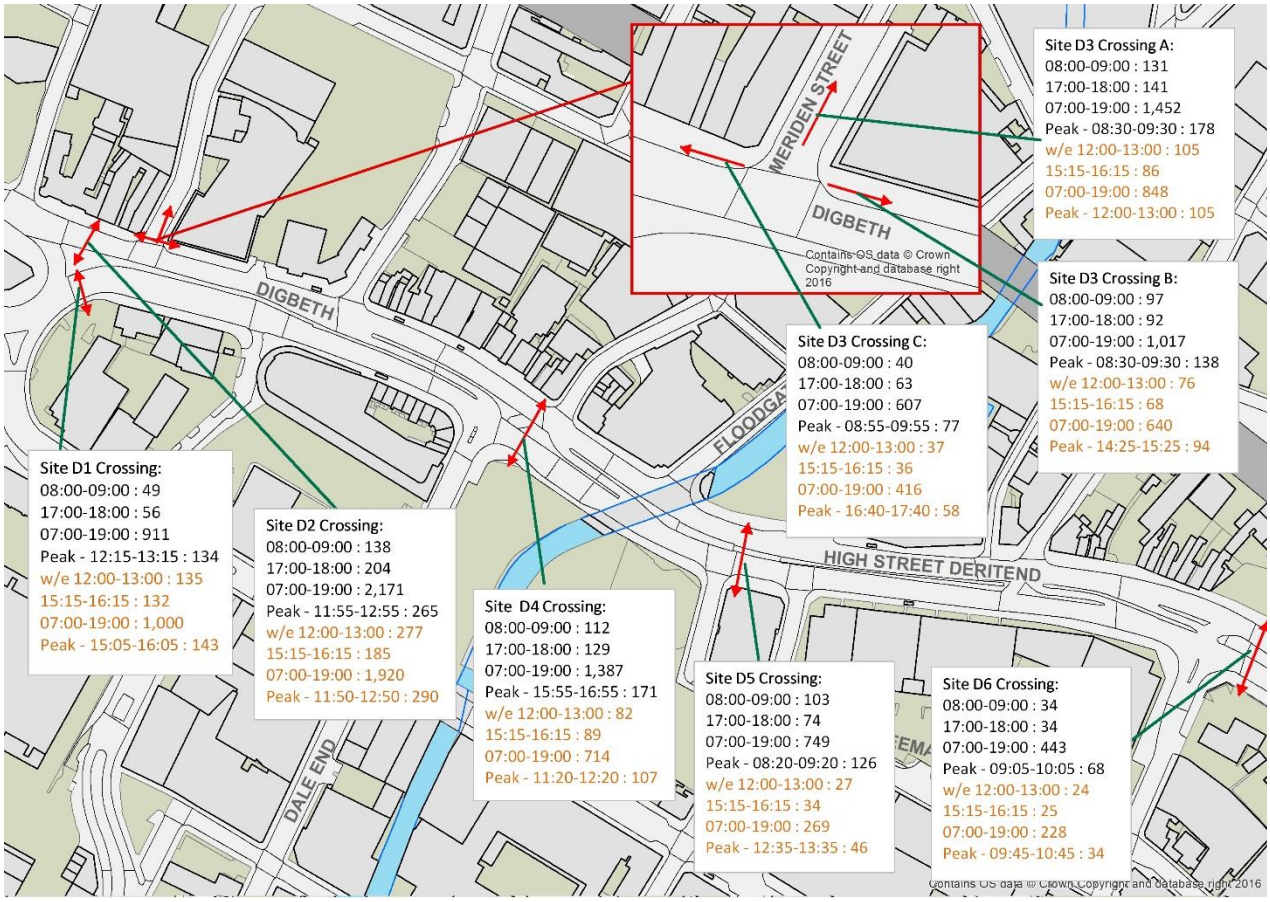
At the New Canal Street / Bordesley Street junction, dropped-kerbs are provided for pedestrians, with right of way for cyclists travelling on the highway in a north / south direction. At the New Canal Street / Coventry Street junction, dropped-kerbs are provided for pedestrians,

The footway on Meriden Street on the Eastern side of the track alignment will experience a pinch point of 1.1m (between the Coventry Street and Digbeth B4100 junctions). The pinch point is 65m north of the Digbeth (B4100) / Meriden Street junction. However, it is not envisaged that pedestrian activity is high at this point, and therefore the impact of this is likely to be minimal.

11.4.3 Section 3: Meriden Street to Adderley Street

Figure 11.3 summarises the pedestrian surveys in Section 3 (along Digbeth B4100 and High Street Deritend).

Figure 11.3: Pedestrian Surveys undertaken along the B4100 and High Street Deritend



Source: Mott MacDonald 2016

Figure 11.3 shows a large pedestrian demand in Section 3 of the track alignment, with a two-way peak hour flow of up to 290 (Site D2 on Figure 11.3).

At the Digbeth (B4100) / Meriden Street junction there is a dropped-kerb for pedestrians to cross Meriden Street. At this junction pedestrians are currently separated from the highway by a guardrail.

West of the junction there is a two-stage crossing for pedestrians via a central refuge on Digbeth (B4100). This pedestrian crossing is to be moved towards the Digbeth (B4100) / Meriden Street junction. The existing footway is separated from road by guardrails.

The proposed crossings west of the Digbeth (B4100) / Meriden Street junction have been located as close to the existing desire lines as possible. The only significant difference is to the crossing across the eastbound carriageway. This has been positioned to maximise intervisibility at the proposed signalised junction, although exact positions could be reviewed with BCC during the detailed design process (subject to safety / intervisibility considerations).

East of the Digbeth (B4100) / Meriden Street junction there is a two-stage staggered pedestrian crossing with a central refuge. The signalled crossing is demand controlled and crosses the eastbound lanes. The crossing is linked to further pedestrian crossings (east towards Birmingham Coach Station or west towards the Moat Lane Gyratory).

It was observed during a site visit by Mott MacDonald transport planners between the hours of 15:30 and 16:30 on the 6 January 2016 that a significant proportion of pedestrians performed a 'U-turn' movement walking from the Birmingham Coach Station area, crossing Digbeth (B4100) and then continuing in an eastbound direction along the north side of Digbeth (B4100). It was observed during the site visit that the many of the pedestrians undertaking this movement sought access to the bus stops located immediately to the west of Oxford Street.

It was observed that a number of pedestrians would cross both sides of the highway informally by jumping over the central reservation guard rails. A significant proportion of these pedestrians crossed the main carriageway to access the 'Hed Sup' retail unit among others, on the north side of Digbeth (B4100).

The tram stop will be located directly east of the Digbeth (B4100) / Rea Street junction and will be accessed via signalised pedestrian crossings. There was a surveyed peak hour two-way flow of 171 pedestrians at this crossing (15:55-16:55, Crossing D4 on Figure 11.3). The signalised pedestrian crossing will be reconfigured to accommodate the tram and tram stop. Footfall at this pedestrian crossing will increase in light of the tram stop introduction.

There is currently a signalised pedestrian crossing across Rea Street in a single phase (with a small pedestrian refuge between the two vehicular lanes). This is to remain as part of the BEE proposals.

On the north side of High Street Deritend, there is a wide pedestrian footway (from the Milk Street junction to the Floodgate Street junction). There is a dropped-kerb for pedestrians to cross the most southern part of Floodgate Street. The pedestrian footway will remain although the width will be reduced as part of the BEE proposal. The footway width also reduces on the southern side of High Street Deritend in this location (see Section 11.4.4 below for more detail).

There is a signalised pedestrian crossing across High Street Deritend located between the Stone Yard and Chapel House Street junctions. This pedestrian crossing is currently staggered and operates in two stages, with a central pedestrian refuge. There was a surveyed peak hour two-way flow of 126 pedestrians at this crossing (08:20-09:20, Crossing D5 on Figure 11.3). With the introduction of the BEE the signalised pedestrian crossing will be reconfigured to accommodate the tram. Footway width is to be reduced to accommodate the staggered crossing and tram (see Chapter 11.4.4 below for more detail).

At the High Street Deritend / Heath Mill Lane junction, there are currently no pedestrian crossing facilities across High Street Deritend. The proposals include a two stage signalised pedestrian crossing directly east of the High Street Deritend / Heath Mill Lane junction.

There is a signalised pedestrian crossing directly east of the High Street Deritend / Alcester Street junction with a central pedestrian refuge. There was a surveyed peak hour two-way flow of 68 pedestrians at this crossing (09:05-10:05, Crossing D6 on Figure 11.3). This signalised crossing is to remain as part of the BEE proposal. There is a dropped kerb crossing across Alcester Street at this junction.

11.4.4 Footway Width – Passenger Comfort Rating

For the purpose of designing the BEE track alignment and associated infrastructure calculations were undertaken to check that the BEE platform sizes and proposed reductions to footway widths are suitable to serve forecasted passenger footfall numbers. Tram platforms can become heavily congested with waiting passengers and as some platforms are also shared footways, pedestrian flows can become restricted.

The Transport for London Pedestrian Comfort Guidance (2010) document gives guidance categorises the comfort level of a footway from the calculated pedestrians per minute across a width of clear footway.

Pedestrian surveys undertaken by Mott MacDonald show pedestrian counts on a number of footways along the BEE route (see Figure 11.4). Using this data, the pedestrian comfort levels have been calculated.

Table 11.1 shows the calculated Pedestrian Comfort Level (PCL) on the assessed footways. The footway numbers shown Table 11.1 in correspond to the locations shown in Figure 11.4. TfL guidelines (Pedestrian Comfort Guidance Document, 2010) state that a PCL of 'B+' or more is the recommended level of comfort for all area types.

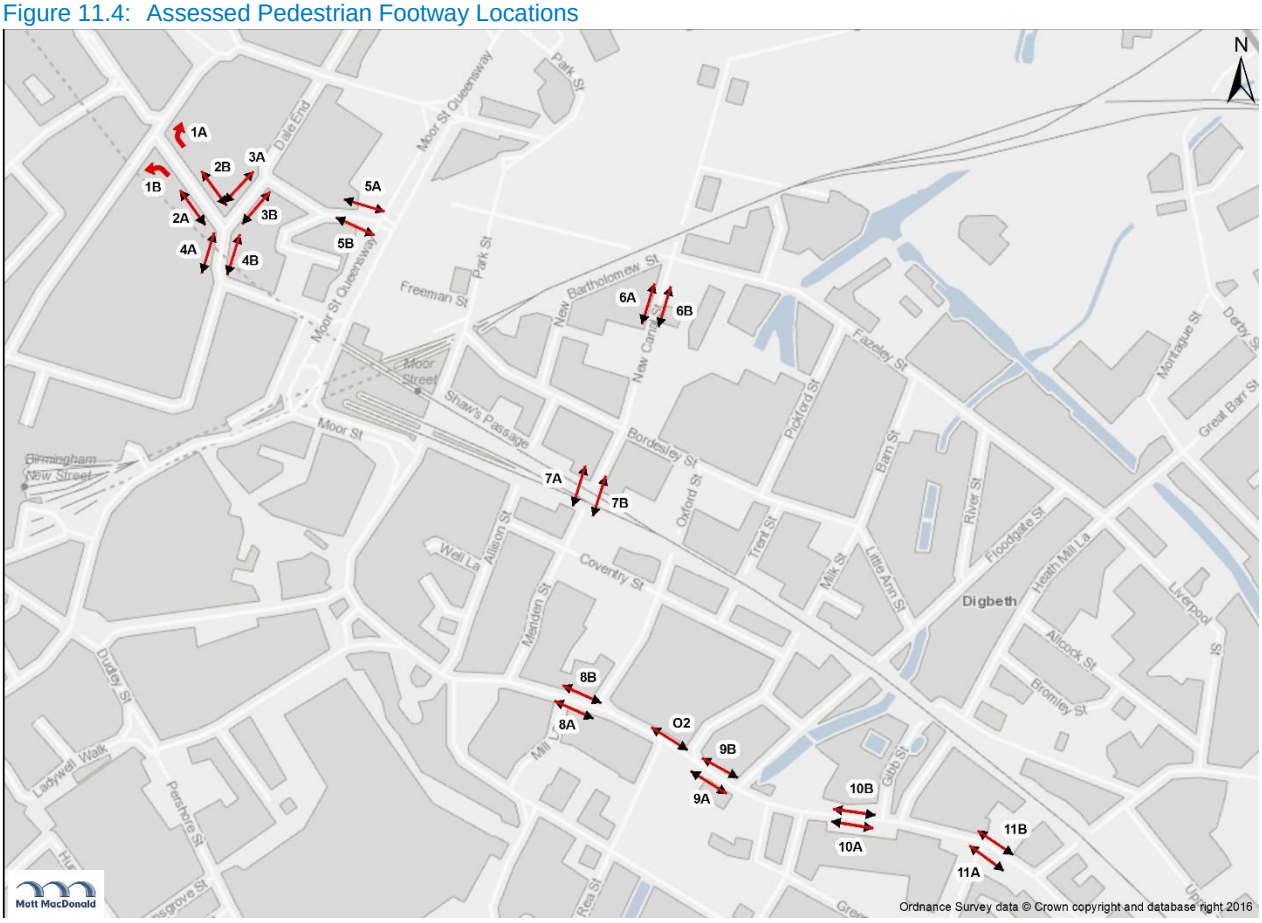
Table 11.1: Footway Widths – Passenger Comfort Rating

Footway Location	Proposed Narrowest Width of Footway (m)	Existing narrowest width of footway (m)	Pedestrian Count Peak Hour	ppmm [10]	PCL
1A. Bull Street North Corner	2.0	3.6	223	1.9	A+
1B. Bull Street South Corner	2.4	5.6	1339	9.2	B+
2A. Bull Street South	7.4	7.5	2155	4.8	A+
2B. Bull Street North	4.3	7.8	1531	5.9	A-
3A. Dale End West	5.2	5.7	849	2.7	A+
3B. Dale End East	1.8	2.7	968	9.2	B+
4A. High Street West	10.1	10.1	3399	5.6	A-
4B. High Street East	2.6	3.5	1861	11.9	B
5A.Albert Street North	3.0	1.8	276	1.5	A+

[10] Pedestrians per minute per metre

Footway Location	Proposed Narrowest Width of Footway (m)	Existing narrowest width of footway (m)	Pedestrian Count Peak Hour	ppmm 10	PCL
5B. Albert Street South	2.9	2.9	297	1.7	A+
6A. New Canal Street East	2.2	2.5	94	0.7	A+
6B. New Canal Street West	2.5	2.3	52	0.3	A+
7A. Meriden Street West	2.1	2.2	91	0.7	A+
7B.Meriden Street East	3.0	1.9	39	0.2	A+
8A.Digbeth B4100 (South side, East of Oxford Street)	3.0	4.5	353	2.0	A+
8B. Digbeth B4100 (North side, East of Oxford Street)	3.2	3.8	634	3.3	A
9A. High Street Deritend (South side, East of Milk Street)	2.6	2.4	124	0.8	A+
9B. High Street Deritend (North side, East of Milk Street)	2.9	3	729	4.2	A
10A. High Street Deritend (South side, East of Chapel House Street)	2.6	3.7	123	0.8	A+
10B. High Street Deritend (North side, West of Gibb Street)	2.4	2.9	325	2.3	A+
11A. High Street Deritend (South side, East of Alcester Street)	2.9	5.2	51	0.3	A+
11B. High Street Deritend (North side, East of Alcester Street)	2.2	3	209	1.6	A+

Figure 11.4: Assessed Pedestrian Footway Locations



Source: Mott MacDonald

Table 11.1 shows that all but one of the proposed footway widths will operate with a PCL of 'B+' or above. The pedestrian footway on the eastern side of High Street (in Section 1 of the route) has a PCL 'B', which indicates normal walking speed is still possible but conflicts are becoming more frequent and in retail areas pedestrians start to consider avoiding the area. The footway width at this location can't be significantly widened due to physical constraints of the delta junction. There is significant pedestrian amenity in this location, though, with several wide signalised pedestrian crossings and wide footways on the opposite side of the highway.

11.5 Proposed Cycle Infrastructure

Existing cycle lanes and designated on-road routes are located along the much of the route corridor and within the outlined study area. The majority of cycle infrastructure is to remain when BEE is operational, with some additional features added. The proposed cycle infrastructure is summarised below, and can be

referenced on the alternative cycle route plan contained in **ES Volume 2 Technical Appendix A (MMD-300207-DRA-HS23-0000-0001)**:

- Existing contraflow cycle lane along Bull Street to become marked cycle lane on two-way street.
- Following routing of track alignment along Bull Street, cyclists will have the option of turning left onto Dale End (current BCC advisory unsigned cycle route) or continuing onto the new alignment (a proposed marked cycle route).
- Along Moor Street Queensway there is an existing signed cycle route within the bus lanes. This is to remain as part of the BEE proposals. Proposed crossing points for cyclists are to be provided at the Moor Street Queensway / Albert Street junction.
- A proposed two-way advisory cycle route (unsigned) is to be constructed between the Moor Street Queensway / Albert Street junction and the New Canal Street / Fazeley Street junction. This follows the tram track alignment.
- Both New Canal Street and Meriden Street are advisory on road cycle routes. The implementation of the tram network along these roads will result in space being restricted, and therefore the current advisory cycle route is to be abandoned. However, designated and non-designated cycle routes are available within the vicinity to the tram network along New Canal Street and Meriden Street. The signed cycle route on Fazeley Street is to remain, and unsigned cycle routes along Bordesley Street, Oxford Street, Coventry Street, Milk Street and Barn Street can be utilised by cyclists.
- Along Digbeth (B4100) and High Street Deritend (from the Moat Lane gyratory to the junction with Adderley Street), the current cycle route within the bus lanes are to be abandoned (in both directions). This is due to the removal of the bus lanes. There are several existing signed and unsigned advisory cycle routes within the vicinity of the cycle lanes to be removed, which can be utilised by cyclists in the area.

Overall, the majority of cycle infrastructure will remain when the tram becomes operational. Where routes become unavailable, solutions have been identified to maintain cycle links.

11.6 Impact on Walking and Cycling from Construction

During the construction period there will be an interruption to the ability of pedestrians to move freely around the affected sections of the route. The city centre end of the scheme, in particular, has a high pedestrian footfall, and efforts will be required to maintain pedestrian circulation by the shortest and simplest reasonable route.

Careful consideration will be needed to ensure that the works cause the minimum disruption to pedestrians, shoppers, residents and commercial activity. Extensive discussions with owners / tenants will be required so that access to premises can be preserved and the impact on pedestrian movements minimised.

In developing a strategy for when closures or diversions should be undertaken, the contractor should pursue the following hierarchy:

- Maintain cycle and pedestrian routes on or close to the existing alignment.
- Install any permanent alternative cycle route in advance of the main construction works.

- If diversions are required, then the following principles should be followed:
  - Keep to a single diversion to be maintained throughout entire construction period, as far as practicable with minor changes as required. Changes should be kept to a minimum.
  - Agree diversions with the Traffic Manager and other key stakeholders (e.g. cycling groups).
  - Provide advance warning and notification.

The cycle route that travels along New Canal Street, Fazeley Street, Liverpool Street and Adderley Street is a signed cycle route and temporary diversions will therefore need to be given particular attention.

For a more detailed description of the impact on walking and cycling from construction, see Chapter 17.

11.7 Summary

Among other reasons, respondents in the public consultation preferred the proposed BEE route as opposed to other options on the basis it would have the least impact upon pedestrian provision (TfWM / Mott MacDonald public consultation, 2014, paragraph 4.7.2). The proposed BEE will result in changes to existing pedestrian and cycling provision, although embedded mitigation measures ensure the overall impact is negligible, and in some cases positive.

Within the last 5 years there have been 48 pedestrian accidents and 13 cyclists accidents along the route (see Chapter 15), although none of these fatal. Signalised pedestrian crossings will be retained along the route, with the addition of pedestrian crossings at the Bull Street / Dale End and High Street Deritend / Heath Mill Lane junctions.

During construction, there will be an interruption to the ability of pedestrians and cyclists to move freely around the affected sections of the route. It will be ensured that the works cause minimum disruption to pedestrians, shoppers, residents and commercial activity.

The proposed scheme will in most cases enhance the existing cycling and pedestrian infrastructure, whilst providing a step change in public transport provision within Birmingham City Centre and the Eastside area. The scheme will allow journeys into, out of and within Birmingham City Centre to be undertaken in a more sustainable manner, incorporating walking and cycling into the wider public transport network. Future proposals, such as the designation of Moor Street Queensway as bus, cycle and taxi only (Curzon HS2 Masterplan) will further improve cyclist and pedestrian safety; as well as bus reliability and efficiency.

12 Impact on Parking

12.1 Introduction

This chapter assesses the impact of the BEE upon existing parking provision. There is limited provision of designated on-street parking directly along the BEE route, although several private and off-street car parks are located in close proximity to the BEE track alignment.

12.2 Section 1: Corporation Street to Eastside Park

12.2.1 On-Street Parking

There are a number of disabled parking spaces that will need to be relocated as part of the BEE proposals. These include:

- Three on-street disabled parking bays located on High Street (directly south of the Bull Street / Dale End junction)
- Four on-street disabled parking bays on New Meeting Street
- Three on street disabled parking bays on Albert Street
- Three disabled parking bays that will need to be maintained that are provided on New Meeting Street at the edge of the Travelodge servicing area.

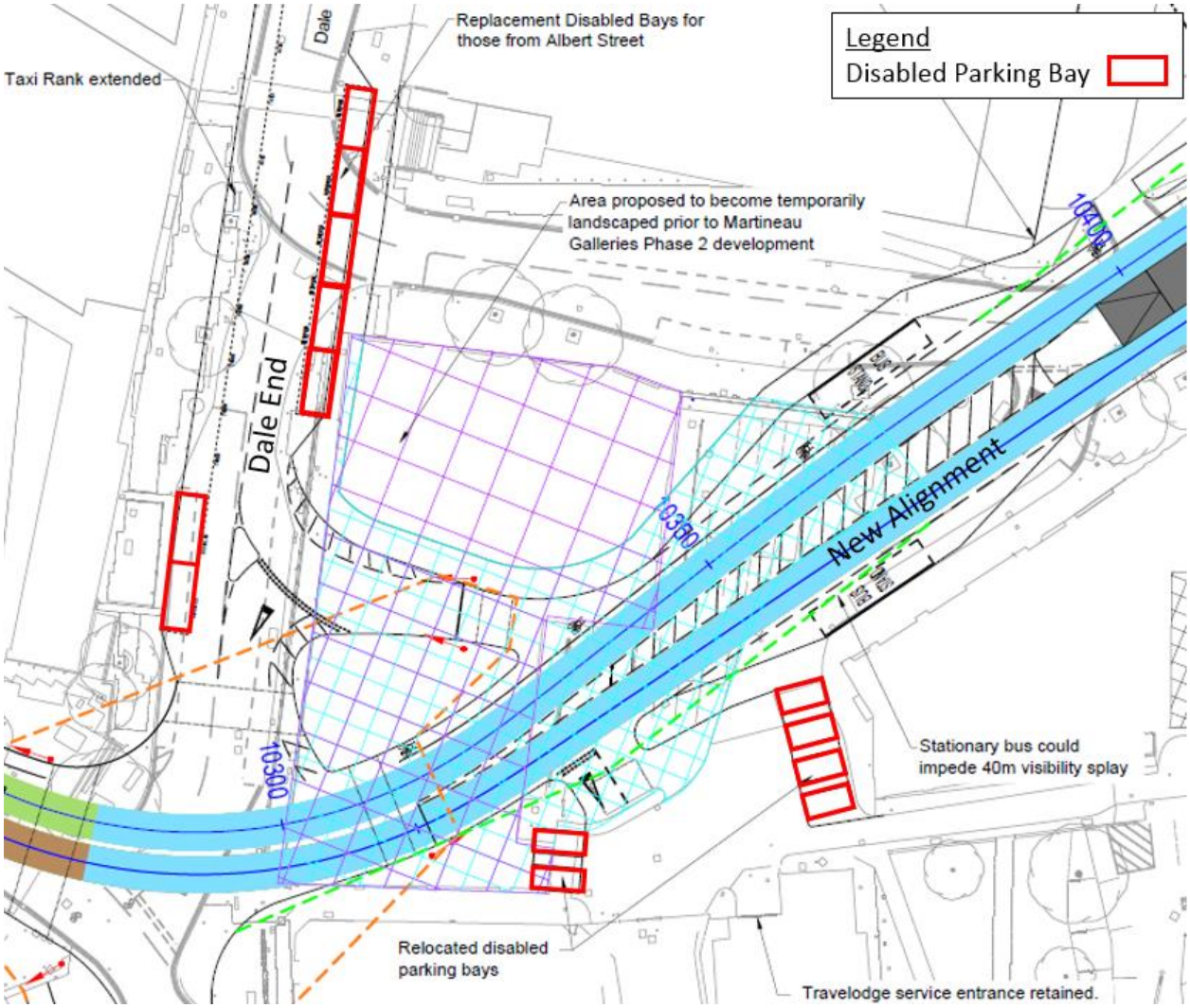
These 13 disabled parking spaces are to be removed as part of the BEE proposals. It is proposed that 11 new disabled parking spaces will replace those lost. The new locations for these disabled parking spaces are shown in Figure 12.1.

As shown in Figure 12.1, six disabled parking spaces will be provided with access from the new alignment.

In addition, five disabled parking spaces will be provided on Dale End. This will be a 33m long bay, providing space for five vehicles (based upon a minimum 6.6m long bay for drivers with disabilities[11]), and a 12m bay providing space for two vehicles. There are therefore seven disabled on-street parking bays accessed from Dale End.

11 Birmingham City Council (2012) Car Parking Guidelines, Supplementary Planning Document

Figure 12.1: Relocation of Disabled Parking Spaces



Source: ES Volume 2 Technical Appendix A, MMD-300207-HS29-DRA-0000-0011

12.2.2 Off-Street Parking

There are 21 off-street private parking bays accessed via New Meeting Street that serve the Kings Parade shopping centre. Under the BEE proposals it is proposed that Albert Street and New Meeting Street are to be permanently closed and that Kings Parade will be demolished (the area of the car parking will be temporarily landscaped prior to the Martineau Galleries Phase 2 development coming forward). Therefore, the loss of the parking spaces that served the Kings Parade building will not be significant due to the removal of the demand for these car parking spaces.

A 1,160 capacity multi-storey NCP car park is located directly north of Albert Street, with two existing accesses (from Dale End and from Albert Street). There is also a service access on Albert Street.

All accesses to the car park are to remain, although some re-routing of traffic accessing the NCP car park will occur (due to the location of the tram stop on the new alignment and proposed left-in / left-out arrangement on the new alignment).

Two private pay-and-display car parks are located directly east of the Moor Street Queensway / Albert Street junction on Seymour Street (the Fazeley Street and Albert Street car parks). There is a further car park serving Hotel La Tour, directly south of the Hotel La Tour site. It is understood Hotel La Tour rent the land for the car park. The three car parks accessed via Seymour Street are to be removed as part of the HS2 proposals.

12.3 Section 2: Eastside Park to Meriden Street

12.3.1 On-Street Parking

A parking beat survey was undertaken on the 25 June 2015 across a large area of Digbeth (north of High Street Deritend). Since the survey was undertaken, the BEE route has been changed. Originally it was to terminate on Adderley Street which would have resulted in a significant number of displaced on street car parking. The current proposals are for BEE to terminate on High Street Deritend. Therefore, the main sections directly affected by BEE are along New Canal Street and Meriden Street.

This section of New Canal Street and Meriden Street is within the Outer Zone of the BCC controlled parking zone area. Within the Outer Zone, parking is only allowed in parking bays and yellow line restrictions apply everywhere else.[12]

There are parking restrictions along the entire length of New Canal Street and Meriden Street. There is a total of 354m of single yellow line parking restrictions and 944m of double yellow line restrictions.

The Traffic Regulation Orders (TRO's) along this section indicate no waiting or loading at any time along the double yellow lines, and limited waiting and loading restrictions on the single yellow lines (generally between 08:00 and 19:30, Monday to Friday). Along Meriden Street between Digbeth (B4100) and Coventry Street, there is no loading Monday to Friday between 07:45-09:15 and 16:30-18:45.

Five areas have been assessed along the section of New Canal Street and Meriden Street from Curzon Street to the north to Digbeth (B4100) to the south and are shown in Figure 12.2. These areas are described as follows:

- Area 1 - New Canal Street between Albert Street and Banbury Street
- Area 2 - New Canal Street between Banbury Street and Fazeley Street
- Area 3 - New Canal Street between Fazeley Street and Bordesley Street

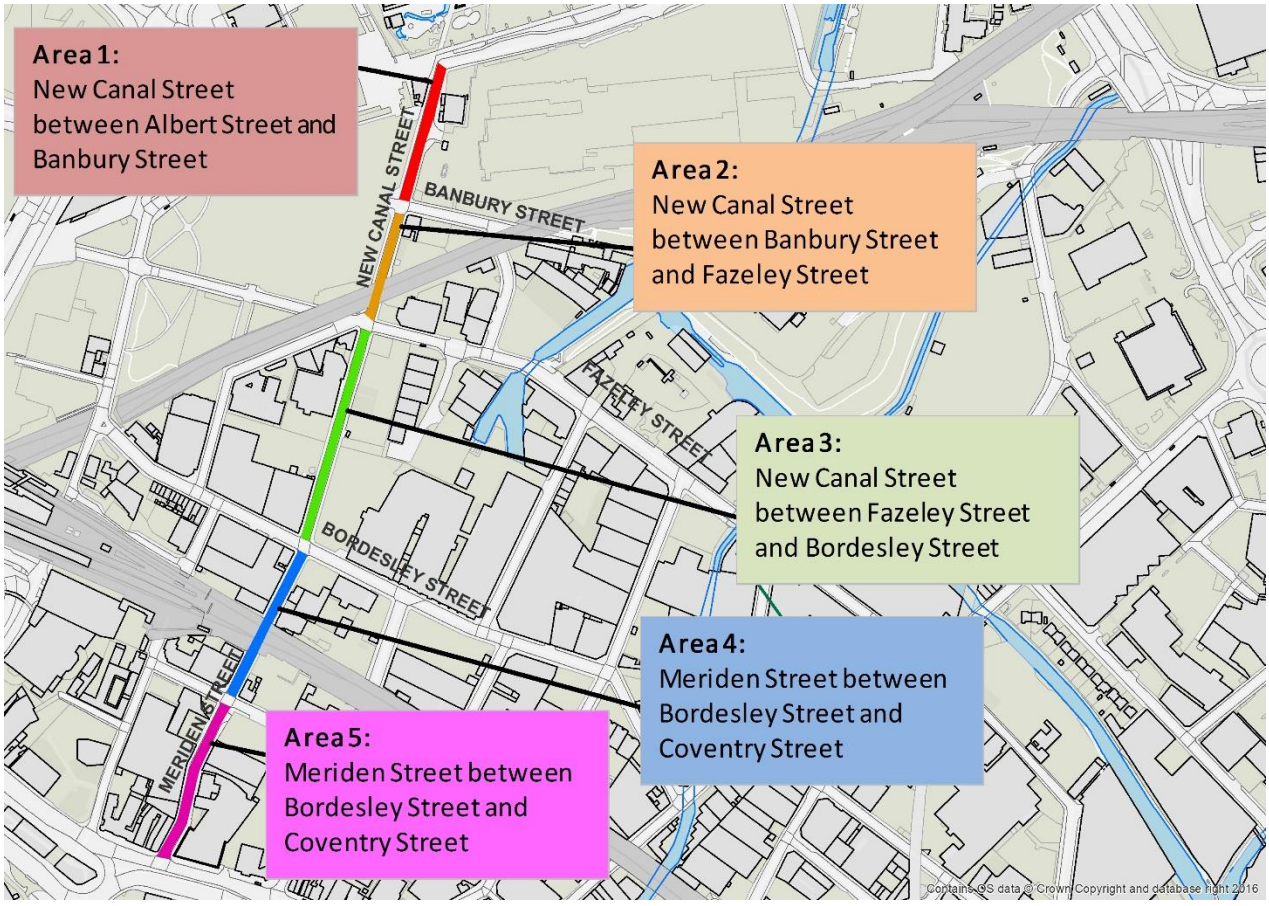
12 Information taken from BCCs parking website

- Area 4 - Meriden Street between Bordesley Street and Coventry Street
- Area 5 - Meriden Street between Digbeth (B4100) and Coventry Street

Vehicle registration plates and the duration of parking were recorded between the hours of 07:00 and 19:00 on the 25 July 2015.

The full results of the parking beat survey can be found in **Appendix H.**

Figure 12.2: Extent of Parking Beat Survey



Source: Mott MacDonald 2016

Table 12.1 summarises the total number of vehicles that were counted parked within all of the five areas by on street parking type.

Table 12.1: Parking on New Canal Street and Meriden Street

Period	No of Vehicles per Restriction Type		
	No Parking Restrictions	Single Yellow Line	Double Yellow Line
07:00-08:00	0	2	1
08:00-09:00	0	2	1
09:00-10:00	0	6	0
10:00-11:00	0	6	0
11:00-12:00	0	7	0
12:00-13:00	0	6	1
13:00-14:00	0	3	0
14:00-15:00	0	4	1
15:00-16:00	0	5	3
16:00-17:00	0	4	2
17:00-18:00	0	3	0
18:00-19:00	0	3	2

Source: Parking Beat Survey on 25 June 2015

The results shown in Table 12.1 show that:

- Maximum of seven vehicles park on single yellow line restrictions during the survey period
- Maximum of three vehicles park on double yellow line restrictions during the survey period.

Table 12.2 shows the total amount of vehicles parked along New Canal Street and Meriden Street between 07:00 and 19:00, as well as the average total duration of stay.

Table 12.2: Number of Registration Plates Observed and Average Total Duration

Street Section	Number of Different Registration Plates Observed	Average Total Duration (hours)
Area 1 - New Canal Street between Albert Street and Banbury Street	1	1.0
Area 2 - New Canal Street between Banbury Street and Fazeley Street	2	1.0
Area 3 - New Canal Street between Fazeley Street and Bordesley Street	1	1.0
Area 4 - Meriden Street between Bordesley Street and Coventry Street	19	2.5
Area 5 - Meriden Street between Digbeth (B4100) and Coventry Street	10	1.0

Source: Mott MacDonald (2015)

Table 12.2 shows that the two most southern areas along this route (Areas four and five on Meriden Street) attract the most parking. Whilst parking is restricted along the length of Area 2, the average total duration of parking between the Bordesley Street and Coventry Street junction is 2.5 hours.

The number of parked vehicles that were surveyed along Meriden (between the Bordesley Street and Coventry Street junctions) may be attributed to the land uses in this area which comprise a cash and carry,

takeaway restaurants, a bar, and a vehicle maintenance garage which may all encourage on-street parking in non-designated areas (it has been observed that the existing vehicle maintenance garage parks vehicles on New Canal Street).

Along Meriden Street between the Coventry Street and Digbeth (B4100) junctions, there was also an increased amount of recorded parking compared to New Canal Street, with 10 vehicles being recorded between 07:00 and 19:00.

The proposed BEE track alignment runs along New Canal Street and Meriden Street, and as a result, no vehicles will be able to stop at any time. Whilst the parking beat survey shows parking to take place along Section 2, there is no loss in designated on-road parking provision along the length of Section 2.

As discussed in Chapter 6.4.6.2, the New Canal Street / Bordesley Street junction is to be signalised with the introduction of BEE. This is due to safety concerns with locating the tram stops in proximity to the existing priority junction.

BCC noted that upon the signalisation of the junction, the on-street parking provision on Bordesley Street would have to be reviewed (due to concerns with the on-street parking reducing the visibility of the signal heads). In a worst case scenario, the 6 spaces on Bordesley Street (west), of which 4 are on the eastbound side of the highway and 2 on the westbound side are to be relocated.

The relocation of these bays is to be discussed with BCC, with a potential location identified to the west of the affected spaces on Bordesley Street.

12.3.2 Off-Street Parking

There are several off-street car parks along New Canal Street and Meriden Street. Directly north of the New Canal Street/ Fazeley Street junction is a drop-kerb access to a private car park for William Marston LTD. Directly south of the New Canal Street/ Fazeley Street junction on the eastern side of the highway is a pay-and-display car park. A pay-and-display car park is also located south of this site with 147 bays (although accessed from Bordesley Street).

The proposed land take (of up to 6.5m) on the eastern side of New Canal Street will result in a reduction in available parking bays in the private pay-and-display car park. This car park is also proposed to be a construction compound, therefore temporarily reducing the supply of car parking in Section 2.

Smaller pay and display car parks are located on the western side of New Canal Street between the Fazeley Street and Bordesley Street junctions.

South of the New Canal Street / Bordesley Street junction on the eastern side of Meriden Street is a private car park for Whittaker Fleet Care LTD.

South of the rail bridge on Meriden Street on the eastern side of the highway is access to a 78 capacity pay-and-display car park (Coventry Street Car Park). This car park is proposed as part of the land take to

house one of the BEE substations, with access to the site from the existing location on Meriden Street. During construction all of the car park provision will be removed, although the location of the substation within the car park provides an opportunity to retain some of the existing provision once the BEE is operational. Access to the revised Coventry Street Car Park will be via Coventry Street (where an old access to the site is located and a drop kerb is provided). A TRO would need to be implemented by BCC to ensure vehicles do not park and block the proposed access off Coventry Street (as vehicles currently park on this undesignated part of the highway).

South of the Meriden Street / Coventry Street junction on the eastern side of the highway is a pay-and-display car park, although access via Meriden Street has been restricted. On the western side of Meriden Street is a private car park for Big Break Snooker. There is also a customer car park for Norton Hydraulics on the western side of Meriden Street.

The existing off-street car parks will be unaffected by the BEE, and access to all car parks will remain.

12.4 Section 3: Meriden Street to Adderley Street

12.4.1 On-Street Parking

There is no on-street parking provision in Section 3 (along Digbeth B4100 and High Street Deritend).

12.4.2 Off-Street Parking

There are several off-street car parks accessed from Digbeth (B4100) and High Street Deritend.

South and City College's car park is located between the Meriden Street and Oxford Street junctions (accessed via the eastbound carriageway). On the south side of High Street Deritend, adjacent to the Floodgate Street junction, is a private car park (accessed via Stone Yard).

Between the Floodgate Street and Gibb Street junctions on the northern side of High Street Deritend is a pay-and-display car park providing parking for the Custard Factory. There is a private car park located between Heath Mill Lane and Adderley Street junctions on the north side of High Street Deritend.

There is further off-street parking adjacent to the Alcester Street junction along High Street Deritend.

None of the parking facilities along Digbeth (B4100) and High Street Deritend will be negatively affected by the BEE and access to the car parks will remain.

12.5 Summary

In summary, the impact on parking provision as a result of the BEE scheme is minimal. In Sections 2 and 3 there is no designated on-street parking and, therefore, no on-street provision will be removed or displaced. There are several off-street pay-and-display and private car parks along the BEE route, both to

the east and west of New Canal Street and Meriden Street, and access to these will remain as existing. The proposed land take (of up to 6.5m) on the eastern side of New Canal Street will result in a reduction in available parking bays in the private pay-and-display car park. This car park is also proposed to be a construction compound, and therefore, temporarily reducing the supply of off-street car parking in Section 2.Three car parks identified are to be removed as part of the overall development of the area to the east of Moor Street Queensway (including the BEE and HS2). These three car parks will be removed due to the HS2 construction works that are planned to commence in 2017. Therefore, this is not considered to represent a material impact as part of the BEE proposals.

The impact on parking provision as a result of the BEE scheme is minimal, with existing parking bays being retained or relocated where possible. Current parking facilities at New Meeting Street and Albert Street will be affected but displaced parking bays will be relocated where necessary to alternative locations.

13 Impact on Taxis

13.1 Introduction

Taxi is a generalised term used to describe all forms of licensed hire vehicles, of which there are two types; Hackney Carriages and Private Hire Vehicles (PHVs).

Licensed hackney carriages are traditional black cabs, whilst PHVs are private motor vehicles used for hire. Licensed PHVs are only distinguished from private motor vehicles by a small plate fixed to the rear of the vehicle and / or a sticker on the front / rear window.

A taxi rank is a place where hackney carriages can wait for passengers, although they are allowed to pick up passengers anywhere on the highway network providing it is safe to do so. PHVs can only pick up passengers by prior arrangement.

Taxis offer an alternative mode of transport to the private car and other forms of public transport and are an important element of the public transport system. Taxis provide for business, leisure and social trips and are an integral part of the public transport network.

13.2 Existing Provision and Impact

There are 63 taxi ranks and 5,000 taxis in Birmingham. In an effort to prevent the obstruction of the city taxi ranks and assist the operation of hackney carriages, taxi ranks have recently been re-established under a new Traffic Regulation Order (The Local Government Act, 1976, Hackney Carriage Stands Authorisations & No Stopping Order 2003). All the ranks have been re-signed and re-marked.

There are three taxi ranks located in close proximity to the BEE route. These are shown in Figure 13.1. These are:

- Dale End (north of the Bull Street / Dale End junction)
- Mill Lane (serving the coach station)
- Digbeth (opposite the Rea Street junction)

Figure 13.1: Location of Taxi Ranks in Proximity to the BEE route alignment



Source: Mott MacDonald 2016

The Dale End rank has been recently revised with the changes in road layout related to the introduction of the tram extensions. The rank operates on both sides of the road, with the head of the rank facing away from the city centre and the feeder rank facing towards the centre. On either side of the road, the taxi rank can provide for five taxis (10 taxis overall). There are two further feeder sections located along Dale End towards the Priory Queensway Bridge.

The “BCC Hackney carriage unmet demand survey Final Report”, produced by CTS Traffic & Transportation LTD, states that the Dale End rank loads 1,485 vehicles per week, with a peak of 49 per hour. In terms of patronage, this is the third largest taxi rank in Birmingham (behind New Street Station and Broad Street). The Dale End taxi rank accounts for 6% of all taxi passengers in Birmingham. The overall judgement of service at the Dale End rank is rated ‘very good’ according to the CTS report.

Taxi rank provision is to be reconfigured as a result of the BEE scheme proposals. There is currently taxi rank provision on either side of the highway on Dale End (total of 51m taxi rank). The BEE proposals

include a 35m long on-street disabled parking area located on the eastern side of Dale End. On the western side of Dale End there is provision for a 50m long taxi rank. There is a negligible decrease in taxi rank provision (from 51m to 50m), and based upon the length of a TX4 Hackney Carriage at 4.58m, the proposed 50m long taxi rank will be able to accommodate the existing capacity for 10 taxis.

Junction capacity assessments undertaken at the Bull Street / Dale End and Moor Street Queensway / Albert Street junctions show there are no capacity issues in the future year Do Minimum and Do Something scenarios. There is therefore no negative impact upon taxis in this location.

The taxi rank at Mill Lane is used less frequently. According to the CTS report, there was a surveyed total of 206 passengers using 127 taxis between 09:00 and 24:00, with a range of 2 to 30 passengers per hour (7th March 2014 – CTS). Junction capacity assessments at this junction show there are no capacity issues in the future Do Minimum and Do Something scenarios.

There is a marked taxi rank on the eastbound side of Digbeth B4100 (between Oxford Street and Milk Street). The rank operates directly along the BEE route and only operates between the hours of 21:00 and 06:00 within the segregated bus lane, and has provision for four taxis. The rank on Digbeth (B4100) is not contained in BCCs draft plans for Traffic Regulation Orders and taxi parking, and therefore not included in the study undertaken by CTS.

The reconfiguration of the Digbeth (B4100) / Rea Street junction and the removal of the bus lane will result in the loss of the unrecognised taxi rank.

13.3 Future Proposals

Highlighted in the Curzon HS2 Masterplan, improvements to the existing taxi and bus provision are to take place. Taxi provision will be enhanced by designating a section of Moor Street Queensway (Carrs Lane to Albert Street) as a bus, taxi and cycle only road. This will improve the efficiency and reliability of taxi services in Birmingham City Centre and Digbeth by reducing delay on Moor Street Queensway.

13.4 Summary

There are three taxi ranks located in proximity of the BEE scheme. The Dale End rank is of vital importance in Birmingham's taxi network, and access to the rank has been safeguarded as part of the BEE proposals.

The marked rank on Digbeth (B4100) is to be removed, although this rank has no formal recognition by BCC. The Mill Lane taxi rank will remain, and will be unaffected by the BEE proposals.

Future proposals highlighted in the Curzon HS2 Masterplan offer improvements to the existing taxi provision by designating Moor Street Queensway as a bus, taxi and cycle only road. This will improve taxi services in Birmingham City Centre and Digbeth.

BEE will not affect the routeing of taxis within Birmingham City Centre. In fact the reconfiguration of the Bull Street / Dale End junction will assist in preventing the U-turning that currently occurs by taxis when switching direction on Dale End.

14 Impact on Access and Servicing

14.1 Introduction

This chapter considers the effect of the BEE scheme, and the associated highway modifications on the access and servicing of the properties within the BEE study area.

The assessment considers alterations to access routes as a result of the proposed track alignment and subsequent highway modifications. This is assessed on a strategic level, before considering the impact on accesses to off-street areas at an individual property level.

There are several on-street loading areas within the study area. New kerbside loading restrictions will be enforced as part of the scheme. The new restrictions will maximise the certainty that traffic flows will not be impeded, and are not expected to have a material effect on any property. The restrictions will also be in place to ensure the uninterrupted running of the tram along shared sections of the track alignment.

This chapter of the TA has required the collection of data to confirm existing conditions, and provides a review of the existing servicing and accessing arrangements in light of the proposed BEE scheme.

14.2 Data Collection

Information detailing the current servicing and access arrangements for the premises along and adjacent to the scheme corridor was collected through a combination of Business Consultation Surveys (undertaken by Mott MacDonald between September and November, 2014) and on-site observations (a total of 92 business premises were assessed). The information collected included:

- The name and type of company occupying the premises
- How the premises are currently serviced (for example, via which building entrance and from which road)
- When and how often premises are serviced (for example, the day of the week and time of day)
- The approximate size of vehicle which undertakes the servicing

The internal layout of buildings was not assessed in relation to access and servicing.

The information gathered as part of the Business Consultation surveys represents the current servicing patterns, providing an understanding of the existing servicing and access arrangements. This has enabled robust proposals to be developed for the future servicing provision around the BEE scheme. The servicing and access proposals will provide effective operation at both individual premises and wider zonal level.

14.3 Section 1: Corporation Street to Eastside Park

14.3.1 Strategic Impacts

Existing access for service vehicles to Upper Bull Street and Lower Bull Street is provided from Dale End. As the new tram alignment is shared between all vehicles at the Dale End/High Street junction, access to this service area will be unaffected by the proposals.

The existing service access for Martineau Place at the Bull Street / Dale End junction is to be signalised, and access to service vehicles will remain. Large vehicles will have to route via the new alignment due to the 2.8m height restriction on Dale End. These restrictions will require traffic to re-route, and will entail in some instances a degree of additional travel.

Journeys in Section 1 may be re-routed due to the closure of Albert Street, although the new tram alignment will provide a shared use road from Moor Street Queensway to the Dale End/High Street junction providing access for service vehicles. Vehicles accessing the existing NCP Car Park access off Albert Street (directly west of the Moor Street Queensway / Albert Street junction) will have to route via the High Street / Dale End junction as the access is to be a left-in / left-out arrangement, or use the u-turn facility at the High Street / Dale End junction. All movements are therefore to be retained, and general traffic can still access the NCP Car Park via Dale End.

Existing service arrangements on New Meeting Street will be partly removed due to the demolition of the Kings Parade building. The service access for the Travelodge and the retail buildings fronting High Street and Carrs Lane will remain, accessed via the new alignment.

The existing service access to Hotel La Tour is located on Masshouse Lane and will be unaffected as part of the BEE proposals. The existing drop-off point is to be retained, although the access to the drop-off point will be reconfigured due to the introduction of the Bus Interchange and the closure of Park Street. Vehicles will access the drop-off point via the Bus Interchange and exit onto Masshouse Lane.

There is to be a general re-routing of traffic in Section 1 (around Park Street, Masshouse Lane and Moor Street Queensway) due to the closure of Park Street as part of the HS2 proposals.

14.3.2 Specific Property Impacts

The existing Kings Parade building as stated is to be fully demolished as part of the BEE proposals to allow for the construction of the new alignment. The parking and servicing area on New Meeting Street is also to be removed.

With the Kings Parade building being demolished, the need for servicing the building is being removed. Therefore, the removal of existing service arrangements (and parking) on New Meeting Street will not result in any negative impacts. The service access for the Travelodge and the retail buildings fronting High Street and Carrs Lane will remain, accessed via the new alignment.

IKEA recently opened an order and collect store in the ground floor of the existing NCP car park (with vehicular accesses located on Dale End and Albert Street). With Albert Street proposed to be closed, access for deliveries to the new superstore will be provided via the new alignment. It is understood that customers will be directed to use the Dale End entrance to the car park to avoid use of the U-turn facility on the tram alignment and Carrs Lane (subject to height restrictions on the bridge on Dale End).

The land upon which three private car parks are located is to be redeveloped (land directly south of Hotel La Tour) as part of the HS2 development. The Fazeley Street and Albert Street private pay-and-display car

parks, and the Hotel La Tour car park, all with access via Seymour Street, will be removed as part of the overall development of the area due to the HS2 proposals. It is understood that Hotel La Tour privately rent the car park, and discussions are ongoing with Hotel La Tour to find an alternative parking arrangement.

14.4 Section 2: Eastside Park to Meriden Street

14.4.1 Strategic Impacts

In Section 2 of the proposed BEE track alignment, there are no significant strategic access and servicing impacts. However, there are a few issues outlined below

There are currently varying loading restrictions along the length of New Canal Street and Meriden Street, with generally no waiting or loading permitted along Section 2. In places there is no loading between 08:00 and 19:30, although loading is permitted outside of these hours. Along Meriden Street between Digbeth (B4100) and Coventry Street, there is no loading Monday to Friday between 07:45-09:15 and 16:30-18:45. These restrictions serve a range of businesses located along the length of Section 2, and there will be no waiting or loading at any time with the introduction of the BEE along New Canal Street and Meriden Street. The majority of premises along New Canal Street and Meriden Street do have service access areas off street, and therefore impact can be minimalised.

Refuse collections have been identified to take place along New Canal Street and Meriden Street for a range of business premises. Discussions will take place with the relevant stakeholders to ensure the tram can operate alongside the refuse collections (this may mean restricting the times refuse collections take place, or relocating the collections).

The BEE proposals will be supported by no waiting or stopping at any time, to mitigate against stationary vehicles blocking the tram on this shared section of track.

14.4.2 Specific Property Impacts

It is understood based upon site observations, that refuse collection and servicing for Digbeth Hall (located on New Canal Street) could be undertaken on New Bartholomew Street.

Latifs (located on New Canal Street) does have an access gate fronting onto New Canal Street. It is understood that deliveries and servicing is undertaken via Bordesley Street and New Bartholomew Street, however there is a waste collection and public entrance on New Canal Street. Refuse vehicles may enter here but must exit onto New Bartholomew Street and Bordesley Street with the introduction of BEE.

It is understood that Whittaker Fleet Care, Chicken.Com, Fancy Fabric Store and a number of other premises on Meriden Street currently require deliveries and refuse collection to be undertaken on Meriden Street. Deliveries and refuse collections for Whittaker Fleet Care can be undertaken on Bordesley Street.

Norton Hydraulics (located on Meriden Street) currently have daily deliveries that take place on Meriden Street, for a duration of 30 minutes. They also have monthly deliveries on Meriden Street of up to 4 hours. Existing TRO's in this location show no loading / unloading Monday-Friday between 07:45-09:15 and 16:30-18:45.

It is observed that some premises along New Canal Street and Meriden Street do have service access areas off street, and therefore impact can be minimalised. Therefore, discussions will to take place with relevant stakeholders along New Canal Street and Meriden Street regarding the loading restrictions in light of the introduction of shared track, and the potential for alternative routing and timing of deliveries/collections.

As previously stated in Chapter 12.3.2, it is proposed that the Coventry Street Car Park will be part of the land take to house one of the BEE substations. Access to the existing site is located on Meriden Street. During construction all of the car park provision will be removed, although the location of the substation within the car park will provide an opportunity to retain some of the existing provision once the BEE is operational. Access to the revised Coventry Street Car Park will be via Coventry Street (where an old access to the site is located and a drop kerb is provided).

The internal layout of buildings was not assessed, although where possible along Section 2 due to safety concerns, vehicles should reverse in to off-street loading areas and leave in a forward direction.

14.5 Section 3: Meriden Street to Adderley Street

14.5.1 Strategic Impacts

Digbeth (B4100) and High Street Deritend is currently three lanes in both directions. Along much of Section 3 it is proposed that the three lanes in both directions are reduced to two lanes in each direction to accommodate the tram (running centrally). It has been observed that some premises do operate servicing from the nearside lane (bus only) on Digbeth (B4100) and High Street Deritend. The servicing and loading occurs at designated times (no loading Monday-Friday between 07:45 and 09:15 and 16:30 and 18:45).

The reduction in vehicular lanes along Digbeth (B4100) and High Street Deritend results in the removal of the bus-only lanes in each direction, which will result in servicing in the nearside traffic lane. A review of the premises along both Digbeth (B4100) and High Street Deritend has indicated that the majority do have alternative service access options either on side streets or within rear car parks, and therefore the potential impact of future servicing along the tram route can be minimalised. Existing restrictions will not change, and loading/unloading will still be allowed outside of peak hours.

Directly east of the Digbeth B4100 / Rea Street junction on the south side of High Street Deritend, an existing loading bay is to be removed. The existing loading bay has restrictive loading times (no loading or unloading Monday-Friday 07:45-09:15 and 16:30-18:45).

Several business premises have identified refuse collections to take place along Digbeth (B4100) and High Street Deritend (although the majority of refuse collections take place on side streets such as Rea Street and Oxford Street). It is however considered that refuse collections already exist along Digbeth (B4100) and High Street Deritend and the implementation of a segregated tram on this section will not impact upon future operations. Discussions are required to take place with the relevant stakeholders to set out the proposals for reducing capacity along this section, and ensure that refuse collections are not impacted by this.

14.5.2 Specific Property Impacts

Directly north of the Digbeth (B4100) / Meriden Street junction on the eastern side of the highway, the South and City College is to be demolished to allow for the tram's left-turn onto Digbeth (B4100).

In order to accommodate the tram, existing footway width will have to be reduced in places along some parts of Section 3. This does not result in any land take, and there is no impact upon property.

14.6 Conclusions

In Section 1 of the study area, journeys will be re-routed due to the closure of Albert Street and the reconfiguring of the area surrounding New Meeting Street, Masshouse Lane and Moor Street Queensway due to the new tram alignment. However, a new shared use road will be provided as part of the scheme between the Dale End/High Street junction and Moor Street Queensway to reduce the overall impact for service vehicles. Furthermore, key service areas are to be retained and improved as part of the proposals such as Martineau Place, Hotel La Tour and the Travelodge Hotel.

In Section 2 of the study area, parking/loading restrictions serve a range of businesses located along the length of Section 2, and will be retained as part of the proposals. The majority of premises along New Canal Street and Meriden Street do have service access areas off-street, and therefore impact can be minimalised. Discussions will need to take place with relevant stakeholders along New Canal Street and Meriden Street regarding the loading restrictions in light of the introduction of shared track. It is envisaged that the introduction of the tram network on this section will provide minimal impact on the ongoing servicing requirements for premises, given that the current loading restrictions will remain in place. Furthermore, off-street service areas are present for the majority of premises.

In Section 3 of the study area, some premises do currently service premises from the nearside lane (bus only) along Digbeth (B4100) and High Street Deritend. The reduction in vehicular lanes along Digbeth (B4100) and High Street Deritend results in the removal of the bus-only lanes in each direction, which will result in servicing in the nearside traffic lane. A review of the premises along both Digbeth (B4100) and High Street Deritend has indicated that the majority do have alternative service access options (as described in Chapter 14.4) either on side streets or within rear car parks, and therefore the potential impact of future servicing along the tram route can be minimalised.

In conclusion, where service areas are impacted upon by the future tram network, solutions have been identified and incorporated into the tram alignment design. Although, there will inevitably be an element of re-routing, it is considered that the impact upon existing service access will be minimal.

15 Impact on Road Safety

15.1 Introduction

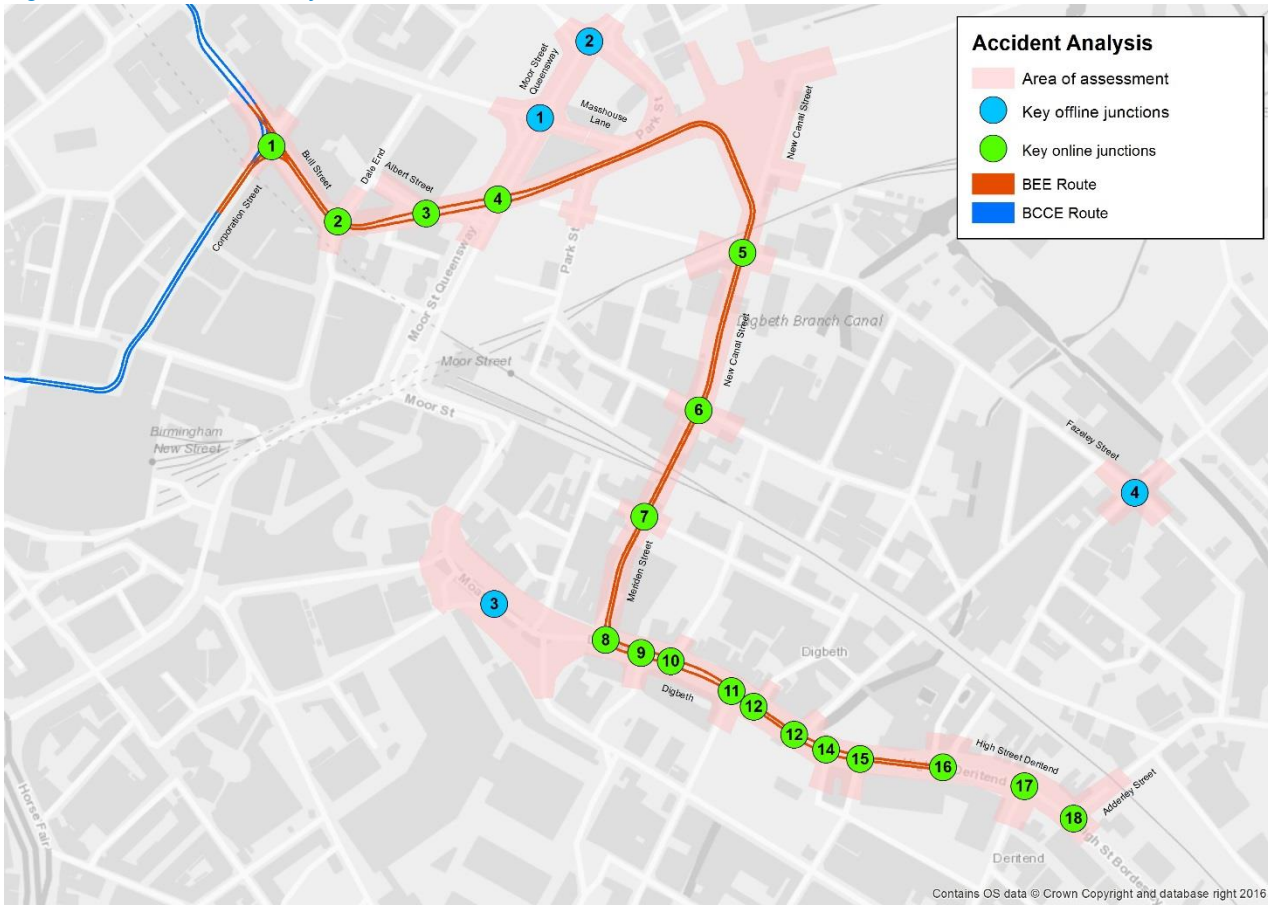
This chapter of the TA shows the collision history in the study area of the Metro proposal analysed over a five year period. As in previous chapter, the study area has been split into the following sections for analysis:

- Section 1 – Corporation Street to Eastside Park
- Section 2 – Eastside Park to Meriden Street
- Section 3 – Meriden Street to Adderley Street

15.2 Collision History Summary

This assessment considers the formal personal injury collision record over the five year period 1 January 2011 to 31 December 2015. The assessment area has been agreed with BCC during the Scoping of this TA and is shown in Table 15.1, and includes the on-line and off-line junctions.

Figure 15.1: Collision History Area of Assessment



Source: Mott MacDonald

The collision history in the full assessment area (including the off-line junctions) is shown in Table 15.1.

Table 15.1: BEE Study Area Collision History

Date	Fatal	Serious	Slight	Total
2011	0	6	15	21
2012	0	3	18	21
2013	0	5	30	35
2014	0	4	25	29
2015	0	3	22	25
Total	**0**	**21**	**110**	**131**

In total, there were 131 collisions over the five year period and, whilst there were no fatalities, 21 of the collisions were serious. As shown in Table 15.2, the 131 collisions resulted in 194 casualties. 23 of the casualties were classified as serious.

Table 15.2: BEE Study Area Casualty Data

	Casualty by Classification			Casualty by Severity			
Date	Driver	Passenger	Pedestrian	Fatal	Serious	Slight	Total Casualties
2011	14	9	6	0	6	23	29
2012	12	13	8	0	4	29	33
2013	23	15	12	0	5	45	50
2014	23	10	12	0	4	41	45
2015	13	12	12	0	4	33	37
Total	**85**	**59**	**50**	**0**	**23**	**171**	**194**

This chapter analyses the collision data in the three outlined sections of the BEE track alignment in accordance with the rest of the TA. The analysis also includes the off-line junctions. The full dataset is located in **Appendix I.**

15.3 Section 1: Corporation Street to Eastside Park

15.3.1 Collision History

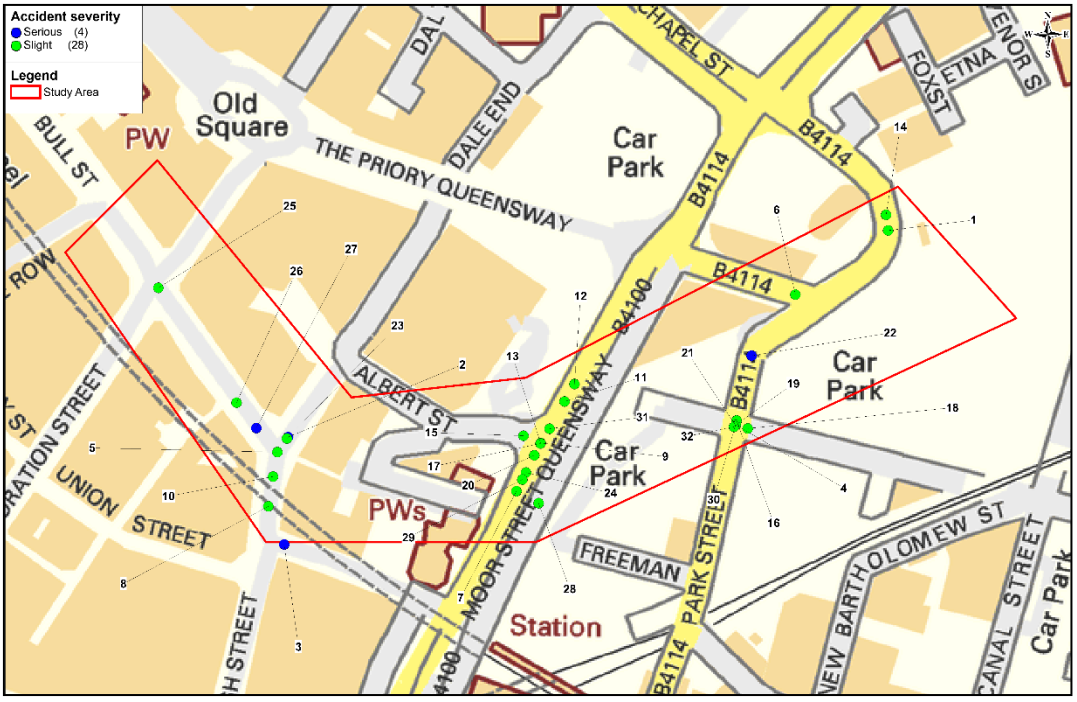
Table 15.3 shows the collision history in Section 1 (see Figure 15.2) of the BEE route over the five year period.

Table 15.3: Section 1 Collision History

Date	Fatal	Serious	Slight	Total
2011	0	2	2	4
2012	0	0	5	5
2013	0	0	9	9
2014	0	1	4	5
2015	0	1	8	9
Total	**0**	**4**	**28**	**32**

The location of the collisions is shown in Figure 15.2.

Figure 15.2: Section 1 Collision Map



Source: Mott MacDonald 2016

Table 15.3 shows a total of 32 personal injury collisions, with zero fatalities and four serious collisions.

Table 15.4 shows the casualty data for Section 1 of the study area.

Table 15.4: Section 1 Casualty Data

	Casualty by Classification			Casualty by Severity			
Date	Driver	Passenger	Pedestrian	Fatal	Serious	Slight	Total Casualties
2011	1	1	2	0	2	2	4
2012	2	0	3	0	0	5	5
2013	6	1	3	0	0	10	10
2014	5	5	1	0	1	10	11
2015	2	1	7	0	1	9	10
Total	**16**	**8**	**16**	**0**	**4**	**36**	**40**

Table 15.3 and Table 15.4 show the 32 collisions produced 40 casualties, of which 16 were pedestrians. There were 4 serious casualties over the five year period.

Four serious collisions took place on this section of the route. Three of the collisions resulted in four pedestrian casualties (see **Appendix I**).

15.3.2 Impact on Road Safety

The implementation of the scheme is not expected to detrimentally impact highway safety and, for much of Section 1, trams are segregated from vehicular traffic and run off-line. Where on-line running occurs, signalised junctions allow for safe vehicular and pedestrian management.

Pedestrian facilities at the Bull Street / Dale End junction will need to cater for a high number of pedestrian movements in all directions. However, the re-location of the signalised pedestrian crossing from Upper Bull Street to this junction will provide a safe crossing facility for pedestrians and cyclists across the junction.

15.4 Section 2: Eastside Park to Meriden Street

15.4.1 Collision History

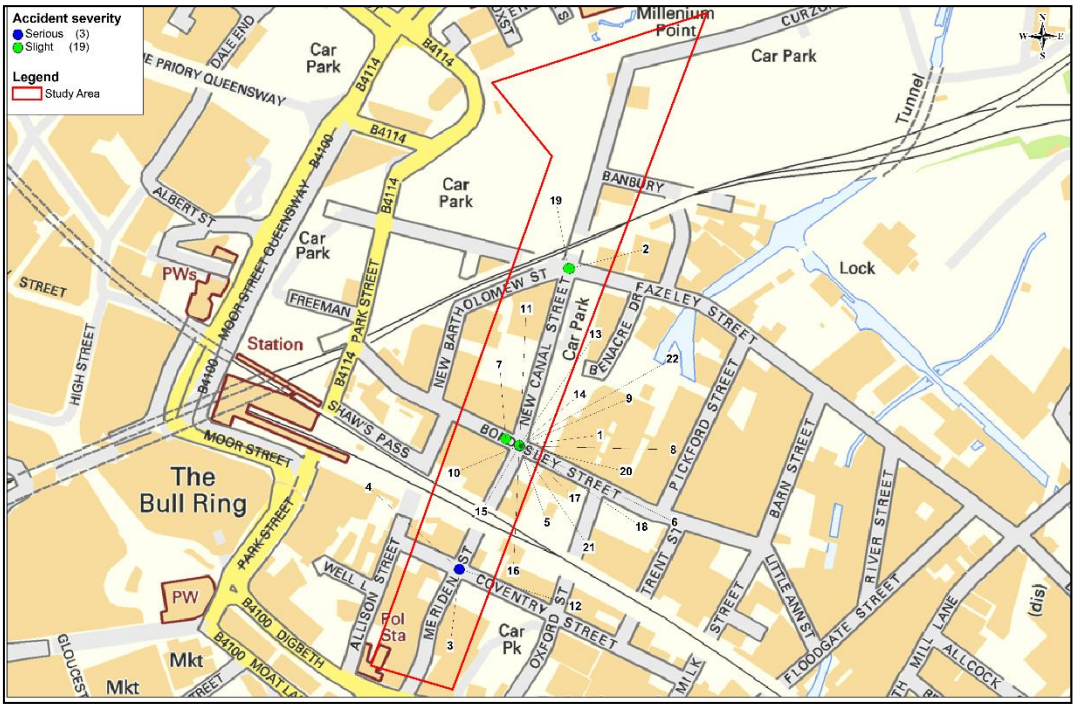
Table 15.5 shows the collision data in Section 2 (see Figure 15.3) over the assessed five year period.

Table 15.5: Section 2 Collision History

Date	Fatal	Serious	Slight	Total
2011	0	1	3	4
2012	-	-	-	-
2013	0	1	7	8
2014	0	0	4	4
2015	0	1	5	6
Total	**0**	**3**	**19**	**22**

The location of the collisions is shown in Figure 15.3.

Figure 15.3: Section 2 Collision Map



Source: Mott MacDonald 2016

Table 15.5 shows a total of 22 personal injury collisions in the area of assessment in Section 2. There were no fatalities and three serious collisions.

Table 15.6 shows the casualty data for Section 2.

Table 15.6: Section 2 Casualty Data

	Casualty by Classification			Casualty by Severity			
Date	Driver	Passenger	Pedestrian	Fatal	Serious	Slight	Total Casualties
2011	6	4	0	0	1	9	10
2012	-	-	-	-	-	-	-
2013	9	9	0	0	1	17	18
2014	5	1	0	0	0	6	6
2015	6	8	0	0	2	12	14
Total	**26**	**22**	**0**	**0**	**4**	**44**	**48**

Table 15.6 shows there were no pedestrian casualties over the five year period in Section 2. This is likely due to low pedestrian and vehicle flows within this section as opposed to Section 1 and Section 3. There were 4 serious casualties over the five year period.

All of the junctions in Section 2 are four arm junctions, with the most northern (New Canal Street / Fazeley Street) being signalised.

Twenty-two collisions were recorded at these junctions; three being serious. The three serious collisions all involved vehicle-to-vehicle conflict, two of these collisions occurred at Coventry Street / Meriden Street with the other occurring at the junction of Bordesley Street / New Canal Street.

The collision at the Coventry Street / Meriden Street junction involved a vehicle to vehicle junction overshoot in wet conditions and resulted in one casualty. The other serious collision occurred at the same junction and resulted in three casualties (one serious casualty), again in wet conditions.

The serious collision at the New Canal Street / Bordesley Street four-armed priority junction resulted in five casualties (two serious casualties). This happened as the vehicle travelling along Bordesley Street towards New Canal Street failed to stop at the priority junction and collided with a northbound vehicle.

15.4.2 Impact on Road Safety

The implementation of the scheme is not expected to detrimentally impact highway safety, but it is recognised that there is greater risk with on-line running, which is further increased by the presence of priority junctions providing direct access adjacent to on-line running.

It is evident from the analysis that there is a safety issue with vehicles travelling from side roads failing to stop at the junction with New Canal Street/Meriden Street. Both the New Canal Street/Fazeley Street and New Canal Street/Bordesley Street junctions are due to be signalised as part of the proposals, and therefore this will reduce fail to give way collisions.

The Meriden Street/Coventry Street junction is to remain as a priority junction due to the relatively low traffic levels on the side roads compared to the other junctions. There is currently no signage at this junction indicating to drivers that they need to give way. Therefore, signs will be erected to warn drivers of the impending junction and possible tram conflict.

15.5 Section 3: Meriden Street to Adderley Street

15.5.1 Collision History

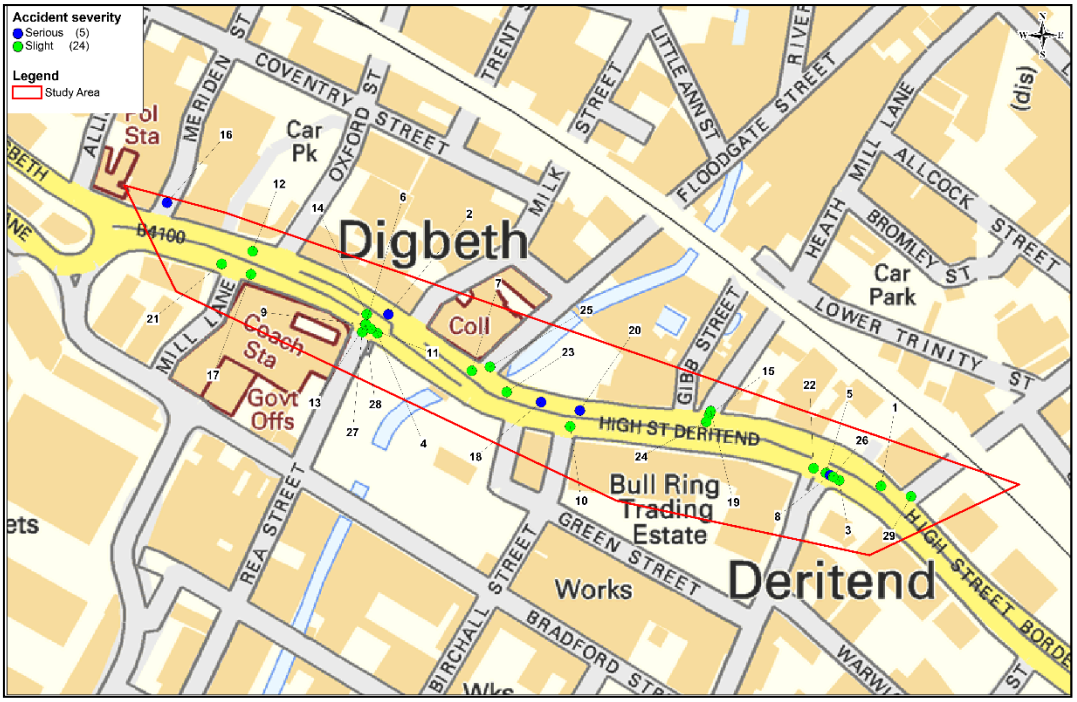
Section 3 of the route has 11 on-line junctions. Table 15.7 shows the collision history over the five year period for Section 3.

Table 15.7: Section 3 Collision History

Date	Fatal	Serious	Slight	Total
2011	0	1	5	6
2012	0	0	1	1
2013	0	1	5	6
2014	0	3	7	10
2015	0	0	6	6
Total	**0**	**5**	**24**	**29**

The location of the collisions is shown in Figure 15.4.

Figure 15.4: Section 3 Collision Map



Source: Mott MacDonald 2016

Table 15.7 shows a total of 29 personal injury collisions with zero fatalities and five serious collisions in Section 3; although 80% of the serious collisions can be attributed to gross negligence on behalf of either the driver or the pedestrian.

Table 15.8 shows the casualty data for Section 3.

Table 15.8: Section 3 Casualty Data

	Casualty by Classification			Casualty by Severity			
Date	Driver	Passenger	Pedestrian	Fatal	Serious	Slight	Total Casualties
2011	2	2	3	0	1	6	7
2012	0	1	0	0	0	1	1
2013	3	2	1	0	1	5	6
2014	8	4	4	0	3	13	16
2015	3	1	3	0	0	7	7
Total	**16**	**10**	**11**	**0**	**5**	**32**	**37**

Table 15.8 shows the highest casualty type are driver casualties (43%) with 30% being pedestrian casualties. There were 5 serious casualties over the five year period.

There are signalised pedestrian crossing facilities along Digbeth (B4100) and High Street Deritend, although observations made by the authors during a site visit (15:30 - 16:30 on 6th January 2016) identified a number of pedestrians crossing both sides of the highway away from controlled crossing facilities by jumping over the central reservation guard rail.

One of the serious collisions involved a pedestrian casualty at the High Street Deritend / Heath Mill Lane junction. A vehicle turning left from High Street Deritend struck a pedestrian as the pedestrian stepped out from between two stationary vehicles. Police reports suggest the pedestrian stepped out without looking. This collision happened in daylight in the AM peak period with a wet carriageway surface.

A further serious collision also happened in wet / damp conditions, at the Digbeth (B4100) / Milk Street junction. This collision occurred at 00:03 and resulted in a pedestrian casualty. Police reports suggest the casualty failed to judge the vehicles speed or path, and was impaired by alcohol.

One serious collision occurred at the High Street Deritend / Alcester Street junction when a pedestrian stepped out in front of a moving vehicle. The two main causes were the pedestrian ‘failed to look properly’ and was ‘impaired by drugs’.

A serious collision occurred 20m from the Digbeth (B4100) / Meriden Street junction in 2014 when a vehicle travelled along the pavement at 03:00 resulting in a pedestrian casualty. The vehicle struck the pedestrian but failed to stop.

The final serious collision occurred at 03:05 and resulted in two casualties. A vehicle pursued by the police travelled the wrong way down Digbeth (B4100) and collided head on with another vehicle. This occurred 50m west of the Floodgate Street junction.

15.5.2 Impact on Road Safety

A large number of pedestrians have been involved in collisions on this section. Whilst pedestrian guard rail is currently installed along the majority of this section, it was observed that a number of pedestrians take

the risk of not using controlled crossings. As the tram is proposed to be off-line along much of this section, the pedestrian guard rail will be removed but signal crossings will be retained and relocated to provide pedestrians with safe crossing points.

15.6 Off-line Junctions

The following summaries are focused on the off-line junction located along Moor Street Queensway, the Moat Lane Gyratory and the Heath Mill Lane / Liverpool Street junction.

15.6.1 Masshouse Lane and Jennens Road

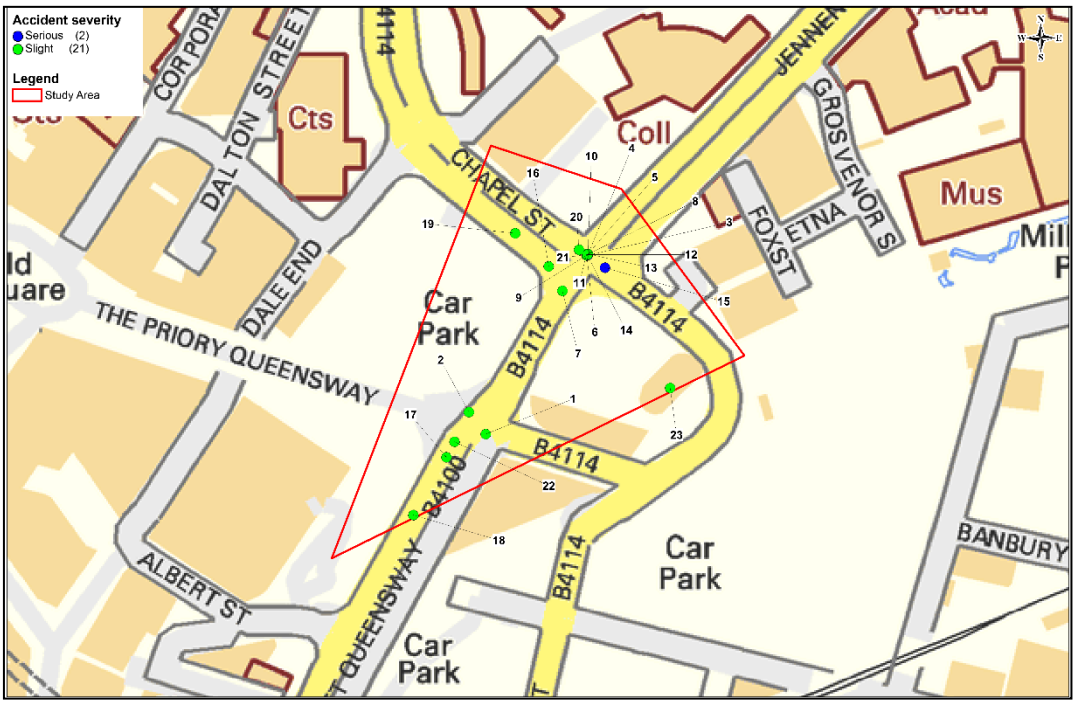
Table 15.9 shows the collision history for the Masshouse Lane and Jennens Road junctions with Moor Street Queensway.

Table 15.9: Masshouse Lane and Jennens Road Collision History

Date	Fatal	Serious	Slight	Total
2011	0	1	5	6
2012	0	0	8	8
2013	0	1	3	4
2014	0	0	3	3
2015	0	0	2	2
Total	**0**	**2**	**21**	**23**

The location of the collisions is shown in Figure 15.5.

Figure 15.5: Masshouse Lane and Jennens Road Collision Map



Source: Mott MacDonald 2016

Table 15.9 shows a total of 23 collisions, with only two collisions being classed as serious. Table 15.10 shows the casualty data for the Masshouse Lane and Jennens Road junctions with Moor Street Queensway.

Table 15.10: Masshouse Lane and Jennens Road Casualty Data

	Casualty by Classification			Casualty by Severity			
Date	Driver	Passenger	Pedestrian	Fatal	Serious	Slight	Total Casualties
2011	5	2	0	0	1	6	7
2012	8	11	0	0	0	19	19
2013	1	1	3	0	1	4	5
2014	3	0	0	0	0	3	3
2015	1	1	1	0	0	3	3
Total	**18**	**15**	**4**	**0**	**2**	**35**	**37**

Both serious collisions were caused by failure to look properly. The collision at Moor Street Queensway / James Watt Queensway (B4114) was caused by the driver disobeying traffic signals resulting in a vehicle-to-vehicle collision. The collision on Park Street/ Moor Street Queensway was caused by a pedestrian crossing Park Street failing to look and stepping into the carriageway in front of a vehicle travelling at low speed.

15.6.2 Moat Lane Gyratory

Table 15.11 shows the collision history for the Moat Lane Gyratory.

Table 15.11: Moat Lane Gyratory Collision History

Date	Fatal	Serious	Slight	Total
2011	0	1	0	1
2012	0	2	4	6
2013	0	2	6	8
2014	0	0	6	6
2015	0	1	1	2
Total	**0**	**6**	**17**	**23**

The location of the collisions is shown in Figure 15.6.

Figure 15.6: Moat Lane Gyratory Collision Map



Source: Mott MacDonald 2016

Table 15.11 shows there were a total of 23 accidents over the five year assessment period on the Moat Lane Gyratory.

Table 15.12 shows the casualty data for the Moat Lane Gyratory.

Table 15.12: Moat Lane Gyratory Casualty Data

	Casualty by Classification			Casualty by Severity			
Date	Driver	Passenger	Pedestrian	Fatal	Serious	Slight	Total Casualties
2011	0	0	1	0	1	0	1
2012	2	1	3	0	2	4	6
2013	4	2	5	0	2	9	11
2014	1	0	7	0	0	8	8
2015	1	1	1	0	1	2	3
Total	**8**	**4**	**17**	**0**	**6**	**23**	**29**

23 collisions are attributed to the Moat Lane Gyratory, six being serious. The 23 collisions produced 29 casualties, with a large proportion of pedestrians involved. Six of the casualties were classified as serious.

15.6.3 Heath Mill Lane / Liverpool Street

Over the five year assessed period there were two collisions (one serious and one slight) at the Heath Mill Lane / Liverpool Street junction, which produced three casualties of which two were pedestrians.

15.6.4 Impact on Road Safety

Both the Moor Street Queensway / James Watt Queensway (B4114) junction and the Moat Lane Gyratory have experienced a large number of collisions over the five year assessment period. However, the majority of these can be attributed to slight collisions or driver error.

A large number of pedestrians were involved in collisions at Moat Lane Gyratory. However, the tram alignment is not proposed to route through this junction, and the Do Something traffic scenario demonstrates less traffic travelling along this route.

15.7 Summary

The personal injury collision data review considers the collision record over the five year period up to 30 July 2015 along the BEE track alignment and wider assessment area.

In total, there were 94 collisions over the five year period, resulting in 191 casualties. Whilst there were no fatalities, 17 of the collisions were serious. It can be seen that after a rise in collisions from 2012 to 2013 (21 up to 35) there has since been a decline down to 25 in 2015, which is similar to the 2012 figure.

Of the 131 collisions, the following breakdown can be observed:

- Section 1 – 32 collisions
- Section 2 – 22 collisions
- Section 3 – 29 collisions
- Moor Street Queensway off-line junctions – 23 collisions
- Moat Lane Gyratory – 23 collisions
- Heath Mill Lane / Liverpool Street – 2 collisions

The scheme will be retaining or re-locating all signalised pedestrian crossings along the route. Additional signalised crossings are to be provided at the Bull Street / Dale End and High Street Deritend / Heath Mill Lane junctions. This will improve pedestrian safety and amenity.

The data suggests a potential safety problem with vehicles travelling from minor roads failing to stop at a number of junctions along New Canal Street and Meriden Street. The New Canal Street / Fazeley Street is currently signalised, and the New Canal Street / Bordesley Street junction is due to be signalised as part of the proposals; therefore reducing the risk of these types of collisions.

Regarding Section 3 of the route, it is evident that a large number of pedestrians have been involved in collisions. Whilst pedestrian guardrails are in place along the majority of this section, it was observed that a number of pedestrians take the risk of not using controlled crossings. As the tram is proposed to be off-line along much of this section, the guardrail will need to be removed but signal crossings will be retained and relocated to ensure that pedestrians can safely cross this section.

Therefore, although there have been a number of collisions recorded on the BEE alignment and at nearby off-line junctions during the assessment period, the majority of these were caused by driver error and gross negligence. Measures have been included within the scheme design to minimise the detrimental impact on road safety, such as re-location of signalised pedestrian crossings and signalisation of problem junctions to improve road safety.

16 Impact on Emergency Services

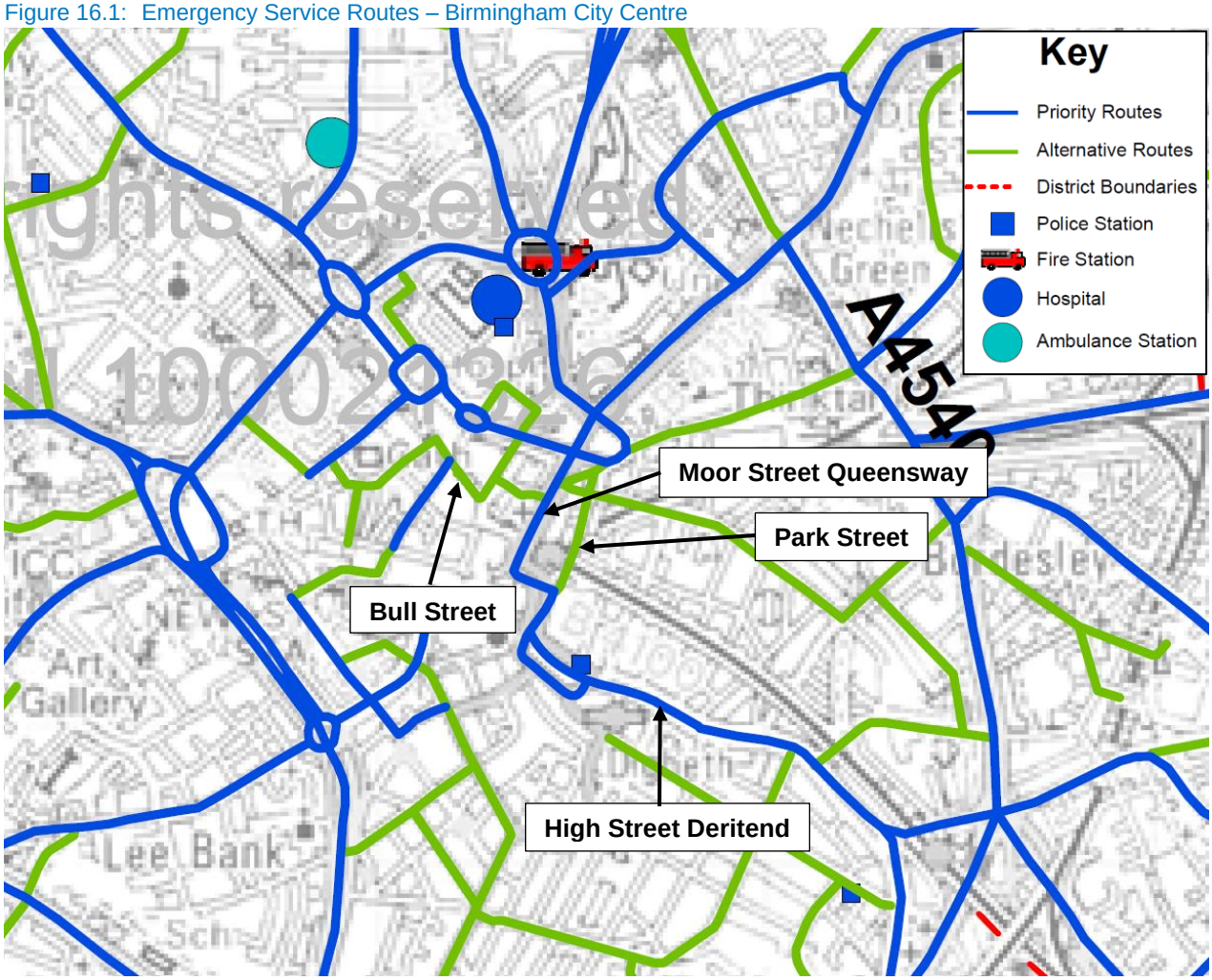
16.1 Introduction

BCC is responsible for a network of 2,550 kilometres of highway, which is divided up into a hierarchy of routes, reflecting the function of each road. The Emergency Services Priority 'Blue' Routes initiative formalises the City Council's approach to accounting for emergency services on Birmingham's roads. The blue routes initiative seeks to assist a reduction in response times for emergency services by ensuring that they are not affected by unnecessary traffic calming or other measures.

Assessing the impact upon the emergency services is necessary in ensuring the emergency services continue to be able to respond in the quickest time possible, whilst ensuring the tram system can operate effectively alongside.

Digbeth Police Station is located 30m west of the tram line at the turning from Meriden Street onto Digbeth (B4100), with Digbeth (B4100) and High Street Deritend being designated as a 'priority route' for emergency services. Figure 16.1 shows the blue routes and alternative routes in the BEE assessment area, as well as the location of the Police Station on Digbeth (B4100).

Figure 16.1: Emergency Service Routes – Birmingham City Centre



Source: BCC Priority for Emergency Services Map

The right-turn from Dale End onto Lower Bull Street is to be removed as part of the BEE scheme (this is identified as an alternative route for emergency services). Emergency service vehicles will be able to route via the new alignment to access Lower Bull Street, and therefore, there is no material impact upon emergency services.

16.2 Impact of BEE on Emergency Services

During construction, access for emergency service vehicles will need to be maintained at all times. Agreements with the relevant bodies will need to be made as to how this can best be achieved. Traffic management proposals will be planned during the construction phases and adequate notice will have to be

given to all the relevant parties, including the emergency services. It will also be necessary to consider evacuation routes and assembly points for adjacent buildings affected by the works.

For the construction of on-street sections, the construction strategy (see **ES Volume 2 Technical Appendix D1**) imposes a maximum work site length of 100m (in compliance with restrictions imposed by the Local Highway Authority and Emergency Services). This is due to emergency service access, and the length of available Fire Brigade hoses. Adequate notice will be given to the emergency services regarding proposed road closures during the construction of the BEE.

The BEE route alignment will interact with a number of the priority and alternative emergency routes within the Birmingham City Centre.

Within Section 1 of the study area (see Figure 2.1) there are a number of priority and alternative routes where BEE will either run alongside or intersect. Moor Street Queensway is a priority route and Bull Street, Dale End and Albert Street are alternative routes. Bull Street and Albert Street are both directly impacted by BEE.

Moor Street Queensway will continue as existing, the only difference to the existing scenario is that the junction will incorporate the tram route alignment and the exit from the proposed Bus Interchange adjacent to Hotel La Tour. From 2026, access between Carrs Lane and the new track alignment (replacing Albert Street) will be restricted to buses and taxis (Hackney Carriages) only. Emergency vehicles will be able to access Bull Street and Dale End via the new shared track tram alignment between Bull Street and Moor Street Queensway.

Bull Street currently operates a one-way system from Dale End towards Corporation Street. This will be maintained with the BEE scheme as the inbound route towards Corporation Street is designated as shared track. Therefore, a situation close to existing will be maintained with BEE.

Albert Street will be removed as part of the BEE scheme, but in its place will be a new link that will connect Bull Street to Moor Street Queensway. Similarly to Bull Street, this will be a shared route so emergency vehicles will be able to access Bull Street along this route from Moor Street Queensway.

The only change on Dale End is that the right-turn movement to Bull Street will be banned for all vehicle movements. However, emergency vehicles will be able to access Bull Street from the new shared track tram alignment between Bull Street and Moor Street Queensway.

The alternative routes on Park Street and Fazeley Street will be directly affected by HS2 when construction begins in 2017.

In Section 2 of the study area (see Figure 2.1), the tram runs along New Canal Street and Meriden Street. These roads are not designated as either priority or alternative routes for the emergency services, and therefore, there will be no impact upon the priority and alternative routes. The tram intersects an alternative route at the New Canal Street / Fazeley Street junction. This junction is currently signalised and will remain

signalised with BEE, therefore generating no negative effect upon current response times for the emergency services.

As stated, Digbeth Police Station is located 30m west of the tram line at the turning from Meriden Street onto Digbeth (B4100). Digbeth (B4100) and High Street Deritend are designated as a priority route for emergency services. For police vehicles located at the police station heading east, they will encounter a signalised junction allowing the tram to turn off Meriden Street and into the offside lanes of Digbeth (B4100) and High Street Deritend. There is currently a signalised junction located here, so the emergency service route will operate in the same way.

On Digbeth (B4100) and High Street Deritend, the tram will operate in the existing offside lanes; this will result in Digbeth (B4100) and High Street Deritend reducing from three to two lanes for vehicular traffic, necessitating the removal of the bus lanes that run along this section of the road. The traffic assessment undertaken in Chapter 6 of this report shows that there will be a corresponding reduction in traffic along Digbeth (B4100) and High Street Deritend related to future Highway schemes. The junction capacity results show that whilst overall capacity along this section is reduced, the junctions will remain within capacity in 2021, and therefore, access for emergency vehicles will be maintained.

For the on-street sections, the length of alignment that can be constructed in a continuous length will be defined by the requirement to maintain access and compliance with restrictions imposed by the Local Highway Authority and Emergency Services, especially the Fire Brigade.

16.3 Summary

During construction, access for emergency vehicles will need to be maintained at all times, and a maximum length of work of 100m will be adopted. Agreements with the relevant bodies will need to be made as to how this can be best achieved.

When BEE is operational existing priority and emergency routes that are directly impacted by BEE will be maintained, although further consultation and agreements will be required with the relevant bodies.

17 Impact from Construction

17.1 Introduction

A construction strategy for BEE has been developed for the purpose of the EIA and is located in **ES Volume 2 Technical Appendix D1**. The construction strategy will assist in informing the assessment of the likely significant effects deriving from the implementation of the construction methodology contained in this strategy. It is anticipated that the construction strategy will be reviewed and refined as the BEE progresses into detailed design.

This chapter of the TA assesses the potential impacts of construction along the route alignment and provides an overview of the construction strategy.

17.2 General Construction Methodology for a Light Rail Transit (LRT) System

The construction methods described below are based on the experience of the BCCE and other similar light rapid transit (LRT) projects. Therefore, they should be considered as indicative at this stage, but due to the scheme being on-street and similarities with previous Metro extensions

and sufficient to undertake the EIA. The final method of working, including the phasing and programming of works, will be determined by the Promoter.

Before the main work of installing the BEE infrastructure can start, preliminary works such as the diversion of public utilities and roads will need to take place. Utilities diversions will be required throughout the BEE and will involve the excavation of new trenches for water pipes, sewers, electricity and communications cables, and gas pipes.

Certain public utilities running within the swept path of the tram track will need to be relocated to minimise future disruption to Midland Metro services during their maintenance and in the event of failure. However, it may not be necessary or possible to relocate all apparatus on street-running sections of the tram due to the restricted space on footpaths, verges or car parking bays. Where this is the case, it may be necessary to lower and protect the utility services from damage caused by vibration or increased load resulting from the operation of Midland Metro.

Alterations to the existing highway will also be required in some areas to accommodate the BEE. This will include:

- Provision of minor traffic flow alterations
- Widening of roads
- Closure of pedestrian subways
- Realignment of footways
- Re-arrangement of lane layouts
- Limiting of traffic movements at intersections
- Repairing and surfacing works
- Removal and installation of pedestrian crossings

These works may entail the excavation of soil and/or pavement, relaying of a formation base and/or casting of a reinforced concrete slab as described above, and resurfacing with asphalt. Existing road markings will be removed and new markings added.

17.3 Indicative Construction Programme

It is currently anticipated that the delivery of the BEE will be phased over a period of approximately 24 months, to include: enabling works, demolition, and construction activities. Construction (including enabling works) is anticipated to commence in 2020. Service diversions will have taken place prior to 2020. The indicative construction programme for BEE is summarised in Table 17.1.

Table 17.1: BEE indicative construction programme

Work stage	Key elements
1	The section of tramway that extends from the tie in to the BCCE on Corporation Street to the intersection with Moor Street Queensway.
2	The section of tramway that extends across Moor Street Queensway.
3	The section of tramway that extends between Moor Street Queensway and the junction of New Canal Street and Fazeley Street and is largely off-highway.
4	The section of tramway that extends between New Canal Street and Meriden Street from the junction with Fazeley Street to just north of the junction with High Street Deritend.
5	The section of tramway that extends between High Street Deritend from the junction with Meriden Street eastwards to the junction with Heath Mill Lane.

Source: Mott MacDonald – Construction Strategy (ES Volume 2 Technical Appendix D1)

Construction hours are assumed to be 07:00-19:00 during weekdays. Some weekend and night-time working will be required to reduce unnecessary disruption to road users during weekday working hours. Any work outside of the standard hours will be agreed in advance with BCC.

Construction will be suspended over the Christmas period (i.e. mid/late November to mid-January) during each year of construction to comply with BCC requirements. This restriction will occur in the following construction stages:

- Work Stage 1
- Work Stage 2
- Work Stage 5

Further stoppages may be required for other major events in the city centre. Whilst the total number of events are unknown at this stage, the management of these events during construction will be discussed with BCC prior to their occurrence.

17.4 Impact of BEE Construction on General Traffic

17.4.1 Introduction

This sub-chapter assesses the impact of construction on general traffic that could be impacted on by BEE. This includes:

- General traffic
- Access traffic
- Construction traffic
- Emergency service access

17.4.2 General Traffic

Works in the carriageway will restrict traffic capacity, while access past the works and to property is maintained. Certain elements of the work will affect vehicular access to frontages; for example, laying crossovers in a safe manner will involve construction activity over the whole width of the street. Where existing vehicular access is to be retained on completion of the scheme, every effort will be made to maintain access during construction.

It is not envisaged that significant additional disruption will be caused by the construction of the tram alignment at minor junctions, such as the side road intersections with New Canal Street and Meriden Street. It is likely that construction can be achieved in these cases either by using conventional traffic management techniques or, where space is limited, by the use of temporary road closures, provided acceptable alternative routes can be provided and access can be maintained.

Construction of the tram alignment at major junctions and road crossings, however, will be more difficult. These are principally:

- Corporation Street / Bull Street
- Bull Street / High Street
- Moor Street Queensway / Albert Street
- Moor Street Queensway
- New Canal Street / Fazeley Street
- Meriden Street / High Street Deritend
- High Street Deritend / Rea Street
- High Street Deritend / Heath Mill Lane

Construction within Moor Street Queensway and High Street Deritend corridor will be particularly problematic as these are main routes into the city centre from areas to the north and east respectively.

The overall strategy will be agreed between TfWM and the Local Highway Authority although it is anticipated that the following principles will be adopted.

Table 17.2: Traffic Diversions

Work Stage	Affected Road	Diversion
Work Stage 1A	Bull Street and Corporation Street	Alternative route for buses via Moor Street Queensway / Priory Queensway. Closure of the BCCE between Bull Street and Corporation Street during Phase 2 of the construction of the delta junction.
Work Stage 1B	Bull Street	Alternative route for buses via Moor Street Queensway / Priory Queensway (inbound track construction only).
Work Stage 1C	New Meeting Street	Service access only. High vehicle access to be maintained from Moor Street Queensway.
Work Stage 1C	Kings Parade	Service access only. High vehicle access to be maintained from Moor Street Queensway.
Work Stage 1D	Albert Street	Service access only. High vehicle access to be maintained from Moor Street Queensway.
Work Stage 1D	Dale End	Service access only. High vehicle access to be maintained from Moor Street Queensway.
Work Stage 2	Moor Street Queensway	Restricted lane use, possible contraflow.
Work Stage 3A	Park Street	If HS2 is on site, will already be closed and available alternative routes being used. If HS2 is not on site alternative routes via Masshouse Lane / Moor Street Queensway (through traffic) and New Canal Street / Bordesley Street (service traffic).
Work Stage 3B	Curzon Street	Service access only.
Work Stage 3B	New Canal Street	Also likely to be already closed if HS2 is on site. Service access likely to be required in either scenario. If HS2 is not on site alternative routes via Park Street or Masshouse Lane / Moor Street Queensway / Rea Street.
Work Stage 3B	Banbury Street	If HS2 is on site Banbury Street will already form part of the new HS2 service road network. Access will be available from Curzon Street to the north and Fazeley Street/Andover Street from the south. If HS2 is not on site, access will be available from Fazeley Street/Andover Street.
Work Stage 3C	New Bartholomew Street	If HS2 is on site, access via Bordesley Street / New Canal Street northbound. If HS2 is not on site access via Park Street.
Work Stage 4A	New Bartholomew Street	If HS2 is on site, access via Bordesley Street / New Canal Street northbound. If HS2 is not on site access via Park Street.
Work Stage 4A	Bordesley Street East and West of New Canal Street	Access via Fazeley Street and Coventry Street
Work Stage 4B	Coventry Street East and West of Meriden Street	Access via Bordesley Street and High Street Deritend.
Work Stage 5	High Street Deritend	Lane closures. Restricted working hours, Traffic on the wider strategic highway network discouraged from using this route.

Source: Mott MacDonald – Construction Strategy (ES Volume 2 Technical Appendix D1)

The period required to complete construction at a junction will depend on the junction size, type, complexity and the traffic flow(s) to be dealt with.

Where permissible, the work which affects access will be carried out either at night or weekends, or in some other manner agreed by those affected and the Local Highway Authority if required.

All restrictions to the use of roads by traffic require the authority of a Traffic Regulation Order made by the Local Highway Authority. Temporary orders will need to be agreed with the Local Highway Authority for the short-term closures or diversions required by works in the highway. It should be noted that in Birmingham, there is a PFI Highway Maintenance contract in place and the Service Provider will also need to provide authorisation for the works on the public highway. Where the works interface with the operational tramway, there may also be a need for possessions of the tramway which would need to be agreed with the tramway operator.

Temporary closures may be necessary for the construction of the Metro, particularly in areas where there is insufficient width for traffic to safely pass when construction of the inbound or outbound track is ongoing.

Two-way operation under signal control would be feasible for the majority of the route, but would limit the length and width of individual work sites. One-way traffic operation would be preferable with traffic travelling in the reverse direction being diverted along parallel routes.

The use of conventional construction techniques is likely to produce traffic re-routing and possible congestion, and special construction methods could be investigated to minimise disruption. For example, out of hours working and temporary closure / possession coupled with the use of prefabricated track elements may provide one solution. Before a construction method can be adopted, however, the impact on traffic flows will have to be assessed and compared for each alternative. All practical methods of construction for the major junctions will need to be considered, and congestion assessed both at the junction and within the wider highway network.

17.4.3 Construction Traffic

Construction traffic associated with the tram will generally be of relatively low volumes along most of the route, but will be present at times and in places where such traffic is not normal. If the HS2 and Martineau Galleries Developments are being constructed at the same time as the Metro extension, construction traffic will be significantly higher. The majority of construction activities relating to HS2 will have finished.

Table 17.3 below shows an estimate of:

- The volumes of construction traffic one way that will need to access each of the Work Areas from the wider highway network during construction
- The number of worker journeys (one way) that will occur

Table 17.3: Indicative Traffic Impacts

Location	Description	2020				2021				2022
Total HGV Movement Generated		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
Work Stage 1	Corporation Street to Moor Street Queensway	705	730	119	0	160	338	150	25	
Work Stage 2	Moor Street Queensway	0	70	76	0	0	0	55	5	
Work Stage 3	Moor Street Queensway to New Canal Street	61	139	631	179	133	85	57	35	

Location	Description	2020				2021				2022
Work Stage 4	New Canal Street to High Street Digbeth	621	440	165	137	155	134	124	140	
Work Stage 5	High Street Digbeth	135	289	252	20	314	123	110	85	
Total No. of Additional HGV Journeys		**1522**	**1668**	**1243**	**336**	**762**	**680**	**496**	**290**	
Approximate No. of Worker Journeys		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
Supervision	Site Compounds	750	1950	1950	1650	1950	1950	1950	1650	110
Work Stage 1	Corporation Street to Moor Street Queensway	475	1452	615	0	472	1423	1100	125	
Work Stage 2	Moor Street Queensway	0	200	385	0	0	0	385	25	
Work Stage 3	Moor Street Queensway to New Canal Street	443	1268	1760	2055	1909	1120	460	175	
Work Stage 4	New Canal Street to High Street Digbeth	667	1664	751	1110	696	550	625	75	
Work Stage 5	High Street Digbeth	450	1140	750	100	405	1040	775	500	
Total No. of Additional Worker Journeys		**2785**	**7674**	**6211**	**4915**	**5432**	**6083**	**5295**	**2550**	**110**

Source: Mott MacDonald – Construction Strategy (ES Volume 2 Technical Appendix D1)

There are a limited number of residential properties in close proximity to the scheme and there will be a need to minimise the effects of construction on these properties, particularly out of normal working hours. The construction methodology will also have to be developed with great sensitivity to the needs of the surrounding road network. If not controlled properly, it will add to congestion, especially in the vicinity of the site compounds at the start and finish of each work day.

The delivery of plant and materials to site compounds and areas of ongoing work should, where feasible, take place during off peak periods. The contractor should minimise the double handling of materials to reduce the impact on the local community of construction traffic between principle compounds and the work sites. The contractor should also be encouraged to use “just in time” deliveries to avoid having to find large storage compounds. The arrival / departure of vehicles used for transporting excavated, waste or other materials such as concrete should be carefully managed so that queues of vehicles do not form.

Parking in the vicinity of the site compounds and work sites may be feasible, particularly in view of the number of car parks in close proximity to the works, but should still be discouraged. Existing parking restrictions along the route are generally comprehensive, but will need to be enhanced to ensure no parking is allowed either during the construction phase or the operation of the tram.

It is also envisaged that further parking restrictions will need to be imposed by the Highway Authority on the streets off New Canal Street and Meriden Street to facilitate construction of the works. The various roads off these streets will need to be used for alternative access during construction of the tram.

Access routes to the individual work sites will have to be agreed by the Contractor with the Local Highway Authorities, based on a pre-agreed framework. During the construction, long and heavy loads (lengths of rail, and occasional extremely long prefabricated rail sections for direct placement on the site) can be expected and vehicles will require to use routes and to stop in places not normally permitted. Parking restrictions will have to be enforced to ensure that access is available when required.

17.4.4 Impact on Buses

Public transport buses currently use the following roads which will be directly affected by the construction of the tramway:

- Corporation Street
- Bull Street
- High Street / Dale End
- Albert Street
- Moor Street Queensway
- Digbeth (B4100), High Street Deritend and the junctions along this section.

Other routes may be also impacted by diverted traffic, which is likely to affect the punctuality of services along these routes. Bus stops are located along Fazeley Street but are not currently in use.

During construction of the inbound track between High Street / Dale End and Corporation Street, and the construction of the Corporation Street / Bull Street junction, it is unlikely that buses will be able to remain on their current routes and diversion of services is likely to be required.

Similarly, during construction work on Albert Street, buses using the Dale End / Albert Street route will need to be diverted. It should be possible to retain the existing bus routes on Moor Street Queensway, although some temporary lane reallocation will be necessary.

Re-routing and associated temporary relocation of bus stops will need to be agreed with the bus companies in advance, and information provided to bus passengers.

17.4.5 Impact on Light Rail

The construction of the BEE will have an impact upon the existing light rail operations in Birmingham City Centre. Where the BEE scheme diverges from the BCCE scheme, there is a direct interaction at the Corporation Street / Bull Street junction between the two tramways. The BCCE scheme has built in passive provision for a delta junction at Corporation Street / Bull Street, which will assist in minimising disruption.

17.4.6 Impact on Heavy Rail and HS2

The construction of the infrastructure for HS2 is expected to commence in 2017 for completion in 2026, ongoing throughout the construction of the Metro extension. This will apply particularly to the HS2 terminus buildings, viaduct structures, utility diversions and access infrastructure. If the current programmes for

construction are adhered to, construction of HS2 will be on site well in advance of the Metro extension and the management of traffic for construction to the east and south of Moor Street will already be well established. Traffic management proposals for the Metro extension will have to fit in with that already in place for the HS2 development, and particular consideration will need to be given to maintaining access for the construction of both projects. Discussions will take place with HS2 prior to the construction of both projects in order to determine how best to achieve this.

There is no proposed impact to the existing heavy rail network.

17.4.7 Impact on Coaches

The impact on coach services will be limited to that from the general traffic management measures.

17.4.8 Impact on Pedestrians and Cyclists

The works will also constitute an interruption to the ability of the pedestrian public to move freely around the affected sections of the route. The city centre end of the scheme in particular has a high pedestrian footfall, and efforts will be required to maintain pedestrian circulation by the shortest and simplest reasonable route.

In planning the construction through the area, careful consideration will be needed to ensure that the works cause the minimum disruption to pedestrians, shoppers, residents and commercial activity. Extensive discussions with owners / tenants will be required so that access to premises can be preserved and the impact on pedestrian movements minimised. The nature of the work dictates that access to premises cannot be maintained all the time. As the city centre in particular moves towards a 7 day 24 hour operation, it cannot be assumed that disruption to access will more readily available on Saturdays and public holidays than during the working week. This may place a limit on the extent of weekend working.

In developing a strategy for when closures or diversions should be undertaken, the contractor should pursue the following hierarchy:

- Maintain cycle and pedestrian routes on or close to the existing alignment.
- Install any permanent alternative cycle route in advance of the main construction works.
- If diversions are required, then the following principles should be followed:
  - Keep to a single diversion to be maintained throughout entire construction period, as far as practicable with minor changes as required. Changes should be kept to a minimum.
  - Agree diversions with the Traffic Manager and other key stakeholders (e.g. cycling groups).
  - Provide advance warning and notification.

The cycle route that travels along New Canal Street, Fazeley Street, Liverpool Street and Adderley Street is a signed cycle route and temporary diversions will therefore need to be given particular attention.

Management of pedestrians will be a key issue in the construction of the works. The western end of the scheme in particular is in close proximity to busy pedestrian crossing points and bus stop locations. There

are also major pedestrian flows along the footways of Bull Street, High Street and Moor Street Queensway and High Street Deritend. Management of pedestrians in these areas will need to be given careful consideration.

17.4.9 Impact on Taxis

The impact on taxis will be limited to that from the general traffic management measures.

17.5 Code of Construction Practice (CoCP)

The Code of Construction Practice (CoCP, see **ES Volume 2 Technical Appendix D2**) is a document that has been prepared and agreed with BCC to minimise/control any likely harm to the environment and human beings arising from construction activities. It has been based on previous experience with BCCE and other recent schemes. The CoCP Part 1 sets out the contractor's general obligations with respect to the impact of construction activities on local residents, businesses, the general public and the surroundings in the vicinity of the works. It applies to the construction phase and is in addition to statutory regulations and other contractual requirements. The construction contractor is required to expand on the CoCP Part 1 into a CoCP Part 2. CoCP Part 2 is likely to include more site specific information to demonstrate how the requirements of the CoCP will be complied with at specific locations. Details of how materials will be delivered or removed from the construction compounds will be considered by the construction contractor in the development of the CoCP Part 2.

17.6 HS2 Construction Programme

The EIA submitted as part of the HS2 proposals includes a section which outlines the construction strategy for HS2[13].

The main construction traffic routes to the HS2 scheme are proposed to be via:

- Fazeley Street – Great Barr Street - Lawley Middleway
- New Canal Street - Bordesley Street- Allison Street – Park Street – High Street Deritend.
- Park Street – Jennens Road

The indicative construction traffic generated by HS2 is summarised in Table 17.4.

13 HS2 London-West Midlands Environmental Statement (Volume 2 Community Forum Area report) CFA26 Washwood Heath to Curzon St November 2013.

Table 17.4: Compound Construction Traffic Information

Compound Type	Compound name	Access to/from Compound	Indicative start/setup date	Estimated duration of use (years)	Estimated duration with busy vehicle movements (months)	Average daily combined two-way vehicle trips during busy period and within peak month of activity.	
						Cars/LGV	HGV
Satellite compound	Curzon St No. 3 viaduct	Curzon Street	Q2 2017	3 years	3	40-50	80-102
Main compound	Curzon St station	Curzon Street	Q2 2017	5 years and 9 months	18	120-150	29-40

In the busiest month, there are estimated to be approximately 1,680 vehicle movements (in/out) per day across the study area (Curzon Street to Washwood Heath). The split of construction vehicles is expected to be 55% HGVs and 45% cars and LGV.

It is proposed that the M6, A38(M) Aston Expresssway,A38 Tyburn Road, A4540 Lawley Middleway, A4040 Bromford Lane, A47 Heartlands Parkway and A45 Coventry Road will provide the primary HGV access and egress routes.

There will be permanent closure of the B4114 Park Street, Andover Street (north end), Banbury Street, Bartholomew Street, Fazeley Street (west of New Canal Street), Freeman Street and Seymour Street in order to construct the proposed Curzon Street station.

The HS2 EIA concludes that changes in peak hour traffic flows as a result of construction traffic and the closures in Birmingham City Centre, in particular the closure of the B4114 Park Street, will lead to a significant effect on congestion and delays in 2021, at the following junctions:

- B4100 Moat Lane/Upper Dean Street (moderate adverse effect)
- Sherlock Street/Wrentham Street (moderate adverse effect)
- B4100 High Street Deritend/Heath Mill Lane (minor adverse effect)
- Camp Hill Circus (moderate adverse effect)
- Woodcock Street/Aston Street (minor adverse effect)

The construction of the infrastructure for the HS2 development is expected to commence in 2017 and be commissioned by 2026. Construction is therefore expected to be ongoing throughout the construction of the BEE. This will apply particularly to the HS2 terminus buildings, viaduct structures, utility diversions and access infrastructure. It is assumed that the programmes for construction will be adhered to, therefore the construction of HS2 will be on site well in advance of the BEE and the management of traffic for construction to the east and south of Moor Street will already be well established. Traffic management proposals for this Midland Metro extension will have to fit in with that already in place for HS2, and particular consideration will need to be given to maintaining access for the construction of both projects.

17.7 Conclusions

Continual access to parts of Birmingham City Centre and Digbeth will be required at all times during the construction of the BEE. Temporarily, the construction of the BEE is likely to affect the movement of traffic and as construction proceeds it may have an effect on property access. Appropriate arrangements will be required to facilitate vehicular and pedestrian access to allow the general life of the area to operate. Such challenges have been successfully tackled during the implementation and construction of the BCCE. The contractor appointed to construct the scheme will bring knowledge and expertise in their management.

Underpinning the management of impacts is the CoCP. The CoCP addresses the contractor's general obligations with respect to minimising the impact of construction activities on businesses, the general public and the surroundings in the vicinity of the works. The CoCP applies to the construction phase of the BEE, and will be in addition to statutory regulations. The contractor will be required to comply with the terms of the CoCP, and to incorporate it in any contract or sub-contract relating to any aspect of the scheme.

The scale of the project will require extensive detailed planning in conjunction with the Highway Authority and organisations such as Emergency Services, public transport operators, cyclists, people with disabilities and local businesses.

Extensive planning and liaison will be required between the contractor, TfWM, BCC and HS2. It will be necessary to continue the planning exercise, and revise plans throughout the construction of the works in order to minimise disruption.

18 Summary and Conclusions

18.1 Overview

The Midland Metro tram system commenced operation in 1999 with the opening of the Wolverhampton to Birmingham Snow Hill line (Line 1). Line 1 consisted of 20.1km of mainly reserved track with a short on-street section in Wolverhampton. There were 23 stops along the route, including three with National Rail interchanges and four park & ride sites.

In 2016 the Birmingham City Centre Extension was opened linking Snow Hill Station to Birmingham New Street Station (via Bull Street and Corporation Street). There are now 26 stops along the Midland Metro route, with a peak frequency of ten trams per hour in each direction. The system currently carries five million passengers a year.

With the current network expansion nearing completion, future network extensions have been identified. TfWM have been and are currently developing various other future extensions to the existing Midland Metro network. These are as follows:

- Centenary Square Extension
- Edgbaston Extension
- Wolverhampton City Centre Extension
- Wednesbury to Brierley Hill Extension
- Birmingham to Eastside Extension
- East Birmingham to Solihull Extension.

In regard to the BEE, it will provide a link to regeneration areas and transport hubs such as HS2 and Birmingham Coach Station. The Birmingham 'Big City Plan' (2010) has designated the Eastside area (170 hectares) as an "area of transformation". The Eastside area is home to the largest physical regeneration project in Birmingham aimed at transforming and revitalising a previously neglected part of the city centre. The Eastside area is home to Eastside City Park, which is the first new park in the city in 130 years, as well as Millennium Point (a science, technology and education centre) which attracts over one million visitors per year. Aston University, Birmingham City University, Ormiston Academy and Birmingham Metropolitan College are also located within the regeneration area and would benefit from an improved public transport network.

Proposals in the Big City Plan to provide 50,000 new city centre jobs, for example, will significantly add pressure to the existing transport network. Therefore, improved connectivity is vital in securing the city's success as is evident in the emerging Core Strategy and in recent investment, including the £600 million New Street Gateway project and £300+ million on extending the Midland Metro through the city centre.

Connectivity will play a key role in capitalising on Birmingham City Centre's current potential. In 2013, 1.6% of city centre commuters in the morning peak used the tram system. Midland Metro expansion, along with further investment within an integrated public transport network, will raise accessibility levels across the city, with 4.4m passengers expected to use the BEE in 2031 (SDG IOBC, 2015, paragraph 4.7). This supports BCCs vision to create a world class city.

The BEE scheme consists of a 1.7km twin track extension to the Midland Metro network forming a delta junction with the BCCE line at the Corporation Street / Bull Street junction. The BEE will provide four additional tram stops:

- Albert Street (directly west of Moor Street Queensway)
- New Canal Street (within the proposed HS2 station)
- Meriden Street (adjacent to the junction with Bordesley Street)
- High Street Deritend (directly east of the junction with Rea Street and Milk Street)

These tram stops provide a link between Birmingham City Centre, existing and proposed transport hubs, and regeneration areas.

This Transport Assessment (TA) provides an examination and understanding of the implications of the scheme on transportation issues. It is intended to be contained as an appendix in the Environmental Impact Assessment (EIA), supporting the chapter contained within that document regarding Traffic and Transportation. The EIA accompanies the Transport and Works Act Order (TWAO) application for the scheme, to be submitted to the Secretary of State to acquire the powers necessary to construct and operate the BEE extension.

The TA has considered the impacts of the BEE on all modes of transport, including but not limited to walking, cycling and public transport. Proposed mitigation measures are set out where necessary to eliminate or reduce the identified impacts of BEE.

18.2 Policy Fit

The policies reviewed as part of Chapter 4 demonstrate a strong support for the expansion of the Midland Metro system in Birmingham's Eastside area.

Both national and local policies encourage sustainable transport choices, promoting investment in transport infrastructure. The West Midlands Local Transport Plan details the positive impacts of Midland Metro extension in Birmingham City Centre, supporting concepts of sustainability, increased patronage of public transport and increased reliability and efficiency.

The overarching theme of local planning policy is to support economic growth with an accessible, sustainable and reliable public transport facility. An emphasis is placed on ensuring public transport services are capable of responding to demand. The BEE supports these policy aims and complements the aspiration to improve the public transport offering in Birmingham's Eastside, Birmingham, and the West Midlands.

18.3 Traffic

Extensive traffic modelling work has been undertaken, along with detailed assessments of the identified on-line and off-line junctions. The purpose of the assessments is to identify what impact the proposed BEE will have on highway capacity and general traffic.

The effect of the BEE has been determined using the Birmingham City Centre strategic highway model which was built using industry standard modelling software, SATURN.

The Do Minimum (DM) scenario represents the expected situation with regards to committed developments and traffic characteristics, and the Do Something (DS) scenario takes the DM and incorporates the BEE proposals.

All on-line junctions were modelled to operate within capacity in the future year DS scenarios.

Furthermore, an assessment was also undertaken to identify the impacts of the BEE proposals on off-line junctions. In total, four junctions across Birmingham City Centre and Birmingham Eastside were identified.

The following were identified to operate over capacity within one or more of the future year DS scenarios:

- Heath Mill Lane / Liverpool Street

The junction operates over capacity in the 2021 AM Peak Do Something scenario. In this scenario there is a modelled queue of 25.9 PCUs (Great Barr Street). This queue is expected to block back past the Great Barr Street / Glover Street junction. Most vehicles should clear during the cycle in which they arrive; however, some vehicles towards the back of the queue may have to wait for a second cycle to pass through the junction. Whilst the junction will be congested, the impact on traffic is not deemed to be severe.

To further improve capacity geometric changes to the junction would need to be implemented. Highway realignment is not considered feasible at this junction due to land constraints, and impacts on businesses and nearby heritage assets.

18.4 Buses

Buses currently form the primary method of public transport in the West Midlands with nearly one million bus journeys per day. With the implementation of the BEE:

- Bus stop provision on Bull Street is to be reduced from kerb-space for five buses to three (although the three existing shelters are to remain). Bus services will not be affected as bus stop BS16 can be utilised for the excess capacity.
- Bus stops MS13 and MS14 on Moor Street Queensway are to be relocated to the Bus Interchange, and bus stop MS9 is to be relocated to bus stop MS10 (currently disused). Bus services will not be negatively affected by these changes.
- Bus services using Park Street (south of the PA1 bus stop) will be diverted via Masshouse Lane and Moor Street Queensway as part of the HS2 proposal, where Park Street will be closed to general traffic. Once the BEE is operational, bus stop PA1 will be relocated to the Bus Interchange. Further services that operate on Park Street may also operate through the Bus Interchange.
- All bus stops are to be retained along Digbeth (B4100), High Street Deritend and on the Moat Lane Gyratory.
- Bus lanes along Digbeth (B4100) and High Street Deritend are to be removed, reducing the vehicular traffic lanes from 3 to 2. The bus stops will remain on street, and therefore, the buses should not be delayed significantly, as they might be if the bus stops were in bus laybys.

The closure of Moor Street Queensway to general traffic (a committed transport scheme to be implemented in 2026) will improve bus service efficiency along Moor Street Queensway. City centre traffic will reduce as a result of the traffic restrictions, and the reliability and efficiency of the bus network will be improved as a result of these changes (with bus service speed increasing on average 1mph along Moor Street Queensway).

Where bus stops are negatively impacted, alternative suitable provision has been proposed, and where service routes are negatively impacted, diversions have been proposed.

18.5 Light Rail

The proposed Midland Metro developments align clearly with transport strategy and policy in Birmingham. In addition to the current network expansion, the BEE scheme and the scheme linking Centenary Square / EDGE will significantly enhance the capacity of Birmingham's transport infrastructure.

Extending the tram along the proposed route will increase public transport access from the Eastside area into the existing employment, leisure and transport hubs. This in turn has the potential to attract investment, people and businesses into the Eastside area; physically, socially and economically improving the area. Coupled with the HS2 development, and further extensions of the Metro line, this extension has the potential to transform Birmingham's Eastside.

There will be minimal disruption to the current Midland Metro network during the construction phase of BEE due to the BCCE scheme providing passive provision for a delta junction at the Corporation Street / Bull Street junction

During operation, there will not be an increase in trams operating on other parts of the tram network following the introduction of BEE. The junction capacity assessments summarised in Chapter 6 also demonstrate that in capacity terms the Corporation Street / Bull Street junction will operate within capacity for the 2021 and 2031 Do Something scenarios.

18.6 Heavy Rail

The BEE will directly interface with the proposed HS2 terminal at Curzon Street, and through current infrastructure, will link the HS2 terminal with New Street Station and Snow Hill Station. Moor Street Station is also in close proximity to the BEE at the Moor Street Queensway junction and the Bus Interchange. The linkage between Birmingham's stations is important, and the BEE along with the current BCCE has the capability to integrate all stations.

Interchange opportunities will also be vital in delivering passengers to Birmingham's rail stations via the Midland Metro. This will offer a high quality and reliable public transport alternative to the car, and improved connectivity between stations and transport modes will significantly improve the public transport network offer.

During the construction phase there will be an interaction with the HS2 construction site, and particular consideration will be given to maintaining access for the construction of both projects.

18.7 Coaches

All site access junctions for Birmingham Coach Station as well as the Digbeth (B4100) / Mill Lane taxi service and drop-off point will not be negatively impacted by the BEE track alignment.

The location of the tram stop in relation to the Birmingham Coach Station will allow inbound coach passengers to easily reach the city centre, Wolverhampton and West Bromwich among other stops on the Midland Metro network. Outbound passengers in the city will also be better connected, allowing for a more efficient public transport route to the coach station. Passengers will find National Express destinations such as Heathrow and Stansted airports, London and Manchester more accessible.

The location of the Birmingham Coach Station will provide the means to create an interchange hub between the Midland Metro, the bus network and the coach network. The IOBC published by SDG furthers this, stating that the BEE will create an “important transport hub” with Birmingham Coach Station.

The Bus Interchange will also provide capacity for coaches to serve the demand for the HS2 terminal station. The impact of BEE upon the Birmingham Coach Station and the current coach network in Birmingham is therefore positive.

18.8 Walking and Cycling

The proposed BEE will result in changes to existing pedestrian and cycling provision, although embedded mitigation measures ensure the overall impact is negligible, and positive in some cases.

Signalised pedestrian crossings will be retained along the route, with the addition of pedestrian crossings at the Bull Street / Dale End and High Street Deritend / Heath Mill Lane junctions.

The proposed scheme will in most cases enhance the existing cycling and pedestrian infrastructure, whilst providing a step change in public transport provision within Birmingham City Centre and the Eastside area. The scheme will allow journeys into, out of, and within Birmingham City Centre to be undertaken in a more sustainable manner, incorporating walking and cycling into the wider public transport network. Future proposals, such as the designation of Moor Street Queensway as bus, cycle and taxi only (Curzon HS2 Masterplan), will further improve cyclist and pedestrian safety; as well as bus reliability and efficiency.

18.9 Parking

The impact on parking provision as a result of the BEE scheme is minimal, with existing parking bays being retained or relocated where possible. Current parking facilities at New Meeting Street and Albert Street will be affected but displaced parking bays will be relocated where necessary to alternative locations.

In Sections 2 and 3 of the route (see Figure 2.1) there is no designated on-street parking and, therefore no on-street provision will be removed or displaced. There are several off-street pay-and-display and private car parks along the BEE route, as well as other streets with on-street parking within the Digbeth area, both to the east and west of New Canal Street and Meriden Street, and access to these will remain as existing.

Three identified car parks are to be removed as part of the overall development of the area to the east of Moor Street Queensway (including the BEE and HS2). These three car parks will be removed due to the HS2 construction works that are planned to commence in 2017. Therefore, this is not considered to represent a material impact as part of the BEE proposals.

18.10 Taxis

The existing taxi rank provision will be maintained, albeit with the removal of the rank on High Street Deritend (although this has no formal recognition by BCC). The Dale End rank is of vital importance in Birmingham's taxi network, therefore access to the rank has been safeguarded as part of the BEE proposals.

Future proposals highlighted in the Curzon HS2 Masterplan offer improvements to the existing taxi provision by designating Moor Street Queensway as a bus, taxi and cycle only road. This will improve taxi services in Birmingham City Centre and Digbeth.

BEE will not affect the routeing of taxis within Birmingham City Centre. In fact the reconfiguration of the Bull Street / Dale End junction will assist in preventing the U-turning that currently occurs by taxis when switching direction on Dale End.

18.11 Servicing and Access

The implementation of the proposed BEE scheme will alter some existing access routes, the availability of on-street loading/unloading and refuse collection access. However, the proposed diversions are not considered to represent a material impact on general access within the BEE scheme corridor.

It has been demonstrated that in relatively few cases where existing access cannot be retained, alternative access arrangements can be provided. Where service areas are impacted upon by the future tram network, solutions have been identified and incorporated into the tram alignment design.

18.12 Highway Safety

A road safety assessment has been undertaken considering the formal accident record over the five year period up to the 30 July 2015 along the BEE track alignment and wider assessment area.

In total, there were 94 collisions over the five year period resulting in 191 casualties. Whilst there were no fatalities, 17 of the collisions were serious. It can be seen that there is a general trend in the number of collisions increasing over time.

It is evident from the analysis that there is a potential safety concern with vehicles travelling from minor roads failing to stop at a number of junctions with New Canal Street / Meriden Street. Both the New Canal Street / Fazeley Street and New Canal Street / Bordesley Street junctions are due to be signalised as part of the proposals, and therefore this will reduce safety concerns.

Although there have been a number of accidents recorded on the BEE alignment and at nearby off-line junctions during the assessment period, the majority of these were caused by driver error. Measures are proposed, where possible to minimise the impact on road safety, such as re-location of signalised pedestrian crossing, signalisation of problem junctions to remove safety concerns etc.

18.13 Emergency Services

During construction, access for emergency service vehicles will need to be maintained at all times. Agreements with the relevant bodies will need to be made as to how this can be best achieved. Traffic management proposals will have to be planned during the construction phases and adequate notice will have to be given to all the relevant parties, including the emergency services. It will also be necessary to consider evacuation routes and assembly points for adjacent buildings affected by the works.

When BEE is operational, existing priority and emergency routes that are directly impacted by BEE will be maintained although further consultation and agreements will be required with the relevant bodies.

18.14 Construction

The BEE is located in a busy city centre environment, and continual access to parts of Birmingham City Centre and Digbeth will be required at all times during the construction of the BEE. Temporarily, the construction of the BEE is likely to affect the movement of traffic and as construction proceeds it may have an effect on property access. Appropriate arrangements will be required to facilitate vehicular and pedestrian access to allow the general life of the area to operate. Such challenges have been successfully tackled during the implementation and construction of the BCCE.

Underpinning the management of impacts is the Code of Construction Practice (CoCP). The CoCP addresses the contractor's general obligations with respect to minimising the impact of construction activities on businesses, the general public and the surroundings in the vicinity of the works. The CoCP applies to the construction phase of the BEE and will be in addition to statutory regulations. The contractor will be required to comply with the terms of the CoCP, and to incorporate it in any contract or sub-contract relating to any aspect of the scheme.

The scale of the project will require extensive detailed planning in conjunction with the Highway Authority and organisations such as Emergency Services, public transport operators, cyclists, people with disabilities and local businesses. Extensive planning and liaison will be required between the contractor, TfWM and BCC. It will be necessary to continue the planning exercise, and revise plans throughout the construction of the works in order to minimise disruption.

18.15 Overall Conclusion

The BEE scheme will achieve a number of goals identified by the West Midlands ITA, the WMCA, TfWM and BCC. Local connectivity will be improved, both within the city centre and to the city centre from locations in the Black Country and north-west of Birmingham.

The BEE will provide a direct, high quality public transport link to the Eastside area, serving existing and proposed significant areas of commercial and leisure activity, as well as linking several transport modes. Interchange opportunities are to be provided between Metro, bus (Bus Interchange), heavy rail (HS2 Curzon Street Station) and coach (Birmingham Coach Station). The proposed extension will also connect these transport hubs to Snow Hill and New Street stations.

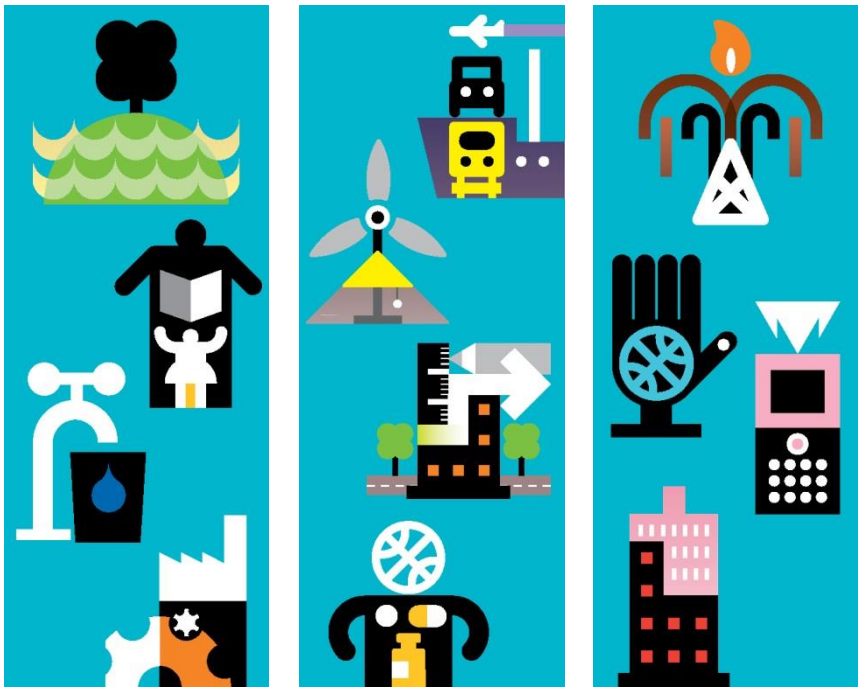
Based upon the summaries provided above it can be concluded that the BEE scheme can be introduced without causing significant detriment to the existing highway, the wider public transport network, pedestrian/cycling provision and its users.

Generally, the scheme will result in positive benefits and the proposals and mitigation measures to offset impacts are wholly aligned with the vision of BCC, its transport policy, and regeneration ambitions.

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Appendix A. Scoping Note



Birmingham Eastside Extension

Transport Assessment Scoping Study
MMD-300207-HS15-DOC-0000-0001

April 2015

Centro

Birmingham Eastside Extension

Transport Assessment Scoping Study
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1 Introduction

1.1 Background

Mott MacDonald has been commissioned by Centro to prepare a Transport Assessment (TA) to support the submission of a Transport and Works Act Order (TWAO) to extend the Midland Metro network from Corporation Street to Birmingham Eastside. This route is called the **Birmingham Eastside Extension** (BEE).

A series of scoping meetings have been held between Centro, Birmingham City Council (BCC) and Mott MacDonald. The outcomes from these meetings have informed the contents of this Scoping Study.

This scoping report concerns the TA only. Details related to the Traffic and Transport input into the Environment Impact Assessment, which will support the TWAO for BEE, will be included within the wider EIA Scoping Study.

In the current absence of any formal guidance for TA's the TA for BEE will be prepared in accordance with the principles of the Department for Transport's "Guidance on Transport Assessment" (March 2007). The TA will include consideration of how the scheme might affect motorised and non-motorised users as well as the more traditional impact assessment, where the impact of the scheme on the highway will be appraised.

This Scoping Study sets out the proposed key elements of the TA and outlines the key assumptions and methodology that are proposed to be employed.

1.2 Report Structure

This report is structured as follows:

- Chapter 2 outlines the metro scheme details
- Chapter 3 states the assessment details, as well as identifying the main committed transport and development schemes
- Chapter 4 examines the potential contents of the TA
- Chapter 5 discusses the modelling methodology and identifies the junctions that will be assessed within the TA
- Chapter 6 identifies the initial survey requirements to provide traffic, queue, pedestrian and parking survey data
- Chapter 7 summarises the findings and concludes the report.

Supporting information is included in appendices as follows

- Appendix A shows the two initial route options for BEE
- Appendix B shows the High Street Deritend route option in greater detail
- Appendix C shows the initial area identified for the road safety assessment
- Appendix D shows the junctions that have been identified for assessment
- Appendix E shows the initial area identified for a parking survey

- Appendix F shows the pedestrian crossings along the BEE route on High Street Deritend.

2 Metro Scheme Details

2.1 Introduction

The first Midland Metro Line (Line 1) was opened in 1999 and connects Wolverhampton City Centre with Birmingham City Centre (at Snow Hill Railway Station). In 2005, Centro secured TWAO powers to extend Line 1 of the Midland Metro from Snow Hill to Five Ways in Edgbaston (Birmingham City Centre Extension – BCCE).

The Government's Growth Deal announcement on 7 July 2014 included funding for the Greater Birmingham & Solihull Local Enterprise Partnership (GBS LEP) for an extension of Midland Metro from Stephenson Street to Eastside, serving the proposed HS2 Curzon Street station and onwards through Digbeth to High Street Deritend.

The scheme will further expand the Metro system, following route extensions to Hagley Road in Edgbaston (with a first phase to Centenary Square) and to Wolverhampton station. These extensions, the current investment in the system to New Street station and in a new tram fleet, and the arrival of High Speed 2 (HS2) will help deliver a world class integrated transport network for Birmingham and the West Midlands.

2.2 Programme

The key programme milestones for implementing BEE are as follows:

- The TA / ES are programmed to commence in March 2015
- Submission of the TWAO is programmed for Spring 2016
- Construction of the BEE is proposed to commence in 2018
- Completion and operation of BEE is programmed for 2021

2.3 Route Options

BEE will connect the existing Birmingham City Centre Extension (BCCE) to High Street Deritend. Two routes were considered to form the BEE route alignment:

- Fazeley Street Route – Option 1
- High Street Deritend Route – Option 2

The Fazeley Street and High Street Deritend Options provide potential route alignments for the Midland Metro. The two routes are shown in **Appendix A**.

The Fazeley Street Route would run along Fazeley Street from the junction with New Canal Street. It would turn onto Liverpool Street, where a stop would be located close to the junction with Great Barr Street and Heath Mill Lane. After this stop, the route would continue along Liverpool Street before turning onto Adderley Street, where a terminus and a new stop would be created.

The High Street Deritend Route runs southwards along New Canal Street before running onto Meriden Street and turning left onto High Street Deritend. The route would operate along the centre of High Street

Deritend, with a stop located close to the junction with Milk Street serving Digbeth Coach Station and The Custard Factory. The BEE terminal station is to be located here, although initial route plans saw the BEE route carrying on along High Street Deritend and turning left onto Adderley Street (where the initial terminus would be located)..

As part of an 'Initial Outline Business Case' a WebTAG assessment was undertaken by Steer Davies Gleave on behalf of Centro to determine the preferred route. The outcome was that the preferred route alignment was the: **High Street Deritend Option (which as stated has been recently revised)**.

2.4 BEE Tram Alignment Scheme Details

The proposed BEE track alignment as stated has been recently revised, with a shorter route being taken forward with the terminal station being located on High Street Deritend. For the purpose of the TA, the route will be split into three sections to allow for a clear and effective assessment of the impacts the BEE will have upon the wider transport network. The three sections and a description of the tram alignment are as follows.

2.4.1 Section 1: Corporation Street to Eastside Park

The proposed tram extension begins at the Corporation Street / Bull Street junction diverging from the existing tram system. The junction is currently signalised and will remain signalised. Pedestrian footpaths will be retained on either side of the road.

From the Corporation Street / Bull Street signalised junction the BEE route will continue towards the south east towards the Bull Street / Dale End junction. This junction will be signalised to provide priority to trams travelling through this junction. To enable the link from the Bull Street / Dale End junction to Moor Street Queensway / Albert Street junction, the King's Parade building will be demolished to enable two-lane running.

The track alignment will pass through an existing car park and on-street disabled parking bays consisting of 28 spaces (on New Meeting Street), and onto Albert Street (where 3 disabled on-street bays are located). All the current spaces will be removed, with five spaces included in the illustrative plans at New Meeting Street.

To the west of the Moor Street Queensway / Albert Street junction the first tram stop will be provided. Passengers will access the trams from a central platform between the outbound and inbound tracks. The track in both directions will be shared use, allowing for vehicles to access parking and retail service areas on New Meeting Street.

The existing signalisation of the Moor Street Queensway / Albert Street junction will be modified to provide priority to trams travelling through this junction. The existing access to the multi-storey car park north of this junction on Albert Street will be removed as part of the future Martineau Development.

To the east of the Moor Street Queensway / Albert Street junction a bus / tram interchange will be provided. This will run along the southern boundary of Hotel La Tour on a currently pedestrianized route. The interchange will provide 5 bus stands.

The track will be segregated from vehicular traffic in both directions from the Moor Street Queensway / Albert Street junction to the New Canal Street / Fazeley Street junction, allowing for an efficient and reliable service between the bus / tram interchange and the proposed HS2 tram stop. This section of the route follows the old Albert Street road which has been recently removed as well as part of Banbury Street to enable the development of the Eastside Park.

2.4.2 Section 2: Eastside Park to Meriden Street

In Section 2, the developed section of Eastside Park will not be impacted and the track alignment runs parallel to this site. Before reaching The Woodman public house the track takes an acute right turn in a southerly direction onto New Canal Street where a tram stop is proposed. This tram stop is also located opposite The Eagle and Tun public house and within the proposed HS2 terminal site. The track is segregated through this section barring an indicative HS2 highway crossing between the proposed tram stop on New Canal Street and this junction with Fazeley Street.

The existing New Canal Street / Fazeley Street signalised junction will be modified to allow priority for trams travelling through this junction. From this junction south towards Meriden Street the track is proposed to be shared use. Visibility at this junction has been highlighted as a possible issue. From the New Canal Street / Fazeley Street junction, the route will continue in a north-south direction towards Digbeth (B4100), via Meriden Street. The New Canal Street / Bordesley Street junction will remain a priority junction, as will the most southerly junction on New Canal Street (Meriden Street / Coventry Street).

Continuing south of the Meriden Street / Coventry Street junction the route passes through an existing left turn only signalised junction onto Digbeth (B4100); where the tram will also turn left.

2.4.3 Section 3: Meriden Street to Adderley Street

In Section 3 of the route, the tram will continue along Digbeth (B4100) and High Street Deritend in an eastbound direction up to the junction with Adderley Street. Along this section the tram track will be segregated from other vehicles for much of the length, with 2 vehicular lanes either side. At the junctions with Rea Street, Heath Mill Lane and Alcester Street, there will be short sections of shared track running in both directions at each of the junctions, allowing for both left and right turns at these junctions. The tram will have priority when travelling through the signalised junctions at Rea Street, Heath Mill Lane and Alcester Street.

The BEE route will terminate at a tram stop between the Milk Street and Floodgate Street junctions, and a loading bay will have to be removed on the inbound part of the track to incorporate the tram stop. The tram line will continue up to the junction of High Street Deritend and Heath Mill Lane to allow the trams to change from the outbound track to the inbound.

2.5 Operational Details

The service to be operated on the BEE route is currently assumed to consist of trams also operating on the Wolverhampton and EDGE/BCCE lines.

The BEE has been designed to accommodate the operation of double unit trams operating at 10 trams per hour (tph) in each direction. 10 trams operate per hour from Wolverhampton, 5 of these will continue along the BEE route and the other 5 will continue along the EDGE route (diverging at the Bull Street / Corporation Street junction).

Similarly, the 10 tph departing from the EDGE terminal will continue onto both the BEE route and Wolverhampton. Again, the 10 tph will split with 5 tph continuing along the BEE route and 5 tph continuing towards Snow Hill and Wolverhampton. All routes along the Midland Metro system therefore have a 6 minute headway.

It is not expected that the number of services on the existing tram line between Wolverhampton and Birmingham will increase.

Each tram will be 33 metres in length. Assuming that each passenger car unit equates to 5.75 metres in length, a typical tram will be 5.74 PCUs in length.

3 Impact Assessment

3.1 Introduction

The purpose of this section is to define the scenarios to be considered in order to assess the impacts of the BEE scheme and to identify any mitigation measures required.

3.2 Assessment Scenarios

3.2.1 Assessment Years

The TA and EIA will seek to identify the impact of the BEE route alignment by comparing future year scenarios, with and without the scheme in place. The BCC SATURN strategic transport model will be used to determine the future year flows and identify how the traffic flows will change with the scheme's introduction.

The future year assessments proposed to be considered are:

- 2021 Opening Year
- 2031 Design Year

These years have been selected for the following reasons:

- The scheme is proposed to be opened in 2021
- The DfT's Guidance on Transport Assessment suggests a design year for strategic schemes which is 10 years after opening year
- Forecasts years for the BCC SATURN model are 2021 and 2031

3.2.2 Base Year

In addition, it is proposed to calibrate individual junction models against a 2015 Base year. Base Year flows will be obtained manually at each of the concerned junctions. Traffic flows are to be obtained at all of the junctions along the BEE track alignment, as well as further junctions (offline junctions) that may also be impacted by the scheme.

The Base Year data will enable peak periods to be derived across the assessment area.

3.2.3 Modelling Scenarios

For the future year assessments, it is proposed to consider the following scenarios:

- The 'without tram', or **Do Minimum (DM)** scenario, which will include:
  - Background traffic growth
  - Committed developments (known schemes with planning consent)
  - Committed transport schemes
- The 'with tram', or **Do Something (DS)** scenario, which will include:

- Background traffic growth
- Committed developments (known schemes with planning consent)
- Committed transport schemes
- BEE route alignment scheme (including mitigation)

3.3 Committed Schemes and Developments

3.3.1 Introduction

BCC will develop SATURN models for the following:

- 2011 Base Year (**not the TA Base Year**)
- 2021 Open Year
- 2031 Future / Design Year

Therefore, an exercise has been undertaken to identify committed transport and development schemes that will be completed within these timeframes. These are summarised in the following two sections.

3.3.2 Committed Transport Schemes

In order to assess future scenarios upon the transport network committed transport developments will need to be included in the capacity modelling. Committed transport developments that are to be included will be agreed between Birmingham City Council, Centro and Steer Davies Gleave. The committed developments will then be incorporated into the SATURN model in order to establish the traffic flows for the future year scenarios, bearing in mind the committed transport schemes.

3.3.3 Committed Developments

Non-transport related developments will also have an impact upon the transport network, and in order to accurately assess the future impact upon the transport network these must be included in the assessments. Committed developments that are to be included will be agreed between Birmingham City Council, Centro and Steer Davies Gleave. The committed developments will then be incorporated into the SATURN model in order to establish the traffic flows for the future year scenarios.

4 Transport Assessment

4.1 Introduction

The purpose of this section is to describe the scope of impacts to be considered by the TA.

4.2 Transport Assessment Guidance

The Guidance on Transport Assessment (2007) published by the Department for Transport was withdrawn as guidance in October 2014. As yet, no new guidance has been produced to replace this document. It is therefore proposed that the Guidance on Transport Assessment (2007) should still be used as the basis for the TA to support the TWAO for BEE, but following the National Planning Policy Framework (2012) principles.

Paragraph 32 of the National Planning Policy Framework (NPPF) states that all developments that generate significant amounts of transport movement should be supported by a Transport Assessment. In this case, the BEE route alignment will have a material impact on the surrounding highway network in terms of changes to traffic movement.

NPPF states that key issues to consider at the start of preparing a Transport Assessment should include:

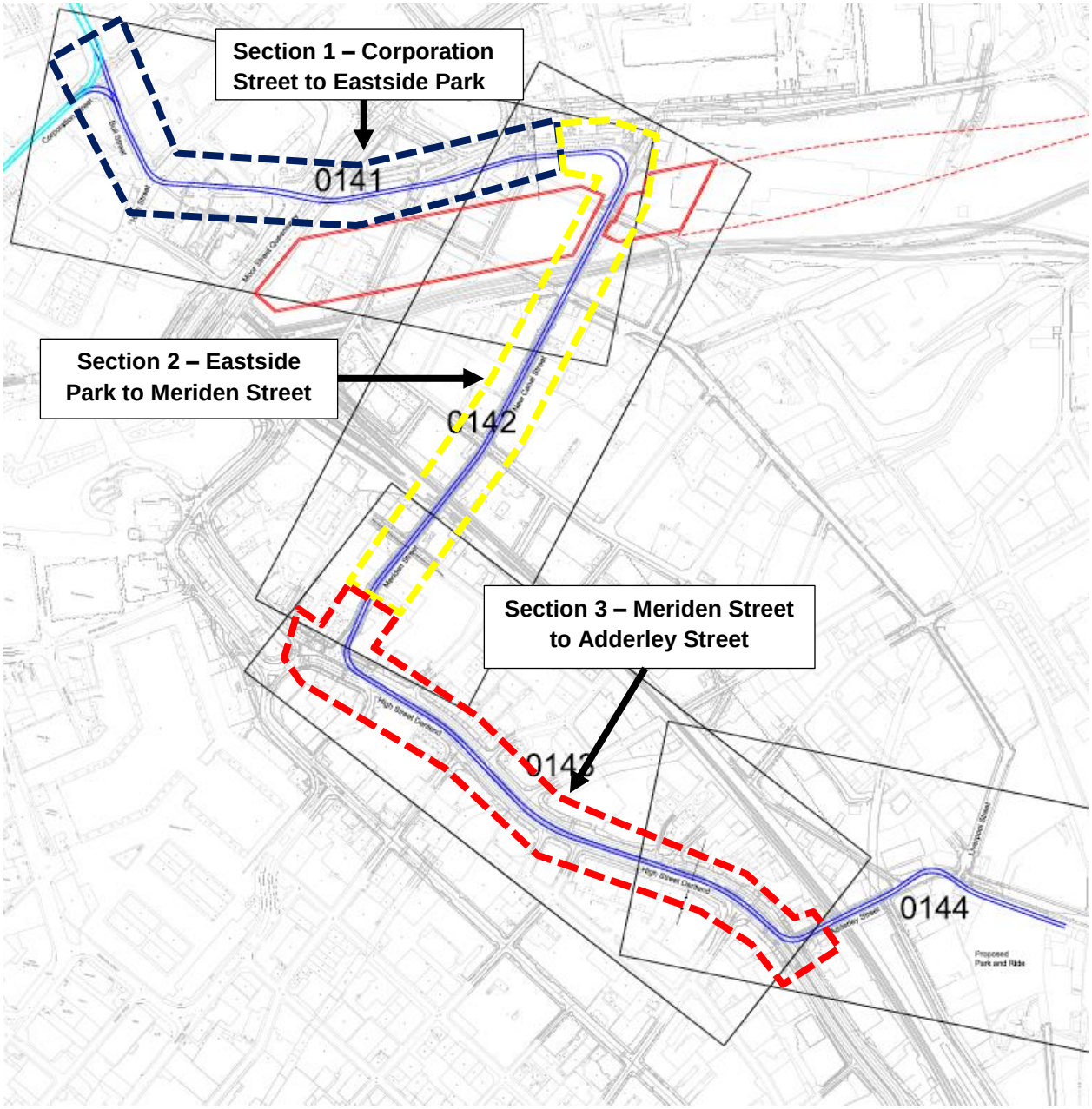
- The planning context of the development proposal
- Appropriate study parameters (i.e. area, scope and duration of study)
- Assessment of public transport capacity, walking/ cycling capacity and road network capacity
- Road trip generation and trip distribution methodologies and/ or assumptions about the development proposal
- Measures to promote sustainable travel
- Safety implications of development
- Mitigation measures (where applicable) – including scope and implementation strategy.

This Scoping Assessment has been developed within the context of this guidance.

4.3 Study Area

The suggested study area for reporting purposes (as separate to the area of influence) is shown in Figure 4.1.

Figure 4.1: Study Areas



Source: Centro / Mott MacDonald

These are summarised as follows:

- Section 1 – Corporation Street to Eastside Park
- Section 2 – Eastside Park to Meriden Street
- Section 3 – Meriden Street to Adderley Street

4.4 National and Local Policy

The TA will refer to the following national guidance:

- National Planning Policy Framework (2012)
- 'Creating growth, cutting carbon: making sustainable local transport happen', January 2011
- 'Future of Transport – A network for 2030', July 2004

The TA will refer to the following local guidance:

- The Greater Birmingham & Solihull Local Enterprise Partnership Strategy for Growth (2013)
- West Midlands Local Transport Plan (2011-2026)
- Towards a World Class Integrated Transport Network (2013)
- Birmingham Mobility Action Plan (2014)
- Birmingham Development Plan 2031
- Big City Plan (2010)
- Birmingham Connected
- Curzon Street HS2 Masterplan

4.5 Transport Impact Overview

The receptors to be assessed are summarised in Table 4.1. This table considers the impact for each of these receptors. The level of assessment required will be explained in more detail in the subsequent sections.

Table 4.1: Estimate of net impact assessment requirements per receptor

Receptor	Net Impact?	Reason	Assessment Required
Traffic (changes in patterns and flow)	YES	BEE will have an impact on junction capacity along the whole route alignment.	Strategic and local modelling assessment of impacts.
Bus services	YES	BEE will have a potential impact on bus movements along the length of the route.	Consideration of impacts on bus routeing, stop positions and delay.
Light Rail	YES	BEE will interact directly with the Birmingham City Centre Extension route at the junction of Corporation Street / Bull Street.	Consideration of operational impacts between trams on different routes.
Heavy rail	YES	BEE will pass through the proposed HS2 rail station at Curzon Street.	Consideration of operational interaction between trams and HS2 station.
Pedestrians	YES	BEE route will affect pedestrian routes and safety.	Consideration of pedestrian routes and safety.

Receptor	Net Impact?	Reason	Assessment Required
Cyclists	YES	BEE route will affect cycle routes and safety.	Consideration of cycle routes and safety.
Parking	YES	BEE could have an impact on existing parking provision along the route, including off street surface and multi-storey car parks, and on street car parking.	Consideration of potential reductions in on street parking and impacts on the access to existing surface and multi storey car parks.
Taxis	Potentially	BEE could have an impact on taxi movements along the whole route.	Consideration of impacts on taxi routeing, rank positions and delay.
Coaches	YES	BEE will pass Digbeth Bus Station.	Consideration of operational interaction between trams and Digbeth Coach Station.
Access and servicing	YES	BEE needs to accommodate access and servicing arrangements along the whole route.	Consideration of adjacent access and servicing arrangements.
Emergency services	Potentially	BEE could have an impact on emergency service routes and access, particularly along High Street Deritend.	Consideration of emergency service routes and potential delay.
Road Safety	YES	Running of the route along the whole alignment will result in an increase in modal conflict opportunities.	Road safety assessment.
Construction	YES	The construction of BEE will have an impact on the surrounding highway	Construction impact assessment.

4.6 Detailed Transport Impacts

4.6.1 Impacts on Traffic Patterns and Flow

The traffic impact assessment will focus on how the BEE alignment impacts on local traffic patterns and flow. A summary of this process is included here, but a more detailed description is provided in the next section.

Strategic Modelling

Using BCCs SATURN model, an extensive traffic modelling assessment of the scheme proposals will be undertaken to identify what impact BEE will have on the highway and its users.

It is understood that BCC will undertake these model runs and provide Centro with the output results. The outputs will be as follows:

- 2011 Base Year (without BEE)
- 2021 Open Year (without BEE)
- 2021 Open Year (with BEE)
- 2031 Design Year (without BEE)
- 2031 Design Year (with BEE)

Junction Capacity Assessments

The outputs of the SATURN model run will then be input to individual junction capacity models to determine what measures are required to mitigate the net impacts of the BEE alignment scheme and to provide detail on the impacts of Metro on the localised highway network.

Software packages to be used in this study include:

- LinSig Version 3 for the modelling of signalised junctions
- ARCADY 9 for the modelling of roundabouts and mini roundabouts
- PICADY 9 for the modelling of priority junctions

4.6.2 Impacts on Buses

The bus impact assessment will focus on how the BEE alignment impacts on bus infrastructure and routes.

The main changes that are proposed in the area of the BEE route alignment are mainly related to the proposed HS2 Rail Station at Curzon Street and the impact on existing bus routes on Moor Street Queensway and the surrounding network.

Along the BEE route alignment the main impacts are expected to occur at the following locations:

- Bull Street
- Moor Street Queensway
- Bus / Tram Interchange adjacent to Hotel La Tour (Park Street)
- High Street Deritend (where it is currently proposed to remove the existing bus lanes).

The potential interaction with Sprint will also be assessed as part of this assessment. Sprint is a concept of ‘bus-based rapid transit’ which will provide a ‘turn-up-and-go’ timetable with journey times and comfort levels that are based on those of light rail systems (trams), while maximising the flexibility and lower costs associated with bus technology.

The second route to be developed (the first route links Birmingham City Centre with Quinton via Broad Street and Five Ways) will link Birmingham City Centre and Birmingham Airport via the A45 Coventry Road, serving the proposed HS2 Interchange and Birmingham International Station. The route in the vicinity of the BEE route alignment has not yet been developed, but the Transport Assessment will consider possible impacts on Sprint.

Where adverse impacts are identified, the assessment will consider what mitigation is appropriate.

4.6.3 Impacts on Light Rail

The BEE route alignment will join the BCCE route at the Corporation Street / Bull Street junction. The interaction between the two routes will be assessed in the TA.

4.6.4 Impacts on Heavy Rail

The BEE route alignment will pass the site for the proposed HS2 Railway Station at Curzon Street. Therefore the future plans for HS2 will be considered and the impacts of the changes. In addition, links between the tram stop at Hotel La Tour to Moor Street Rail Station will be considered.

Impacts will be considered in terms of changes to:

- Highway network surrounding HS2
- Management during construction of HS2
- Pedestrian linkages to Moor Street Queensway

4.6.5 Impacts on Pedestrians

The pedestrian impact assessment will focus on how the BEE alignment impacts on the pedestrian environment along the whole route. Key pedestrian facilities along the BEE alignment route which will be considered in the assessment include:

- Corporation Street / Bull Street junction
- Moor Street Queensway / Albert Street junction
- Pedestrian movements in the vicinity of the proposed bus/tram interchange adjacent to Hotel La Tour
- BEE in the vicinity of the proposed HS2 Rail Station
- Pedestrian movements in the vicinity of the proposed tram stop on Meriden Street
- Assessment of changes proposed for crossings at the High Street Deritend / Meriden Street junction
- Pedestrian movements in the vicinity of the proposed tram stop on High Street Deritend (particularly related to access to the Birmingham Coach Station)
- Pedestrian movements at the High Street Deritend / Alcester Street junction
- Pedestrian movements at the High Street Deritend / Adderley Street junction

4.6.6 Impacts on Cycling

The cycling impact assessment will focus on how the BEE alignment impacts on the cycling environment along the whole route. This will focus on existing cycle facilities along the route including existing cycle lanes and routes.We will assess cycling routes and infrastructure along the BEE route alignment, and assess the impact of the proposed changes. Impacts will be considered in terms of changes to:

- Route length
- Availability of cycling routes
- Management of conflict points

- Tram rails within cycle routes
- Accident exposure and risk

4.6.7 Where adverse impacts are identified, the assessment will consider what mitigation is appropriate.Impacts on Parking

The car parking impact assessment will focus on how the BEE route alignment will effect parking provision along the whole route. This will focus on the following types of parking:

- On street
- Off street surface
- Multi-storey

On street parking is predominantly found on the following sections:

- Along New Canal Street and Meriden Street (although not designated on-street parking)
- On-street disabled parking bays on New Meeting Street and Albert Street (although parking facilities here are minimal)

There are a number of surface car parks that have access off the BEE route alignment. These are a mixture of surface car parks and parking for businesses and shops. These are located throughout the BEE route alignment.

There is one multi-storey car park that will be directly affected by the BEE route alignment. The High Street Car Park is located on Dingley's Passage which is accessed off Albert Street. There are no existing Park and Ride sites that are located along the BEE route alignment

Where adverse impacts are identified, the assessment will consider what mitigation is appropriate.

4.6.8 Impacts on Taxis

The taxi impact assessment will focus on how the BEE alignment impacts on the taxi infrastructure and delay along the whole route.

There are three taxi ranks located in close proximity to the BEE route; situated on Dale End (north of the Bull Street / Dale End junction), along High Street Deritend and at Mill Lane (serving the coach station).

The Dale End rank has been recently revised with the changes in road layout related to the introduction of the BCCE. The Dale End rank is of vital importance in Birmingham's taxi network and access to the rank must be safeguarded. It is thought the three taxi ranks will continue to operate alongside the BEE proposal.

The main impact is expected to be changes in delay for taxis through the BEE route alignment and this will be assessed in detail through the strategic modelling that is proposed for this study.

Where adverse impacts are identified, the assessment will consider what mitigation is appropriate.

4.6.9 Impacts on Coaches

The coach impact assessment will focus on how the BEE alignment impacts on coach infrastructure and services..

The main area for consideration will be along High Street Deritend where access to Birmingham Coach Station (the National Express Coach Station) is taken. We will consider coaches accessing the coach station and assess the impact of the changes related to the BEE route alignment along High Street Deritend.

Where adverse impacts are identified, the assessment will consider what mitigation is appropriate.

4.6.10 Impacts and Access and Servicing

The access and servicing impact assessment will focus on how the BEE route alignment impacts on access and servicing of properties along the whole route. Where adverse impacts are identified, the assessment will consider what mitigation is appropriate.

4.6.11 Impacts on Emergency Services

The emergency services impact assessment will focus on how the BEE route alignment will affect access for emergency vehicles along the whole route. In particular, High Street Deritend is designated as a priority route for emergency services within Birmingham, linking the A450 Bordesley to Birmingham City Centre.

Where adverse impacts are identified, the assessment will consider what mitigation is appropriate.

4.6.12 Impacts on Road Safety

The road safety assessment will focus on the route of the BEE route alignment. We will firstly consider road safety along the entire route. This will include an assessment of the most recent 5 year period of accident history.

For the purpose of the TA it is proposed to restrict the accident review to the area immediately surrounding the route alignment. A review of accident data upon the identified offline junctions will also be undertaken and included within the assessment. The area is shown in **Appendix C**. It is proposed that 5 years of accident records will be assessed in the Transport Assessment.

4.6.13 Impacts during Construction

The construction impact assessment will focus on the BEE scheme construction impacts.

We will consider the construction traffic management implications of building the scheme on the surrounding highway network. This section of the TA will utilise information provided in the Construction Management Plan. Where adverse impacts are identified, the assessment will consider what mitigation is appropriate.

4.7 Structure of the Transport Assessment

The proposed structure is described as follows:

- **Chapter 1: Introduction**
  - Existing tram routes
  - Future tram expansion
  - Birmingham Eastside Extension
  - Scheme objectives
- **Chapter 2: The Transport Assessment**
  - Background
  - Purpose of the study
  - Extent of the study area
  - Structure of the assessment
- **Chapter 3: Scheme Description**
  - Introduction
  - Route description
  - Operations
  - Scheme Delivery
- **Chapter 4: Policy Review**
  - Local Policy
  - National Policy
  - Conclusions
- **Chapter 5: Impact on Traffic**
  - Modelling methodology
  - Forecasting approach
  - Do Minimum forecast (without BEE)
  - Do Something forecast (with BEE)
  - Committed transport schemes
  - Committed developments
  - Predicted traffic flows
  - Detailed junction assessments: On line junctions
  - Identification of Off line impact
  - Conclusions
- **Chapter 6: Impact on Bus Services**
  - Introduction
  - Bus facilities and routes

- Summary

- **Chapter 7: Impact on Light Rail**
  - Policy fit
  - Existing tram operations
  - Proposed tram operations
  - Conclusions

- **Chapter 8: Impact on Heavy Rail**
  - Existing baseline
  - Future Schemes (HS2)
  - Conclusions
- **Chapter 9: Impact on Coaches**
  - National Express Coach Station
  - Conclusions
- **Chapter 10: Impact on Walking and Cycling**
  - Introduction
  - Connectivity
  - Impact on pedestrian and cycling facilities
  - Summary
- **Chapter 11: Impact on Parking**
  - On street parking
    - Informal
    - Formal
  - Pay and Display Parking
  - Park and Ride
  - Other Private Parking
  - Conclusions
- **Chapter 12: Impact on Taxis**
  - Introduction
  - Existing provision
  - Summary
- **Chapter 13: Impact on Services and Access**
  - Introduction
  - Data collection
  - Strategic and specific property impacts
  - Emergency access
  - Conclusions
- **Chapter 14: Impact on Road Safety**
  - Accident History Summary
  - Detailed assessment

  - Summary
- **Chapter 15: Impact on Emergency Services**
  - Impact of Development on Emergency Services
  - Conclusions
- **Chapter 16: Impact of Construction**
  - Construction methodology
  - Code of construction practice
  - The Construction Management Plan
  - Traffic
  - Public transport services
  - Pedestrians
  - Cyclists
  - Conclusions
- **Chapter 17: Summary and Conclusions**
  - Policy fit
  - Traffic
  - Light rail
  - Heavy rail
  - Buses
  - Coaches
  - Pedestrians and cyclists
  - Parking
  - Taxis
  - Emergency Services
  - Servicing and access
  - Construction and phasing
  - Highway safety
  - Overall conclusions

5 Junction Impact Assessment

5.1 Introduction

The purpose of this section is to expand on the proposed scope of the traffic pattern and flow impact assessment.

5.2 Proposed Modelling Methodology

The future year scenarios described in Section 3.2 above will firstly be assessed using BCC's strategic SATURN model. For signalised junctions affected by the tram, flows from the SATURN DM scenario will be tested in LINSIG so that signal timings can be developed and then input back into the SATURN DM model.

The SATURN model results will allow us to identify:

- Full area of influence of the BEE scheme
- DN and DM flows at affected junctions

The flows for affected junctions will then be used to assess the junctions in more detail, using the following software:

- LinSig Version 3: LinSig is a software tool developed by JCT Consultancy which allows traffic engineers to model traffic signals and their effect on traffic capacities and queuing. As well as modelling the effects of traffic signals LinSig also optimises signal timings to reduce delay or increase capacity at a junction or group of interlinked junctions.
- PICADY 9: PICADY (Priority Intersection Capacity and Delay) is a tool within the Junctions 9 software programme that has been produced by the Transport Research Laboratory (UK) for the assessment of priority junctions.
- ARCADY 9: ARCADY (Assessment of Roundabout Capacity And Delay) is a tool within the Junctions 9 software programme that has been produced by the Transport Research Laboratory (UK) for the assessment of roundabouts.

It is noted that SATURN flows will not be input directly into these individual junction models. Instead, it is proposed to use the methodology outlined in DMRB Volume 12, Section 1, Part 1, Traffic Advisory Model. Using the SATURN model, we will measure the changes in flow between the development scenarios (Do Minimum and Do Something), as well as the changes in flows between the base year, opening year and design year. This will then be applied to the base year observed traffic data to derive future year flows for the individual junctions.

Where the requirement for mitigation is identified, the measures will be tested for adequacy in the SATURN model and the resulting traffic flows will be input into the individual junction models, where appropriate.

5.3 Potential Modelling

It may be prudent to also consider the development of a microsimulation model to assess the impacts of the BEE scheme. If required, we propose a similar approach to that used for other schemes, including:

- BCCE
- CSQ
- Five Ways Extension.

5.4 Area of Influence

As noted above, the area of influence will be determined by the outputs from the SATURN model following consultation with BCC and Centro. At this stage, we have identified the major junctions on the BEE route alignment between the Corporation Street / Bull Street junction and the tram stop at the terminus of the BEE route on High Street Deritend and suggested whether or not they are likely to require assessment. Our suggestions are presented in the following two sub-sections.

5.4.1 On Line Junctions

Table 5.1 summarises the 'On Line' junctions (those that are directly on the BEE route alignment) that have been considered for inclusion within the TA. Justification for their inclusion / exclusion is also noted. The location of the on line junctions are shown in **Appendix D**.

Table 5.1: Key Online Junctions Located Along the BEE Route Alignment

Ref	Junction	Existing	Proposed	Requires Capacity Assessment
1	**Corporation Street / Bull Street**	**Signalised**	**Signalised**	**YES – BEE has a direct impact on this junction**
2	**High Street / Bull Street**	**Priority**	**Signalised**	**YES – BEE has a direct impact on this junction**
3	Albert Street / New Meeting St	Priority	Priority	NO – opposing traffic flows expected to be low
4	**Moor Street Queensway / Albert Street**	**Signalised**	**Signalised**	**YES – BEE has a direct impact on this junction**
5	**New Canal Street / Fazeley Street**	**Signalised**	**Signalised**	**YES – BEE has a direct impact on this junction**
6	**New Canal Street / Bordesley Street**	**Priority**	**Priority**	**YES – whilst it is assumed that the direct impact of BEE will be low, BCC have requested that this junction is assessed as a result of changes in traffic flows that may occur as a direct result of BEE.**
7	New Canal Street / Coventry Street	Priority	Priority	NO – BEE has a direct impact on this junction, but traffic flows are low
8	**High Street Deritend / Meriden Street**	**Signalised**	**Signalised**	**YES – BEE has a direct impact on this junction**
9	New Canal Street / Mill Lane	Priority	Priority	NO - this junction has a left in / left out arrangement. BEE will not directly affect the

Ref	Junction	Existing	Proposed	Requires Capacity Assessment
				operation of this junction, other than High Street Deritend will reduce from 3 to 2 lanes.
10	New Canal Street / Oxford Street	Priority	Priority	NO - BEE will not directly affect the operation of this junction.
11	**High Street Deritend / Rea Street**	**Signalised**	**Signalised**	**YES – if right turn is allowed from Rea Street (currently banned) then BEE will have a direct impact on this junction. In addition, the westbound lanes on High Street Deritend will reduce from 3 to 2 lanes.**
12	High Street Deritend / Milk Street	Priority	Priority	NO – BEE has a direct impact on this junction (ie the right turn from High Street Deritend to be removed), but traffic flows are low. The proposed tram stop is located immediately to the east of this junction.
13	High Street Deritend / Floodgate Street	Priority	Priority	NO – this junction has a left in / left out arrangement. BEE will not directly affect the operation of this junction.
14	High Street Deritend / Stone Yard	Priority	Priority	NO - this junction has a left in / left out arrangement. BEE will not directly affect the operation of this junction, other than High Street Deritend will reduce from 3 to 2 lanes.
15	High Street Deritend / Chapel House Street	Priority	Priority	NO - this junction has a left in / left out arrangement. BEE will not directly affect the operation of this junction, other than High Street Deritend will reduce from 3 to 2 lanes.
16	**High Street Deritend / Heath Mill Lane**	**Signalised**	**Signalised**	**YES – BEE has a direct impact on this junction**
17	**High Street Deritend / Alcester Street**	**Signalised**	**Signalised**	**YES – BEE has a direct impact on this junction**
18	**High Street Deritend / Adderley Street**	**Priority**	**Priority**	**YES – BEE has a direct impact on this junction**

Source: BEE Route Alignment Drawings

5.4.2 Off Line Junctions

Table 5.2 summarises the 'Off Line' junctions (those that are not on the BEE route alignment but will be affected by the scheme) that have been considered for inclusion within the TA. Justification for their inclusion / exclusion is also noted. The location of the off line junctions are shown in **Appendix D**.

Table 5.2: Key Offline Junctions Located Along the BEE Route Alignment

Ref	Junction	Existing	Proposed	Requires Capacity Assessment
1	Moor Street Queensway / Masshouse Lane	Signalised	Signalised	YES – it is anticipated that the UTC system is linked with the Moor Street Queensway / Albert Street junction.
2	Moor Street Queensway / Chapel Street	Signalised	Signalised	YES – it is anticipated that the UTC system is linked with the Moor Street Queensway / Albert Street junction.
3	Moat Lane Gyratory	Signalised	Signalised	YES – Interaction with the Tram and future changes to the layout related to the Southside development.
4	Heath Mill Lane / Liverpool Street	Signalised	Signalised	MAYBE – Potential improvements associated with the Curzon Street Masterplan and offline BEE impacts as a result of re-routed traffic

Source: BEE Route Alignment Drawings

6 Survey Requirements

6.1 Introduction

The purpose of this section is to summarise what survey data will be required to complete the TA. Survey data will be required to:

- Validate junction capacity models, particularly for the 2015 base scenario
- Quantify parking that will be affected by the BEE route
- Quantify the impact on existing pedestrian routes that will be affected by the BEE route.

6.2 Traffic

6.2.1 Manual Counts

For calibration purposes new traffic surveys will need to be commissioned for the main junctions on the BEE route alignment to enable junction capacity assessments to be undertaken for the 2015 Base Year. These new traffic surveys will be undertaken for the following periods:

- Weekday AM (07:00-10:00)
- Weekday PM (16:00-19:00)
- Saturday (11:00-17:00).

These traffic surveys should record every turning movement at the junction at 15 minute intervals for the following vehicle categories:

- Pedal Cycle
- Motor Cycle
- Cars and Light Goods Vehicles
- Other Goods Vehicle 1
- Other Goods Vehicle 2
- Bus and Coaches.

The data collection will be undertaken using video footage at each of the online and offline junctions. This will allow for more accurate traffic counts, as well as enabling a review of the data at a later stage. This will be helpful for calculating queue data in order to validate junction capacity assessments, and adds consistency to the assessment (both queue and traffic count data taken from the same periods on the same days).

A search of existing traffic count data has been undertaken to identify whether there is existing traffic survey information that could be used for the 2015 Base Year assessments. This is summarised in Table 6.1. The reference numbers of each junction refer to the labels shown on the diagram contained within **Appendix D**.

Table 6.1: Availability of Traffic Data at Key Junctions

Ref	Junction	Existing Data	New Survey Required
	ON LINE		
1	Corporation Street / Bull Street	No Data Available. This junction is currently affected by BCCE works. No survey can be done at this junction until works have been completed and the tram is operational. Use data included in the BCCE LinSig model to assess the existing situation.	MAYBE – cannot be undertaken before the school summer holiday break due to the ongoing BCCE works. We will review work that was done previously at the junction and use this data accordingly.
2	High Street / Bull Street	No data Available	YES
3	Albert Street / New Meeting Street	No data available	NO
4	Moor Street Queensway / Albert Street	No data available	YES
5	New Canal Street / Fazeley Street	CS07-Classified Turning Counts (CTC) and Queue length survey , Thursday 14/06/2012 (07:00-10:00, 16:00-19:00), Arup West Midlands HS2 Traffic Surveys 2012	YES – it is recommended that a 2015 survey is undertaken so that we can identify trends in changes in traffic flows between previous years and 2015.
6	New Canal Street / Bordesley Street	No data available	YES
7	New Canal Street / Coventry Street	No data available	NO
8	High Street Deritend / Meriden Street	No data available	YES
9	New Canal Street / Mill Lane	No data available	NO
10	New Canal Street / Oxford Street	No data available	NO
11	High Street Deritend / Rea Street	No data available	YES
12	High Street Deritend / Milk Street	No data available	NO
13	High Street Deritend / Floodgate Street	No data available	NO
14	High Street Deritend / Stone Yard	No data available	NO
15	High Street Deritend / Chapel House Street	No data available	NO
16	High Street Deritend / Heath Mill Lane	CS68-Classified Turning Counts (CTC) and Queue length survey, Thursday 14/06/2012 (7:00-10:00, 16:00-19:00), Arup West Midlands HS2 Traffic Surveys 2012	YES – it is recommended that a 2015 survey is undertaken so that we can identify trends in changes in traffic flows between previous years and 2015.
17	High Street Deritend / Alcester Street	No data available	YES
18	High Street Deritend / Adderley Street	No data available	YES
19	Adderley Street / Upper Trinity Street	No data available	NO
20	Adderley Street / Lower Trinity Street	No data available	NO
21	Adderley Street / Liverpool Street & Liverpool Street / Allcock Street	No data available	YES

Ref	Junction	Existing Data	New Survey Required
	OFF LINE		
1	Moor Street Queensway / Masshouse Lane	Site 2- CTC, Queue, Sat, Sig, Thursday 23/05/2013 (7:00-10:00, 16:00-19:00), Arup Survey Report for HS2 Birmingham 2013	YES – it is recommended that a 2015 survey is undertaken so that we can identify trends in changes in traffic flows between previous years and 2015.
2	Moor Street Queensway / Chapel Street	Site 3- CTC, Queue, Sat, Sig, Thursday 23/05/2013 (7:00-10:00, 16:00-19:00), Arup Survey Report for HS2 Birmingham 2013	YES – it is recommended that a 2015 survey is undertaken so that we can identify trends in changes in traffic flows between previous years and 2015.
3	Moat Lane Gyratory	TCR11638 Tuesday 19/11/2013 (7:30-9:30, 16:30-18:30). East side of the gyratory only. No queue data available.	YES – it is recommended that a 2015 survey is undertaken incorporating the whole gyratory.
4	Heath Mill Lane / Liverpool Street	CS06-CTC (Classified Turning Counts), Day: 14/06/2012, Period: 7:00-10:00, 16:00-19:00	YES – BCC have identified this junction as a location where impacts may occur as a result of BEE becoming operational.

Source: SPECTRUM / HS2

6.3 Parking

It has been identified that the following areas along the BEE route alignment experience on street parking:

- Section along New Canal Street and Meriden Street (although not designated on-street parking)
- On-street disabled parking bays on New Meeting Street and Albert Street (although parking facilities here are minimal)

It is proposed that a beat survey is undertaken to quantify the numbers of vehicles parked on the two sections identified above. We are also proposing to review parking on the surrounding area that will be directly affected by BEE. It is proposed that this is done on one Weekday between the hours of 07:00 and 19:00.

Appendix E shows an area recommended for parking surveys. For the New Canal Street / Meriden Street section we recommend that the following information is recorded for each of the parked vehicles on an hourly basis:

- Vehicle type and partial registration
- Parking controls in operation
- Duration of stay
- Street name.

6.4 Pedestrian

A search of existing traffic count data has been undertaken to identify whether there is existing pedestrian survey information that could be used for the 2015 Base Year assessments. The available data is summarised in Table 6.2.

Table 6.2: Availability of Pedestrian Data at Key Junctions

Junction	Existing Data
ON LINE	
Corporation Street / Bull Street	P5R6511 Nov 2010 (7:00-19:00)
High Street / Bull Street	No data available
Albert Street / New Meeting Street	No data available
New Street Queensway / Albert Street	P5R11588 / P5R11589 / P5R9490 (all Oct 2010) P5R9490A / P5R11588A / P5R11589A (Nov 2010) P7,P8,P19,P20,P21,P22,P30,P31, Thursday 23/05/2013 (7:00-10:00, 16:00-19:00), Arup Survey Report for HS2 Birmingham 2013
New Canal Street / BEE Alignment	No data available
New Canal Street / Fazeley Street	No data available
New Canal Street / Bordesley Street	No data available
New Canal Street / Coventry Street	No data available
High Street Deritend / Meriden Street	No data available
New Canal Street / Mill Lane	No data available
New Canal Street / Oxford Street	No data available
High Street Deritend / Rea Street	No data available
High Street Deritend / Milk Street	No data available
High Street Deritend / Floodgate Street	No data available
High Street Deritend / Stone Yard	No data available
High Street Deritend / Chapel House Street	No data available
High Street Deritend / Heath Mill Lane	No data available
High Street Deritend / Alcester Street	No data available
High Street Deritend / Adderley Street	No data available
Adderley Street / Upper Trinity Street	No data available
Adderley Street / Lower Trinity Street	No data available
Adderley Street / Liverpool Street & Liverpool Street / Allcock Street	No data available
OFF LINE	
Moor Street Queensway / Masshouse Lane	P4R11570 Tu 11/05/2010 (7:00-19:00) P5R11570 Tu 19/10/2010 (7:00-19:00) P5R11570A Sa 06/10/2010 (7:00-19:00)

Junction	Existing Data
	Site 2- Ped, Th 23/05/2013 (7:00-10:00, 16:00-19:00), Arup Survey Report for HS2 Birmingham 2013
Moor Street Queensway / Chapel Street	P5R11190, P5R11190A Tu 19/10/2010 (7:00-19:00) P5R11190B, P5R11190C Sa 06/11/2010 (9:00-15:00) Site 3-Ped, 23/05/2013 (7:00-10:00, 16:00-19:00), Arup Survey Report for HS2 Birmingham 2013

Source: SPECTRUM / HS2

It can be observed in Table 6.2 that the only pedestrian data available within the last five years is mainly from the surveys that were undertaken in 2013 to support the transport work undertaken for HS2.

Following meetings with BCC it was suggested that the main pedestrian impacts that should be looked at are along High Street Deritend. **Appendix F** shows the location of the pedestrian crossings located on High Street Deritend. This includes new pedestrian crossings, existing crossings that will not be affected and those that will be removed.

We have assumed that pedestrian counts should be taken at all designated pedestrian crossings along the BEE track alignment.

We propose that surveys are undertaken to determine how many pedestrians cross at the locations (one weekday between 07:00 and 19:00), as well as using on site observations to determine the high level origin and destination of these trips.

6.5 Summary

The surveys identified above will have to be undertaken in a neutral month. Before the summer school holiday period in late July and August, the months of May and June fit this criteria.

7 Summary

7.1 Overview

Mott MacDonald has been commissioned by Centro to prepare a Transport Assessment to support the submission of an application to support a Transport and Works Act Order powers to extend Midland Metro as far as High Street Deritend, Digbeth.

To support this TWAO, BCC and Steer Davies Gleave are currently updating the Birmingham City Centre SATURN model to include the latest committed schemes and developments. The following assessment years will be available:

- 2011 Base Year
- 2021 Open Year
- 2031 Future Year

The 2021 and 2031 scenarios will be assessed as a:

- Do Minimum Scenario (without BEE)
- Do Something Scenario (with BEE)

7.2 Response Required

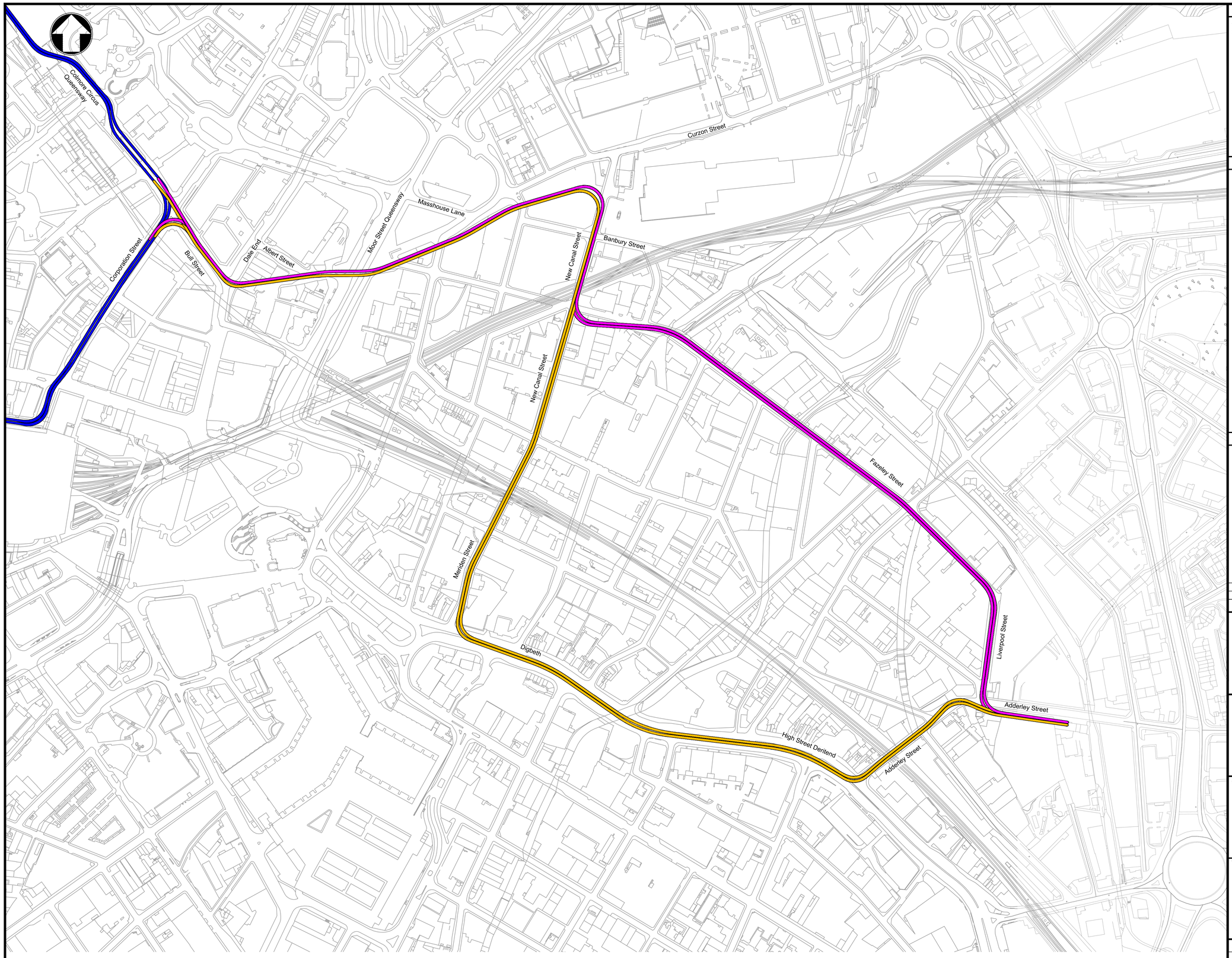
In response to the scope set out in this document we require BCC to confirm that they agree to the:

- Overall assessment approach
- List of committed schemes and developments
- Modelling methodology
- List of junctions identified for assessment
- Traffic survey requirements

Appendices

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Appendix A. Route Options



PLAN

Scale - 1:2500

1:2500 0 125m 250m

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Notes

1. All dimensions are in metres unless otherwise stated.
2. Do not scale any items or information from this drawing.

Key to symbols

- Fazeley Street Option
- High Street Deritend Option
- Birmingham City Centre Extension

Reference drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd
P3	02/09/2014	MAW	Route Option Updated and BCCE Added	CMS	GJL
P2	15/07/2014	MAW	Updated Route Option	CMS	GJL
P1	08/05/2014	AJB	Preliminary Issue	CMS	GJL

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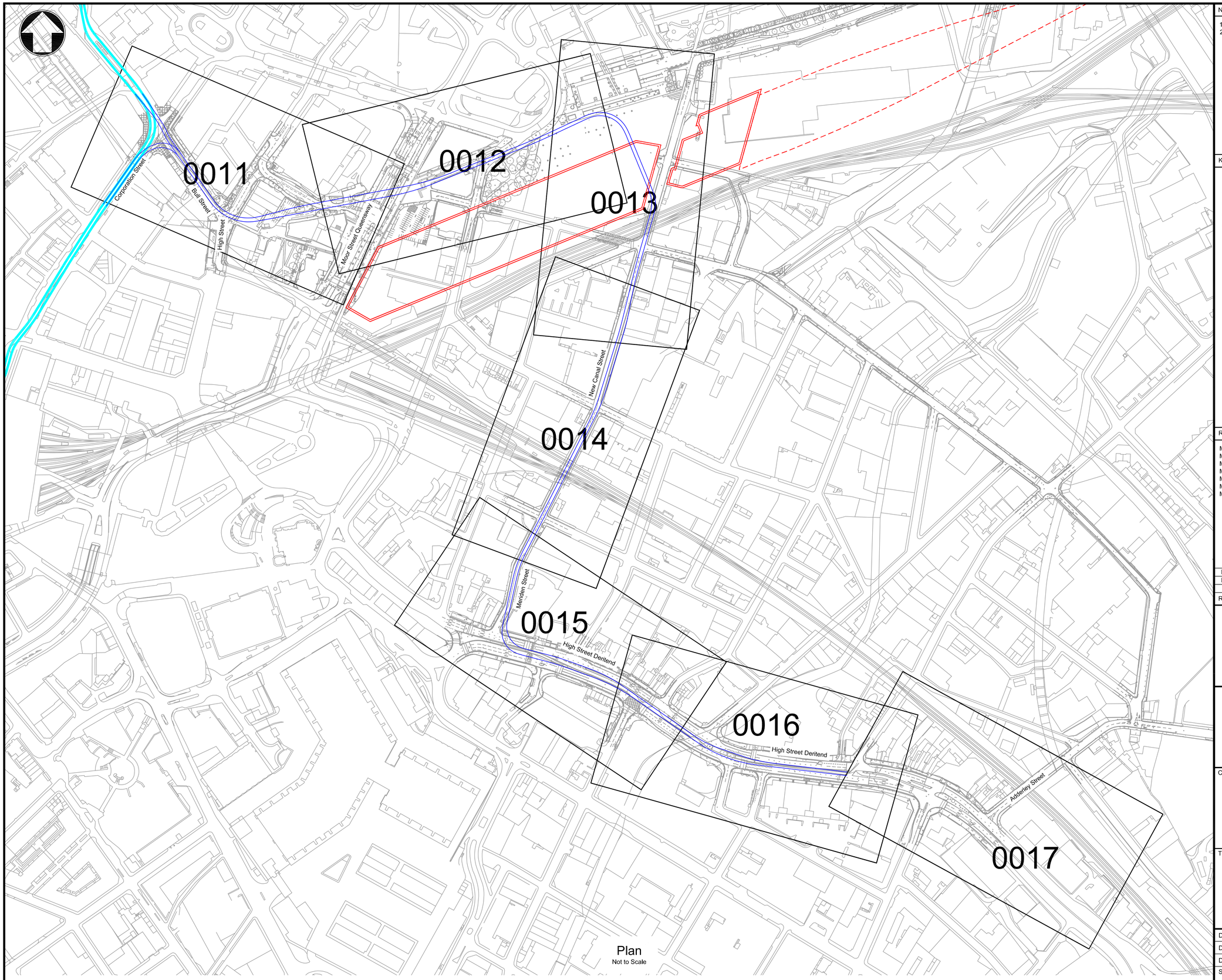
Title
Midland Metro Phase 2
Birmingham Eastside Extension
Tram Route Options

Designed	M. Whitehouse	MW	Eng check	C. Searson	CS
Drawn	A. Brown	AB	Coordination	C. Searson	CS
Dwg check	M. Donovan	MD	Approved	G. Last	GL

Scale at A1: 1:2500
Status: PRE
Rev: P3

Drawing Number
MMD-300207-HS07-DRA-0000-0099

Appendix B. High Street Deritend Route



Plan
Not to Scale

Notes

1. All dimensions are in metres unless otherwise stated.
2. Do not scale any items or information from this drawing.

Key to symbols

- Indicative BEE Route
- Indicative BCCE Route
- HS2 Station Building outline (indicative only)
- HS2 Viaduct outline (indicative only)

Reference drawings

MMD-300207-HS29-DRA-0000-0011 - Route Layout (Sheet 1 of 7)
MMD-300207-HS29-DRA-0000-0012 - Route Layout (Sheet 2 of 7)
MMD-300207-HS29-DRA-0000-0013 - Route Layout (Sheet 3 of 7)
MMD-300207-HS29-DRA-0000-0014 - Route Layout (Sheet 4 of 7)
MMD-300207-HS29-DRA-0000-0015 - Route Layout (Sheet 5 of 7)
MMD-300207-HS29-DRA-0000-0016 - Route Layout (Sheet 6 of 7)
MMD-300207-HS29-DRA-0000-0017 - Route Layout (Sheet 7 of 7)

Rev	Date	Drawn	Description	Ch'k'd	App'd
P3	15/09/2016	JK	Revised Alignment.	CMS	GJL
P2	29/04/2016	EQ	Revised Alignment.	CMS	GJL
P1	16/09/2015	JK	First Issue.	CMS	GJL

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Title
Midland Metro Phase 2
Birmingham Eastside Extension
Route Layout
Key Plan

Designed	E.Quarshie		Eng check	C. Searson	
Drawn	E.Quarshie		Coordination	C. Searson	
Dwg check	A. Griffiths		Approved	G. Last	

Scale at A1	Status	Rev
As Shown	PRE	P3

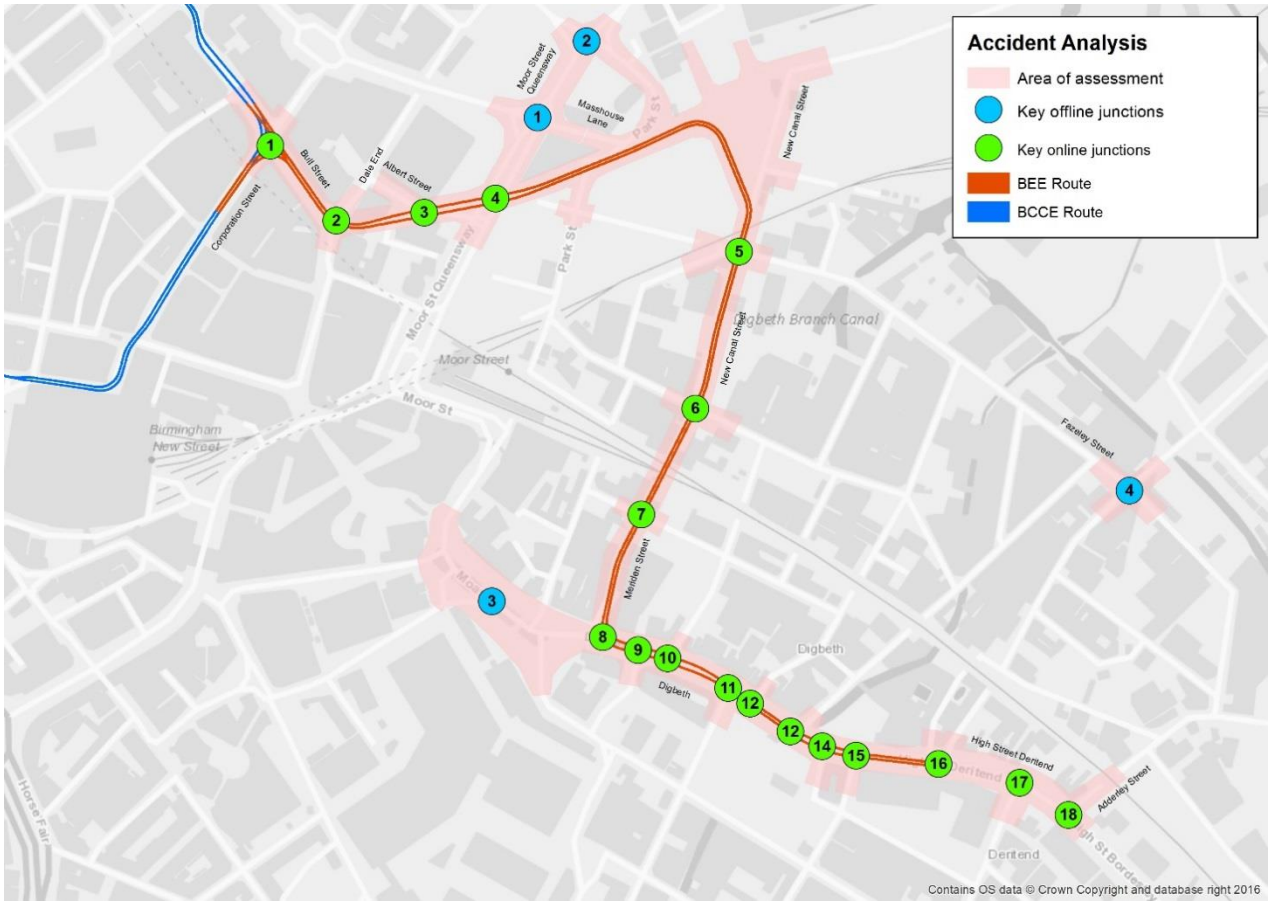
Drawing Number
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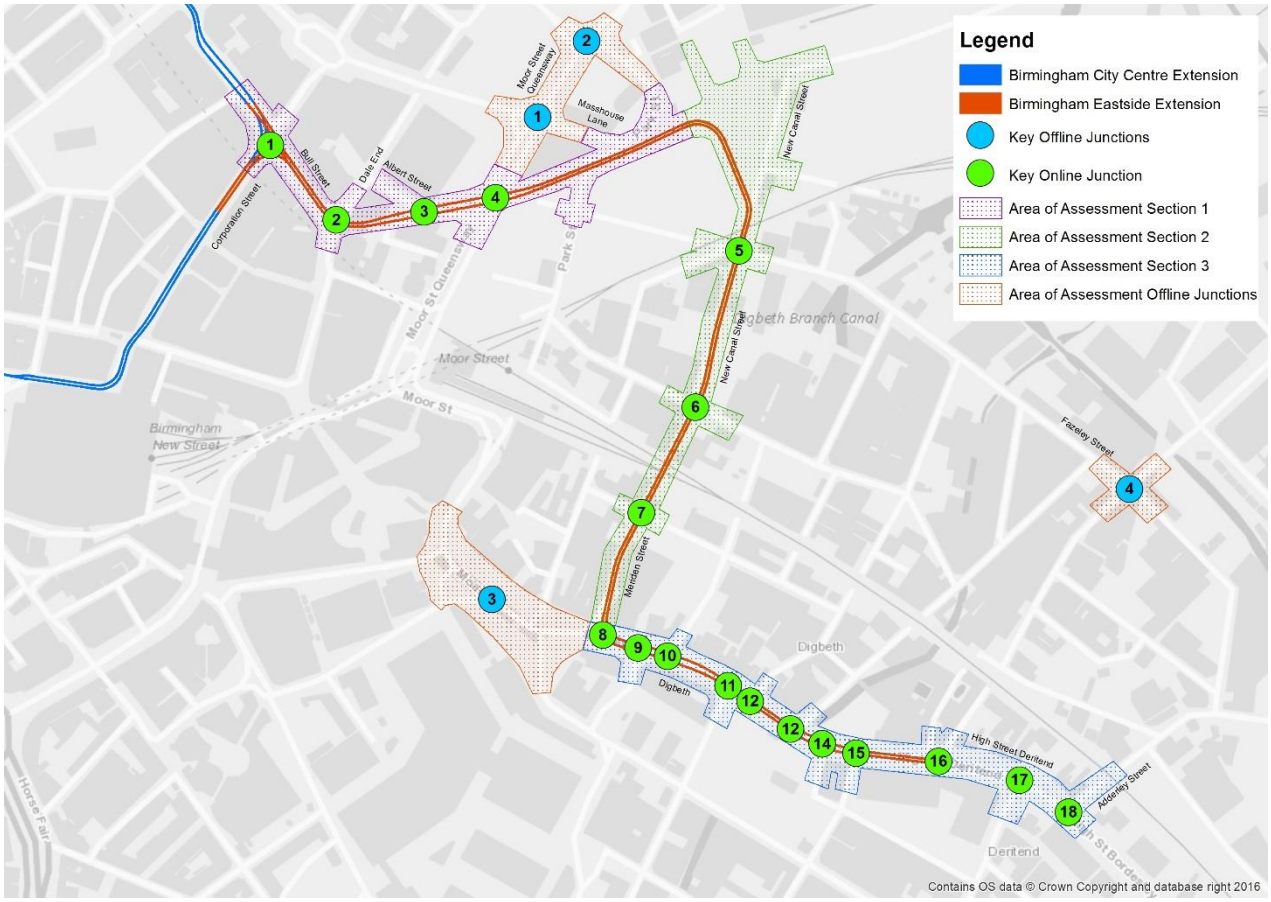
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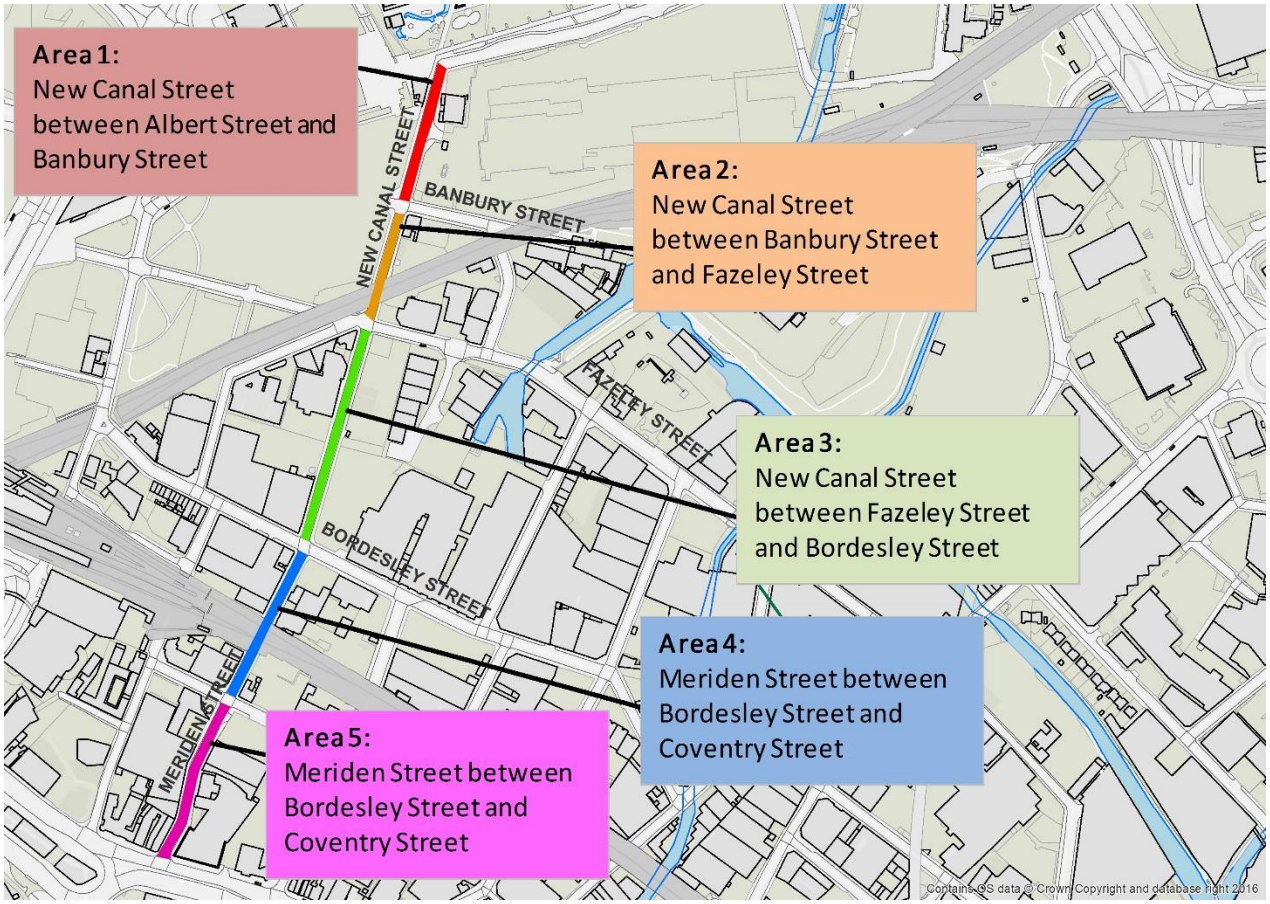
Appendix C. Area for Accident Analysis



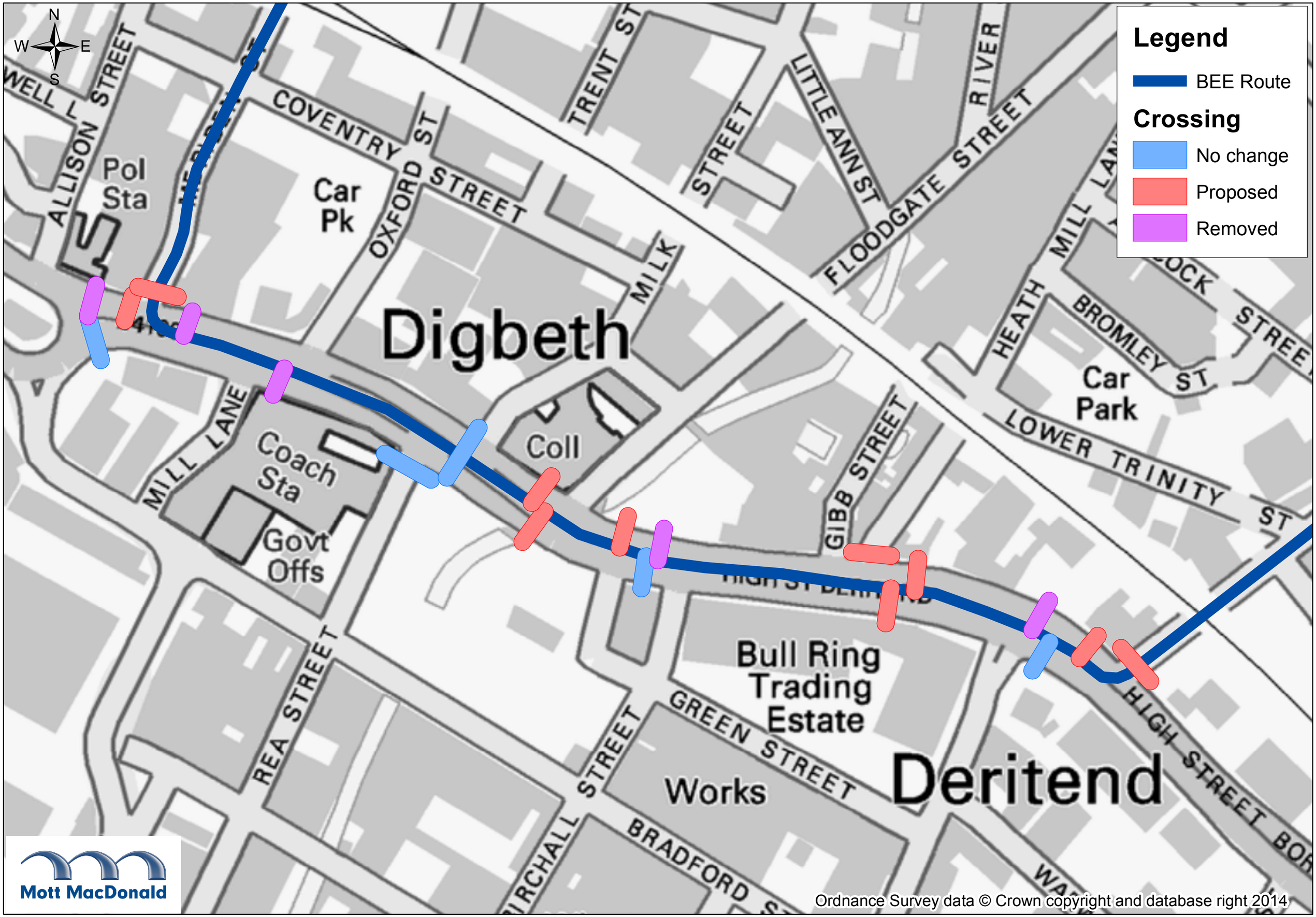
Appendix D. Junctions to be Assessed



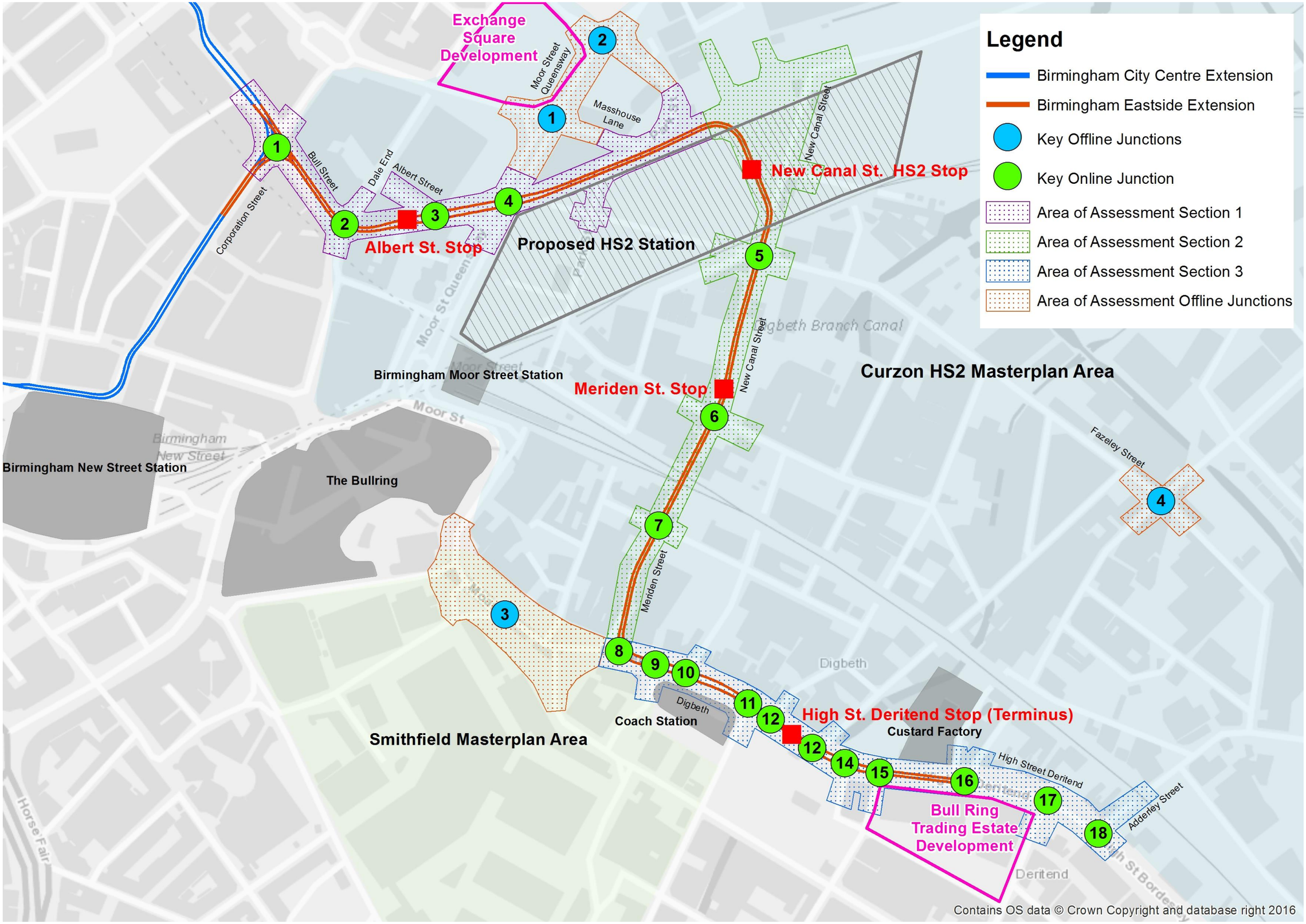
Appendix E. Parking Survey



Appendix F. Pedestrian Crossings on High Street Deritend


N
W
E
S
Legend
BEE Route
Crossing
No change
Proposed
Removed
Digbeth
Deritend
Bull Ring Trading Estate
Works
Car Pk
Car Park
Pol Sta
Coach Sta
Govt Offs
Coll
ALLISON STREET
COVENTRY ST
OXFORD STREET
TRENT ST
LITTLE ANN ST
FLOODGATE STREET
RIVER
HEATH MILL LANE
BROMLEY ST
LOWER TRINITY ST
MILL LANE
REA STREET
GREEN STREET
BRADFORD ST
HIGH STREET BORDESLEY
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Appendix B. Study Area Map



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Appendix C. Existing Route Description

C.1 Introduction

The following chapter details the prevailing conditions along the proposed BEE scheme corridor running from Birmingham City Centre to Moor Street Queensway, along New Canal Street and Meriden Street to the terminus of the scheme on High Street Deritend.

C.2 Bull Street

Bull Street is a one-way single carriageway road that provides access from High Street and Dale End in the south to Corporation Street in a north westerly direction. Bull Street is a bus and cycle only carriageway. The footways are continuous along its length with a crossing zone in the most southern part, another crossing zone along Bull Street and a signalised crossing at the Corporation Street junction. Bull Street is a busy retail street with three bus stops and a designated cycle lane in the opposite direction to the road's one-way system. Photo C.1 shows this.

Photo C.1: Lower Bull Street (viewed from Bull Street / Corporation Street junction)



C.3 Dale End / High Street

High Street merges onto Bull Street continuously, with a priority junction at Dale End. High Street has sheltered bus stops and on-street disabled parking bays located south of the junction with Dale End. High Street is a one-way carriageway for all vehicle types heading north, although only buses and cycles are able to continue onto the restricted Bull Street. All other vehicle types must turn right onto Dale End. Dale End is a single carriageway road with vehicles travelling in both directions. A taxi rank is located on Dale End on both sides of the carriageway; the third busiest taxi rank in Birmingham.

There is no priority crossing for pedestrians, although tactile paving is used for a crossing point where Bull Street meets High Street. There is a drop-kerb pedestrian crossing on Dale End. There are footways located on all sides of the roads, and a footway is located east of the junction between McDonalds and BETFRED to allow pedestrian access to New Meeting Street. This is show in Photo C.2.

Photo C.2: New Meeting Street Access (from High Street / Dale End junction)



C.4 New Meeting Street

New Meeting Street is a cul-de-sac with access from Albert Street providing parking and access to retail units. As stated it can be accessed via a footway shown in Photo C.2 from High Street / Dale End, as well as pedestrian access from Moor Street Queensway to the east. There are 21 private parking bays here, along with seven on-street disabled parking bays.

The vehicular access to New Meeting Street is at a priority junction with Albert Street, with a drop-kerb pedestrian crossing for pedestrians travelling along Albert Street. The footways are discontinuous along New Meeting Streets length. Photo C.3 shows New Meeting Street as viewed from the Albert Street priority junction.

Photo C.3: New Meeting Street



C.5 Albert Street

Albert Street is a single carriageway dual direction road connecting Dale End with Moor Street Queensway. Albert Street merges with Dale End in the north with two signalised crossing for pedestrians.

There are two sheltered bus stops located on the eastbound side of the road, and three disabled on-street parking bays located on the westbound side of the road.

There are pedestrian footways on both sides of the road. Towards the signalised junction with Moor Street Queensway there are two access points to a 1,160 bay multi-story car park, with one access being a priority junction (Dingley's Passage). There is a drop-kerb tactile paving crossing for pedestrians crossing both these junctions. There is also a priority junction access to New Meeting Street, as well as access to a private car park on the south side of Albert Street.

Four cycle racks are provided on the southern side of Albert Street and although there is no segregated cycle lane there is a cycle area at the signalised junction with Moor Street Queensway. The signalised junction at Moor Street Queensway allows for safe pedestrian crossing, with a central refuge between lanes. The carriageway on Albert Street widens at the Moor Street Queensway junction allowing for traffic turning left / right to be segregated.

C.6 Moor Street Queensway

Moor Street Queensway is single and dual carriageway in parts, with a discontinuous bus lane connecting Birmingham Moor Street Rail Station in the south to Moor Street Queensway / James Watt Queensway (B4114) in the north. A central reservation separates traffic directions, whilst also providing as a safe crossing point for pedestrians at the Albert Street junction.

There is access to Carrs Lane (priority junction), Masshouse Lane (signalised junction) and The Priory Queensway (signalised junction), as well as Albert Street as previously stated. At the northern part of Moor Street Queensway, the inside lane leads to James Watt Queensway (B4114) with a signalised pedestrian crossing. The signalised junction also provides signalised pedestrian crossing facilities.

Continuous pedestrian footways flank both sides of the road, with signalised crossing provided along Moor Street Queensway. The route is also a busy bus route, with 6 bus stops located along Moor Street Queensway.

The Albert Street three-arm signalised junction is the junction most concerning the BEE route along Moor Street Queensway. The northbound approach has three lanes, with one dedicated for vehicles turning left onto Albert Street and; two lanes therefore continue along Moor Street Queensway. North of the junction on both sides of the road there are segregated bus lanes, with two other vehicle lanes. Approaching the Albert Street / Moor Street Queensway junction southbound, there are two vehicular lanes and one bus lane (as well as a flagpole bus stop). One vehicle lane is dedicated for vehicles turning left onto Albert Street. The bus lanes are also signposted for taxis and cyclists.

C.7 Hotel La Tour

Hotel La Tour is located east of the Moor Street Queensway / Albert Street junction. The Hotel is accessed via the one-way road, Masshouse Lane from Moor Street Queensway). Park Street continues from

Masshouse Lane, and a drop-off bay is accessed via Park Street outside the hotel's entrance. A sheltered bus stop is also located adjacent to Hotel La Tour's entrance with 10 services operating here.

A pedestrianised area links Moor Street Queensway to the hotel's entrance with trees, benches and bins provided (see Photo C.4). Masshouse Lane to the rear of the Hotel La Tour entrance (north of the building) is a one-way three lane carriageway, with the central lane being bus only. Masshouse Lane connects to Moor Street Queensway, and the three lanes correspond to the desired direction of travel along Moor Street Queensway, with the bus-only middle lane providing a crossing point over Moor Street Queensway to The Priory Queensway. A loading bay as well as access to a block of flats is located on the northern side of the road, with an access to Hotel La Tour on the southern side.

Photo C.4: Hotel La Tour



C.8 Eastside Park

Eastside Park is a recently constructed £11.75 million park located east of Hotel La Tour, and is the first major park to be built in Birmingham for more than 130 years. The park adds 2.73 hectares of green space to the city centre, extending Park Street Gardens, taking in the former car park in front of Millennium Point,

through to Cardigan Street. The park borders Curzon Street and New Canal Street, and lines the frontage of Millennium Point.

C.9 New Canal Street

In the north, New Canal Street continuously connects to Curzon Street, with two signalised pedestrian crossings allowing for safe pedestrian management. The old Curzon Street Rail Station and The Woodman public house are located at the north of New Canal Street, as well as vehicular access to derelict land (although currently gated off).

On the western side of New Canal Street is the recently constructed Eastside Park. Footways are evident on both sides of the road, with a drop-kerb pedestrian crossing at the Banbury Street priority junction on the eastern side of New Canal Street.

North of the signalised four arm junction with Fazeley Street is a 5.4m high rail bridge crossing New Canal Street in an east-west direction. South of this junction on the eastern side of the road is an off-street pay and display car park. New Canal Street continues south to the Bordesley Street junction with pedestrian footways on either side.

There are no designated on-street parking zones along the length of New Canal Street, although several off-street pay and display car parks are located here. The southbound side of the road is double yellow lined, and the northbound is single yellow.

C.10 Meriden Street

Meriden Street runs from the south of the New Canal Street / Bordesley Street junction to the junction with Digbeth (B4100). South of the New Canal Street / Bordesley Street junction on the eastern side of the road lies a private off-street car park accessed by both Bordesley Street and Meriden Street. 60m south of the Bordesley Street junction a rail bridge crosses Meriden Street, with pay and display off-street parking located south of the bridge.

Between the Bordesley Street junction and the Coventry Street junction to the south there are pedestrian footways on either side of the road. The southbound side of the road is double yellow lined, and the northbound is single yellow.

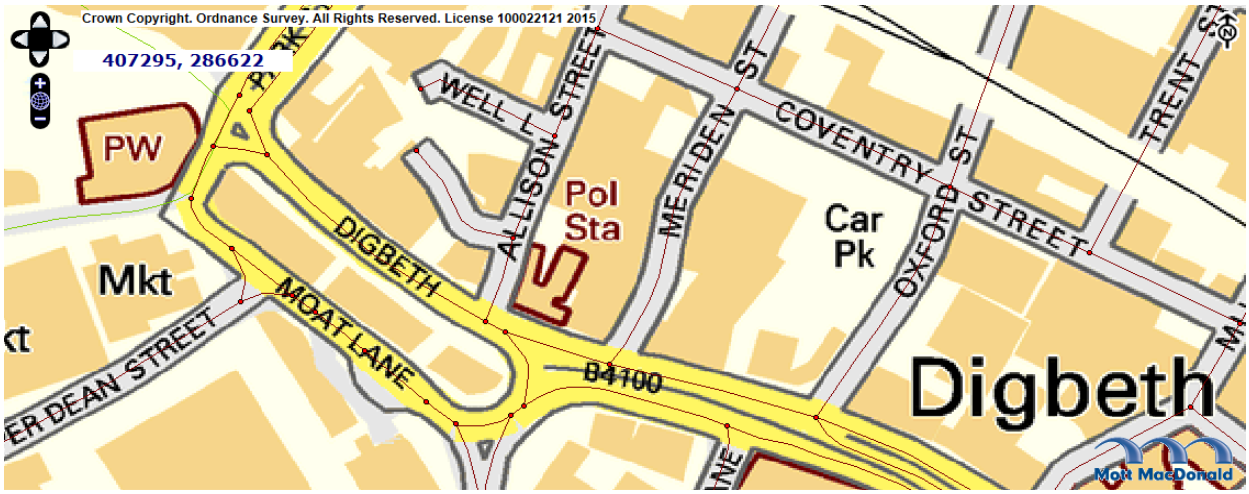
Meriden Street continues south past the Coventry Street junction with vehicles travelling along Meriden Street having priority. The junction is a four-arm priority junction with Coventry Street running in an east-west direction. Located south of this junction are car parks on both sides of the road, one being a private customer car park (west side of the road) and one a pay and display (east side of the road). Meriden Street continues south towards Digbeth (B4100) with pedestrian footways on either side of the road. The length of Meriden Street between Coventry Street and Digbeth (B4100) is double yellow lined.

The junction with Digbeth (B4100) is a three-arm signalised junction, with vehicles travelling along Meriden Street having a left-turn only onto Digbeth (B4100). There is a drop-kerb for pedestrians crossing Meriden Street at its most southern section.

C.11 Digbeth (B4100) and High Street Deritend (Eastbound)

From the Meriden Street junction, Digbeth (B4100) runs in a south easterly direction onto High Street Deritend and towards Bordesley Rail Station. West of the Meriden Street junction is the Moat Lane signalised gyratory, which provides access to Digbeth (B4100). As shown in Map C.1, the Moat Lane gyratory is comprised of five entry and exit points, and discontinuously comprises of three lanes.

Map C.1: Moat Lane Gyratory



At the Digbeth (B4100) / Meriden Street junction, pedestrians are currently separated from the highway by a pedestrian guardrail. In the centre of the road there is also a footway connecting pedestrians to different signalised crossings. This footway is again separated from the road by guardrails.

East of the Meriden Street junction Digbeth (B4100) comprises of three vehicular lanes in each direction with a pedestrianized central reservation as stated, as can be seen in Photo C.5. Here, the footway is separated from the road by guardrails, except where a signalised crossing, bus stop (sheltered) and service area into South & City College are located.

Photo C.5: Digbeth B4100 eastbound (viewed from the Meriden Street Junction)



At the Oxford Street priority junction with Digbeth (B4100), there is a drop-kerb for pedestrians to cross the most southern part of Oxford Street. Guardrails separate pedestrians from the highway between this junction and up to the Digbeth (B4100) / Milk Street junction; apart from where Birmingham Coach Stop DS5 and DS6 are located. The bus stops are both sheltered.

Photo C.6 shows the existing segregated right-turn lane onto Rea Street. This is to be reconfigured, and the right-turn lane will be shared with the BEE track alignment (to be accessed in separate signal stages to prevent a tram / vehicle conflict). Oxford Street is to be signalised to allow for the safe management of traffic into the shared track merger lane (right-turn onto Rea Street).

Photo C.6: Oxford Street Priority Junction (start of eastbound bus lane and Rea Street segregated right-turn lane)



There is also a signalised pedestrian crossing situated west of the Milk Street / Digbeth (B4100) junction. The signalised junction takes pedestrians to a footway in the centre of the road which connects to another signalised crossing taking pedestrians to the south side of Digbeth (B4100). This central footway is again separated from the road by guardrails.

On High Street Deritend, from the Milk Street junction to the Floodgate Street junction there are no guardrails to separate pedestrians and the highway, apart from at the junction with Floodgate Street on the western side of the junction along High Street Deritend. There is a drop-kerb for pedestrians to cross the most southern part of Floodgate Street. The central footway exists but not for pedestrian use here, up until a signalised crossing east of the Floodgate Street / High Street Deritend junction. This is to allow for pedestrians to currently cross both sides of the road.

Gibb Street is a small access road to the Custard Factory and other retail units, and tactile paving provides a pedestrian crossing point. Pedestrians are separated from the highway by guardrails at this junction. The Heath Mill Lane / High Street Deritend junction is a signalised junction for vehicles, although with no pedestrian crossing across High Street Deritend. A drop-kerb on the southern section of Heath Mill Lane provides a pedestrian crossing point.

From the Heath Mill Lane junction, the pedestrian footway on High Street Deritend is separated from the highway where possible by guardrails. There are two car parks among other access points where the railings are not evident. These access roads provide drop-kerbs for pedestrians. Pedestrians remain separated by guardrails from the highway on the north side of the road where possible up until the Adderley Street junction.

C.12 Digbeth (B4100) and High Street Deritend (Westbound)

On the south side of High Street Deritend, there is a signalised junction with Alcester Street, with provision for pedestrian crossing points. The pedestrian crossing is split into two sections, with a section of footway in the middle of the road surrounded by guardrails. The south side of the road in this section is less segregated from the pedestrian footways with guardrails as opposed to the north side.

The carriageway on High Street Deritend segregates buses and other vehicles, although vehicles may access bus lanes to enable a left-turn at junctions off the westbound side of High Street Deritend. Between the Stone Yard and Chapel House Street junctions on the south side of the road, guardrails or concrete bollards are evident across this length apart from where access is needed to the signalised pedestrian crossing. Both these junctions provide drop kerbs for pedestrians to cross.

At the junction with Rea Street, pedestrians are separated from the highway again with guardrails, and can cross Rea Street via a signalised crossing with tactile paving. There is a small hold section in the middle of the road for pedestrians crossing, not surrounded by guardrails. Pedestrians can also cross High Street Deritend in a similar way, albeit with a safer central crossing point surrounded by guardrails.

The Rea Street / High Street Deritend junction is a signalised three-arm junction, with the Birmingham Coach Station located directly west of the junction (Photo C.7). From Rea Street to Mill Lane (the location of Birmingham Coach Station) the pedestrian walkway is wholly separated from the highway by guardrails. There is a non-signalised drop-kerb pedestrians crossing across Mill Lane.

Photo C.7: National Express Birmingham Coach Station



There are no fully segregated cycle lanes, although cyclists are permitted to use the segregated bus lanes on Digbeth (B4100) and High Street Deritend.

Appendix D. Base Year Junction Capacity Assessments and Calibration

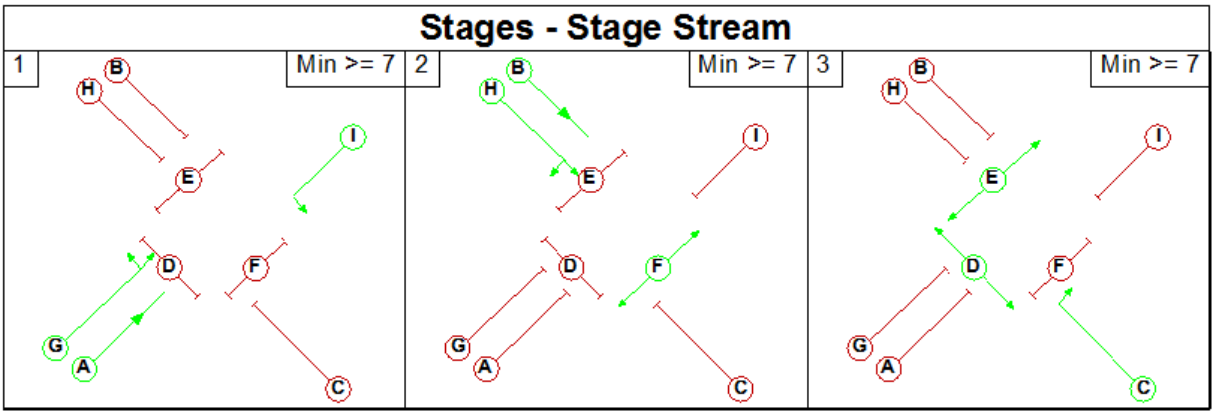
D.1 Corporation Street / Bull Street

This junction has recently undergone construction and the new staging can be seen below in Figure D.1. It will be reconfigured again once the BEE route is in place. The junction currently operates in three stages with a Tram phase (green in Figure D.1) also operating over this junction as part of the BCCE.

- Stage 1 provides vehicle movements and tram movements from Corporation Street, and cycle movements from Corporation Street to Lower Bull Street.
- Stage 2 provides vehicle and tram movements from Bull Street with a pedestrian phase operating across Bull Street.
- Stage 3 provides bus and cycle movements on Lower Bull Street onto Corporation Street, as well as two pedestrian phases across the LRT alignment.

Based on site observations stages typically run for their minimum green time which has been reflected in the modelling. The key exception is when a tram approaches and in this case the stage green time will be extended for longer. The minimum cycle time has been modelled which represents a worst case scenario as it results in more inter-stage periods in the hour.

Figure D.1: Corporation Street / Bull Street Staging



The 2015 Base Year results are summarised in Table D.1.

Table D.1: Corporation Street / Bull Street 2015 Base Year Results

	AM Peak		PM Peak		SAT Peak	
Movement	**DoS (%)**	**MMQ (PCU)**	**DoS (%)**	**MMQ (PCU)**	**DoS (%)**	**MMQ (PCU)**
Bull Street (north) to Corporation Street			Tram Only			
Bull Street (south) to Corporation Street	55.5	3.1	56.4	3.1	51.4	2.8
Corporation Street to Corporation Street			Tram Only			
Cycle Time (s)		51		51		51
PRC (%)		62.1		59.6		75.0

Source: LinSig V3

Table D.1 shows the junction works within capacity in the 2015 observed scenarios.

It was not possible to compare modelled queues and surveyed queues at this location due to the junction being under construction at the time of the traffic surveys, although on-site observations were used to calculate the signal timings.

D.2 Bull Street / Dale End

The 2015 Base Year results are shown in Table D.2.

Table D.2: Bull Street / Dale End 2015 Base Year Results

	AM Peak		PM Peak		Saturday Peak	
Movement	RFC	Queue (PCU)	RFC	Queue (PCU)	RFC	Queue (PCU)
Bull Street			Exit Only			
Dale End	0.01	0.0	0.03	0.0	0.03	0.1
High Street	0.37	1.4	0.42	1.6	0.39	1.4

Source: Junctions 9 (PICADY)

The results in Table D.2 show the priority junction at Bull Street / Dale End to work within capacity in the 2015 Base Year over the three peak periods.

The LinSig model was compared against the average queue lengths in Table D.3.

Table D.3: Bull Street / Dale End Surveyed Queue Lengths (PCUs)

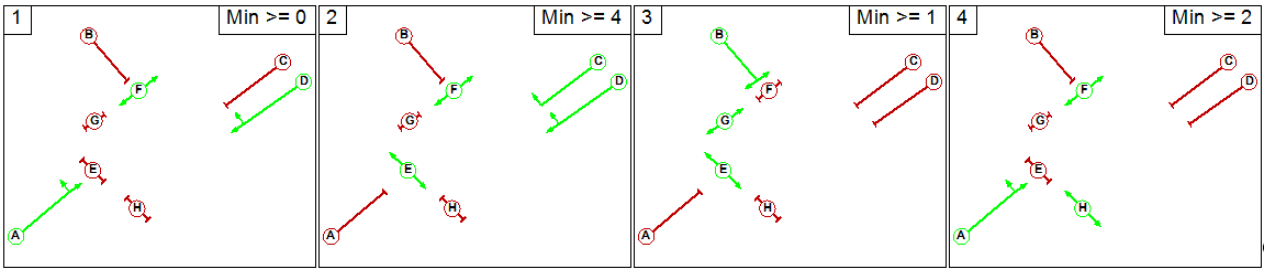
	AM Peak		PM Peak		Saturday Peak	
Movement	Observed	Modelled	Observed	Modelled	Observed	Modelled
Bull Street			Exit only			
Dale End	0.3	0.0	0.1	0.0	0.2	0.1
High Street	1.1	1.4	0.3	1.6	0.8	1.4

Source: Mott MacDonald/Junctions 9 (PICADY)

D.3 Moor Street Queensway / Albert Street

Figure D.2 shows the current signal staging of the Moor Street Queensway / Albert Street junction (where phases A and C are Moor Street Queensway, and Phase B is Albert Street).

Figure D.2: Current Stating of Moor Street Queensway / Albert Street



The Base Year AM and PM results are shown in Table D.4, with the results taken from the wider LinSig model of Moor Street Queensway (with the junctions of Albert Street, Masshouse Lane and James Watt Queensway B4114).

Table D.4: Moor Street Queensway / Albert Street 2015 Base Year Results

	AM Peak		PM Peak		Saturday Peak	
Movement	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
Albert Street Left/Right	61.8	4.8	71.0	7.6	66.4	6.5
Moor Street Queensway (north) Ahead (Lane 1)	14.6	1.7	17.5	1.9	16.9	1.8
Moor Street Queensway (north) Right/Ahead (Lane 2/3)	20.0	2.3	23.4	2.6	24.1	2.6
Moor Street Queensway (south) Left/Ahead (Lane 1)	19.4	2.3	31.1	4.0	22.6	2.7
Moor Street Queensway (south) Ahead (Lane 2/3)	31.7	2.9	45.5	4.5	34.0	3.2
Cycle Time (s)		78		78		78
PRC (%)		45.6		26.7		35.6

Source: LinSig V3

The modelled results for the Moor Street Queensway / Albert Street junction in the Base Year show the junction to operate within capacity in all scenarios.

The LinSig model was compared against the average queue lengths in Table D.5 and video footage.

Table D.5: Moor Street Queensway / Albert Street Surveyed Queue Lengths (PCUs)

	AM Peak		PM Peak		Saturday Peak	
Movement	Observed	Modelled	Observed	Modelled	Observed	Modelled
Albert Street Left/Right	2.2	4.8	2.8	7.6	2.9	6.5
Moor Street Queensway (north) Ahead	3.3	1.7	2.3	1.9	3.1	1.8
Moor Street Queensway (north) Right/Ahead	0.5	2.3	0.5	2.6	0.8	2.6

	AM Peak		PM Peak		Saturday Peak	
Movement	Observed	Modelled	Observed	Modelled	Observed	Modelled
Moor Street Queensway (south) Left/Ahead	3.4	2.3	4.8	4.0	3.5	2.7
Moor Street Queensway (south) Ahead	4.4	2.9	7.6	4.5	5.2	3.2

Source: Mott MacDonald/LinSig V3

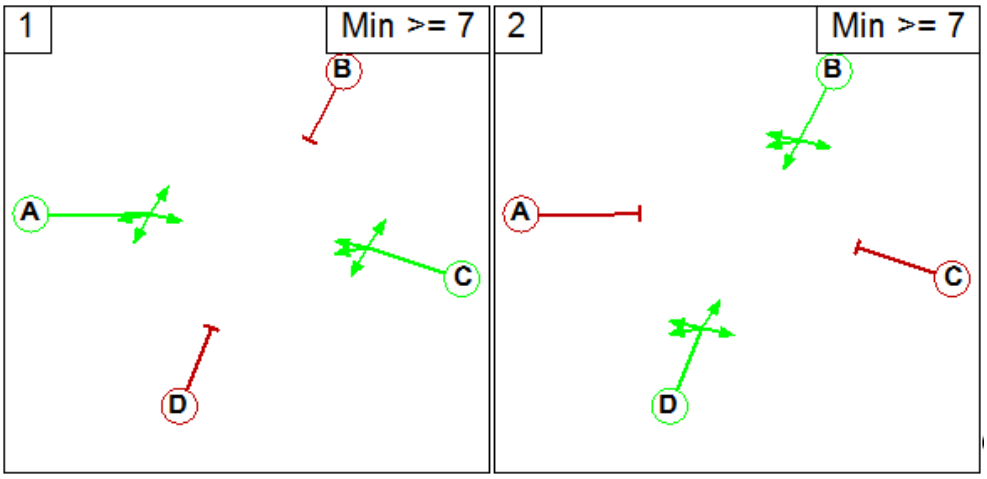
D.4 New Canal Street / Fazeley Street

The New Canal Street / Fazeley Street junction operates in two stages:

- Fazeley Street in Stage 1
- New Canal Street in Stage 2.

All movements are permitted and the pedestrian facilities are uncontrolled.

Figure D.3: Current Staging of New Canal Street / Fazeley Street



The 2015 Base Year results are shown in Table D.6.

Table D.6: New Canal Street / Fazeley Street 2015 Base Year Results

	AM Peak		PM Peak		Saturday Peak	
Movement	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
New Canal Street (north)	32.7	3.7	31.7	3.8	23.8	1.8
Fazeley Street (east)	33.5	3.1	40.8	4.6	28.5	2.0
New Canal Street (south)	12.2	1.2	40.1	4.9	43.2	3.9
Fazeley Street (west)	29.7	3.1	32.1	3.7	42.3	3.3
Cycle Time (s)		68		73		50

Movement	AM Peak		PM Peak		Saturday Peak	
	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
PRC (%)		168.3		120.3		108.1

Source: LinSig V3

The results for the New Canal Street / Fazeley Street junction in Table D.6 show the junction operates within capacity in the Base Year.

The LinSig model was compared against the average surveyed queue lengths in Table D.7.

Table D.7: New Canal Street / Fazeley Street Surveyed Queue Lengths (PCUs)

Movement	AM Peak		PM Peak		Saturday Peak	
	Observed	Modelled	Observed	Modelled	Observed	Modelled
New Canal Street (north)	4.4	3.7	3.1	3.8	2.4	1.8
Fazeley Street (east)	1.6	3.1	2.9	4.6	0.8	2.0
New Canal Street (south)	0.8	1.2	4.3	4.9	4.6	3.9
Fazeley Street (west)	3.8	3.1	1.7	3.7	2.1	3.3

Source: Mott MacDonald /LinSig V3

D.5 New Canal Street / Bordesley Street

Table D.8 shows the 2015 Base Year modelled results for the New Canal Street / Bordesley Street junction.

Table D.8: New Canal Street / Bordesley Street 2015 Base Year Results

Movement	AM Peak		PM Peak		Saturday Peak	
	RFC	Queue (PCU)	RFC	Queue (PCU)	RFC	Queue (PCU)
New Canal Street	0.05	0.1	0.02	0.0	0.05	0.1
Bordesley Street (east)	0.09	0.1	0.31	0.5	0.21	0.3
Meriden Street	0.02	0.0	0.02	0.0	0.03	0.0
Bordesley Street (west)	0.18	0.2	0.47	0.9	0.64	1.7

Source: Junctions 9 (PICADY)

Table D.8 shows the junction operates within capacity within all scenarios.

The PICADY model was compared against the surveyed queue lengths in Table D.9.

Table D.9: New Canal Street / Bordesley Street Surveyed Queue Lengths (PCUs)

	AM Peak		PM Peak		Saturday Peak	
Movement	Observed	Modelled	Observed	Modelled	Observed	Modelled
New Canal Street	0.0	0.1	0.0	0.0	0.0	0.1
Bordesley Street (east)	0.0	0.1	0.3	0.5	0.2	0.3
Meriden Street	0.0	0.0	0.0	0.0	0.0	0.0
Bordesley Street (west)	0.3	0.2	0.4	0.9	2.1	1.7

Source: Mott MacDonald/Junctions 9 (PICADY)

D.6 Digbeth B4100 / Meriden Street

The current staging at Digbeth B4100 / Meriden Street operates in three streams with five pedestrian crossings. A map with the direction of traffic and pedestrian crossings is shown in Figure D.4 and the staging of the signalised junction is shown in Figure D.5.

Figure D.4: Digbeth B4100 / Meriden Street Junction Directions

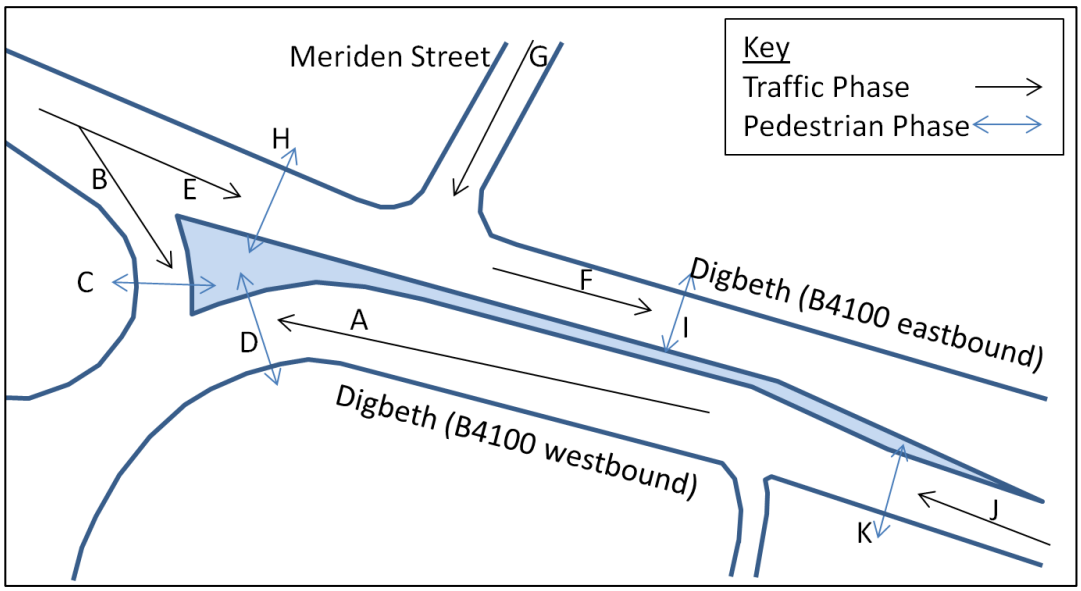


Figure D.5: Existing Digbeth B4100 / Meriden Street Staging

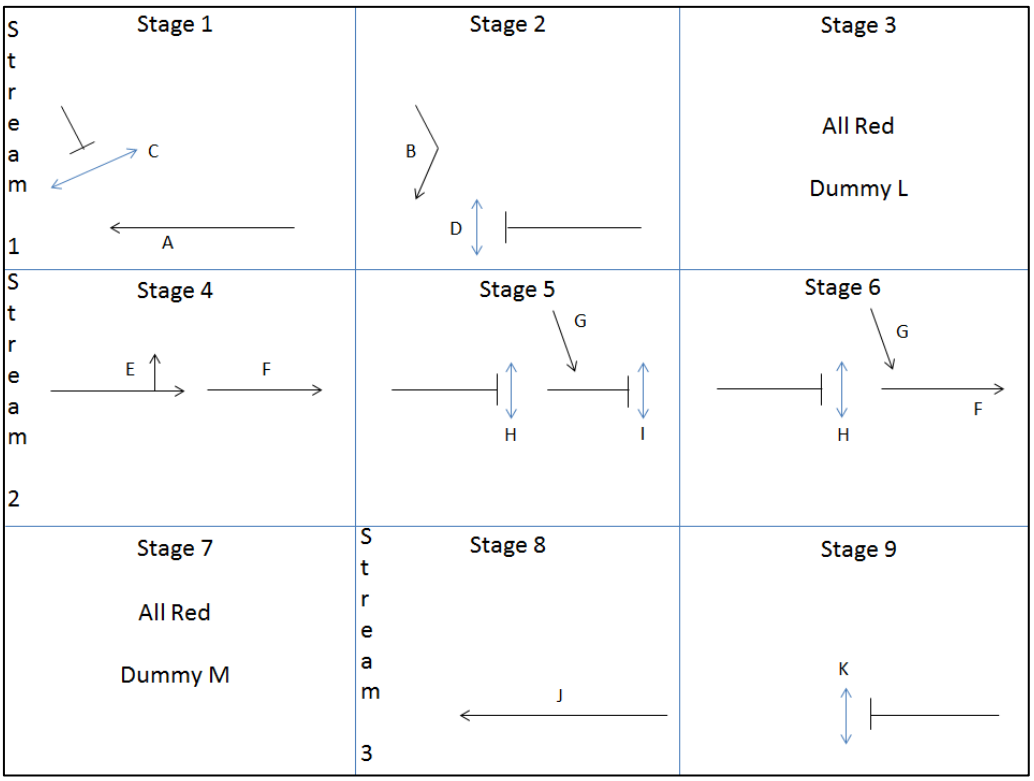


Figure D.5 shows:

- Stream 1 is the Digbeth (B4100) / Moat Lane Gyratory node.
- Stream 2 is the Digbeth (B4100) / Meriden Street node.
- Stream 3 is the crossing over the westbound Digbeth (B4100) carriageway.

The Digbeth B4100 /Meriden Street 2015 Base Year results are shown in Table D.10.

Table D.10: Digbeth B4100 / Meriden Street 2015 Base Year Results

	AM Peak		PM Peak		Saturday Peak	
Movement	**DoS (%)**	**Queue (PCU)**	**DoS (%)**	**Queue (PCU)**	**DoS (%)**	**Queue (PCU)**
Digbeth B4100 (west) Ahead and Left (Lane 1)	32.9	3.2	53.6	5.8	43.4	5.3
Digbeth B4100 (west) Ahead (Lane 2/3)	18.9	1.1	36.7	2.4	32.1	2.2
Meriden Street	69.5	3.2	73.2	4.9	66.9	4.1
Cycle Time (s)	180		165		195	
PRC (%)	29.6		23.0		34.5	

Source: LinSig V3

It is evident at the Meriden Street junction that there are queues up to 4.9 PCUs (PM Peak) modelled. The degree of saturation though in all cases is below 90%.

The LinSig model was compared against the surveyed queue lengths in Table D.11.

Table D.11: Digbeth B4100 / Meriden Street Surveyed Queue Lengths (PCUs)

	AM Peak		PM Peak		Saturday Peak	
Movement	Observed	Modelled	Observed	Modelled	Observed	Modelled
Meriden Street Left	1.8	3.2	2.2	4.9	2.5	4.1

Source: Mott MacDonald/LinSig V3

D.7 Digbeth B4100 / Rea Street

The controller for the Digbeth B4100 / Rea Street and High Street Deritend / Milk Street junction operates in two streams (as shown in Figure D.6 and Figure D.7).

Figure D.6: Current Staging of Digbeth B4100 / Rea Street / Milk Street (Stream 1)

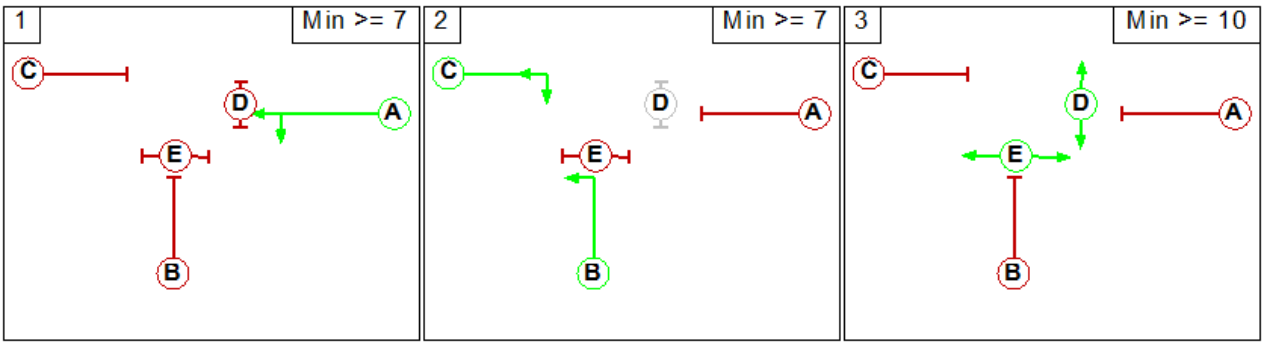
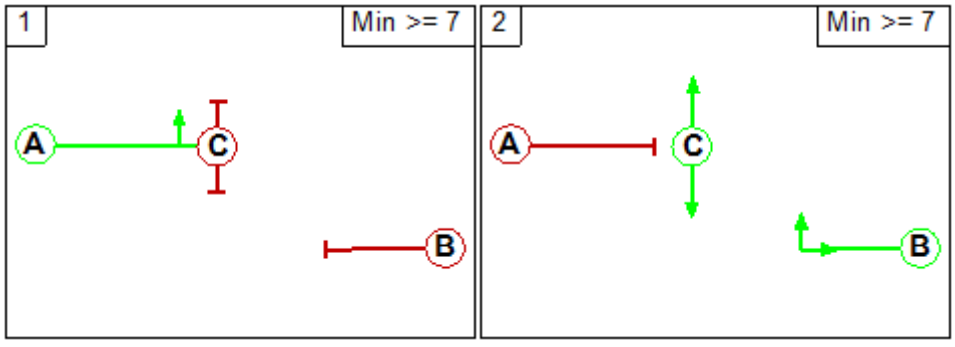


Figure D.7: Current Staging of Digbeth B4100 / Rea Street / Milk Street (Stream 2)



Stream 1 allows movements to and from Rea Street and the second stream allows movements to Milk Street. The right-turn movement from Rea Street is not permitted.

- Stream 1 (Stage 1) allows ahead and left movements from Digbeth (B4100) East.
- Stream 1 (Stage 2) allows for a right-turn into Rea Street from the right-turn lane on Digbeth (B4100) and movements from Rea Street to Digbeth (westbound).
- Stream 1 (Stage 3) allows for pedestrian movements across Rea Street and across Digbeth (B4100) westbound into a central pedestrian refuge.
- Stream 2 (Stage 1) allows for ahead movements from Digbeth (B4100 east) and a left-turn onto Milk St.
- Stream 2 (Stage 2) allows for a right-turn from Digbeth (B4100 east) onto Milk Street, with a pedestrian crossing across the eastbound direction of Digbeth (B4100).

The 2015 Base Year results are shown in Table D.12.

Table D.12: Digbeth B4100 / Rea Street 2015 Base Year Results

	AM Peak		PM Peak		Saturday Peak	
Movement	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
High Street Deritend (east) Left/Ahead (Lane 1)	27.4	2.9	28.2	2.2	24.0	1.9
High Street Deritend (east) Ahead (Lane 2/3)	64.6	6.8	71.8	6.8	60.9	5.5
High Street Deritend (east) Right/U-Turn (Lane 4)	41.9	3.1	51.3	3.2	23.6	1.2
Rea Street Left	5.8	0.5	9.6	0.8	8.0	0.7
Digbeth (B4100 west) Ahead/Left (Lane 1)	8.2	0.7	4.6	0.3	8.7	0.6
Digbeth (B4100 west) Ahead (Lane 2/3)	27.6	1.8	47.7	3.4	40.3	2.5
Digbeth (B4100 west) Right/U-Turn (Lane 4)	63.5	6.2	71.6	8.5	62.8	6.5
Cycle Time (s)	83		77		76	
PRC (%)	39.3		25.4		43.3	

Source: LinSig V3

Table D.12 shows the Digbeth B4100 / Rea Street junction (including the Milk Street junction) operates within capacity during the assessed peak periods.

The LinSig model was compared against the average surveyed queue lengths (in Table D.13) and video footage.

Table D.13: Digbeth B4100 / Rea Street Surveyed Queue Lengths (PCUs)

	AM Peak		PM Peak		Saturday Peak	
Movement	Observed	Modelled	Observed	Modelled	Observe	Modelled
High Street Deritend (east) Left/Ahead (Lane 1)	2.8	2.9	5.0	2.2	2.8	1.9

	AM Peak		PM Peak		Saturday Peak	
Movement	Observed	Modelled	Observed	Modelled	Observe	Modelled
High Street Deritend (east) Ahead (Lane 2/3)	4.3	6.8	4.4	6.8	4.3	5.5
High Street Deritend (east) Right/U-Turn (Lane 4)	4.0	3.1	4.2	3.2	2.3	1.2
Rea Street Left	0.8	0.5	0.7	0.8	No data	0.7
Digbeth (B4100 west) Ahead/Left (Lane 1)	0.2	0.7	0.2	0.3	1.1	0.6
Digbeth (B4100 west) Ahead (Lane 2/3)	3.1	1.8	2.8	3.4	2.8	2.5
Digbeth (B4100 west) Right/U-Turn(Lane 4)	2.8	6.2	7.3	8.5	0.8	6.5

Source: Mott MacDonald/LinSig V3

D.8 High Street Deritend / Milk Street

This junction is included in the LinSig model for Rea Street as the junctions operate the same signal controller.

D.9 High Street Deritend / Floodgate Street

The 2015 Base Year results for the High Street Deritend / Floodgate Street junction are shown in Table D.14.

Table D.14: High Street Deritend / Floodgate Street 2015 Base Year Results

	AM Peak		PM Peak		Saturday Peak	
Movement	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
Floodgate Street Left	9.4	0.1	23.4	0.3	11.1	0.1

Source: LinSig V3

The results for the Base Year assessment of High Street Deritend / Floodgate Street show the junction operates within capacity over all the peak hours.

The LinSig model was compared with the surveyed queue lengths shown in Table D.15.

Table D.15: High Street Deritend / Floodgate Street Surveyed Queue Lengths (PCUs)

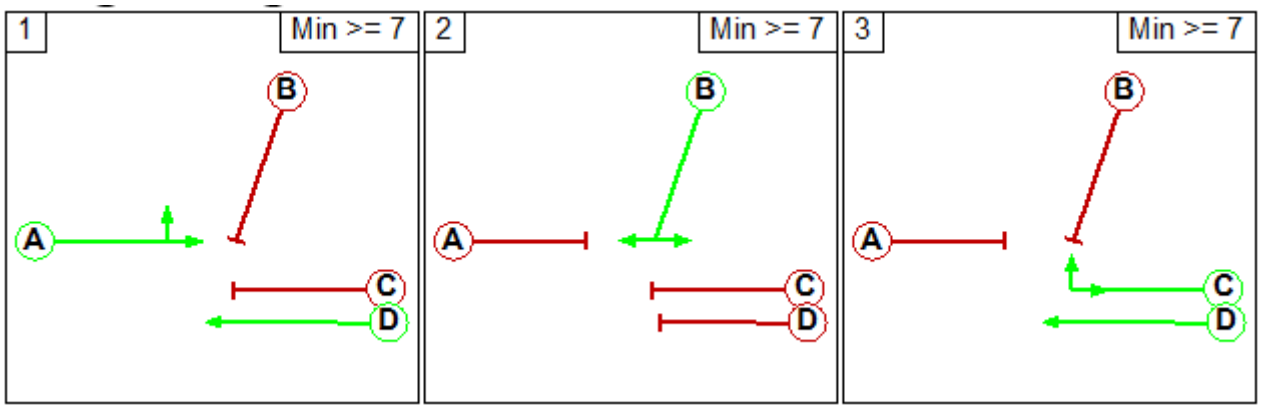
	AM Peak		PM Peak		Saturday Peak	
Movement	Observed	Modelled	Observed	Modelled	Observed	Modelled
Floodgate Street Left	0.0	0.1	0.1	0.3	0.1	0.1

Source: LinSig V3

D.10 High Street Deritend / Heath Mill Lane

Figure D.8 shows the staging of the signalised junction at High Street Deritend / Heath Mill Lane.

Figure D.8: Current Staging of High Street Deritend / Heath Mill Lane



The staging is as follows:

- Stage 1 allows for ahead movements in both directions on High Street Deritend, as well as a left-turn to Heath Mill Lane.
- Stage 2 allows for all movements from Heath Mill Lane.
- Stage 3 allows for all movements from High Street Deritend (east).

The 2015 Base Year results are shown in Table D.16.

Table D.16: High Street Deritend / Heath Mill Lane 2015 Base Year Results

	AM Peak		PM Peak		Saturday Peak	
Movement	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
Heath Mill Lane Left/Right	49.6	8.1	63.8	11.4	51.0	5.1
High Street Deritend (east) Ahead (Lane 1)	24.4	4.3	16.0	2.8	12.1	1.4
High Street Deritend (east) Ahead (Lane 2/3)	41.1	5.0	29.9	3.5	26.7	2.3
High Street Deritend (east) Right/U-Turn (Lane 4)	48.7	7.8	64.3	9.1	50.3	4.6
High Street Deritend (west) Ahead/Left (Lane 1)	39.2	3.8	31.5	4.1	22.8	2.1
High Street Deritend (west) Ahead (Lane 2)	48.6	5.7	63.0	11.2	49.2	6.2
High Street Deritend (west) ahead (Lane 3)	48.8	5.7	63.1	11.2	49.3	6.2

Movement	AM Peak		PM Peak		Saturday Peak	
	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
Cycle Time (s)	113		117		81	
PRC (%)	81.3		39.9		76.4	

Source: LinSig V3

Table D.16 shows the junction to operate within capacity in the Base Year assessment in all peak periods. The highest modelled queue is 7.8 (AM Peak) for right-turners and U-turn movements from High Street Deritend (east) onto Heath Mill Lane.

The LinSig model was compared with the surveyed queue lengths in Table D.17 and video footage of the junction.

Table D.17: High Street Deritend / Heath Mill Lane Surveyed Queue Lengths (PCUs)

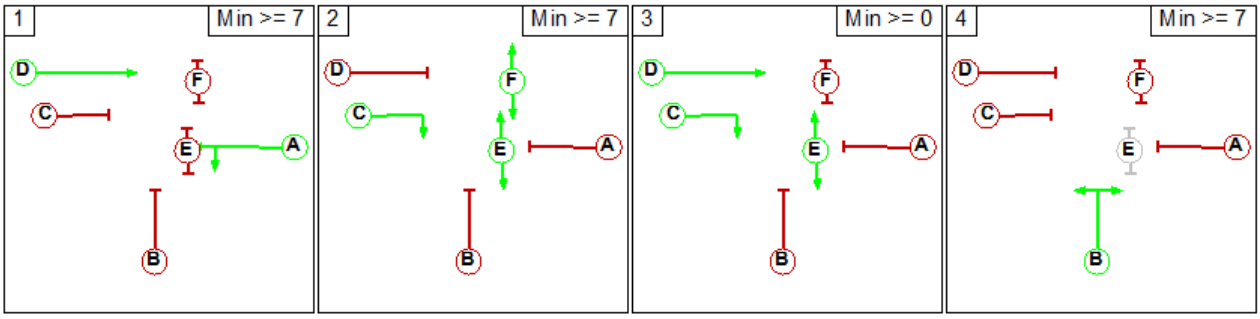
Movement	AM Peak		PM Peak		Saturday Peak	
	Observed	Modelled	Observed	Modelled	Observed	Modelled
Heath Mill Lane Left/Right	7.6	8.1	9.4	11.4	4.2	5.1
High Street Deritend (east) Ahead (Lane 1)	0.8	4.3	1.5	2.8	0.7	1.4
High Street Deritend (east) Ahead (Lane 2/3)	4.3	5.0	3.3	3.5	2.3	2.3
High Street Deritend (east) Right/U-Turn (Lane 4)	9.8	7.8	7.2	9.1	4.5	4.6
High Street Deritend (west) Ahead/Left (Lane 1)	2.8	3.8	4.3	4.1	0.8	2.1
High Street Deritend (west) Ahead (Lane 2)	2.6	5.7	7.7	11.2	7.3	6.2
High Street Deritend (west) ahead (Lane 3)	0.8	5.7	5.9	11.2	2.9	6.2

Source: Mott MacDonald/LinSig V3

D.11 High Street Deritend / Alcester Street

The existing controller operates with four stages as shown in Figure D.9.

Figure D.9: Current Staging of High Street Deritend / Alcester Street



The staging is as follows:

- Stage 1 allows ahead and left-turn movements from High Street Deritend (east) and an ahead movement on High Street Deritend (west).
- Stage 2 allows for movements from High Street Deritend (west) onto Alcester Street via a right-turn only lane. Pedestrians are also able to cross High Street Deritend via the staggered crossing facility.
- Stage 3 allows for all movements from High Street Deritend (west) as well as half of the staggered pedestrian crossing across High Street Deritend.
- Stage 4 allows for all movements from Alcester Street.

The 2015 Base Year results are shown in Table D.18.

Table D.18: High Street Deritend / Alcester Street (Adderley Street) 2015 Base Year Results

	AM Peak		PM Peak		Saturday Peak	
Movement	**DoS (%)**	**Queue (PCU)**	**DoS (%)**	**Queue (PCU)**	**DoS (%)**	**Queue (PCU)**
High Street Deritend (west) Ahead (Lane 1)	21,4	2.5	52.7	6.2	37.0	4.6
High Street Deritend (west) Ahead (Lane 2)	21.6	2.6	52.8	6.3	37.1	4.6
High Street Deritend (west) Ahead/Right (Lane 3/4)	30.5	2.8	62.5	6.7	44.8	4.9
High Street Deritend (east) Ahead/Left (Lane 1)	27.6	3.3	35.4	4.0	31.2	3.7
High Street Deritend (east) Ahead (Lane 2)	58.0	8.6	45.9	5.6	33.4	4.2
High Street Deritend (east) Ahead/U-Turn (Lane 3)	59.5	9.5	48.0	6.3	35.3	4.8
Alcester Street Left/Right	59.3	5.5	63.4	7.4	45.7	3.9
Cycle Time (s)	88		88		88	
PRC (%)	51.3		41.9		97.1	

Source: LinSig V3

The results in Table D.18 show that in the Base Year all of the assessed lanes over the two junctions operate within capacity.

The LinSig model was compared with the surveyed queue lengths in Table D.19.

Table D.19: High Street Deritend / Alcester Street (and Adderley Street) Surveyed Queue Lengths (PCUs)

	AM Peak		PM Peak		Saturday Peak	
Movement	Observed	Modelled	Observed	Modelled	Observed	Modelled
High Street Deritend (west) Ahead (Lane 1)	0.7	2.5	0.4	6.2	1.1	4.6
High Street Deritend (west) Ahead (Lane 2)	1.7	2.6	4.3	6.3	3.7	4.6
High Street Deritend (west) Ahead/Right (Lane 3/4)	2.3	2.8	3.5	6.7	1.6	4.9
High Street Deritend (east) Ahead/Left (Lane 1)	3.0	3.3	2.3	4.0	1.9	3.7
High Street Deritend (east) Ahead (Lane 2)	5.4	8.6	3.6	5.6	3.4	4.2
High Street Deritend (east) Ahead/U-Turn (Lane 3)	4.4	9.5	2.3	6.3	2.4	4.8
Alcester Street Left/Right	5.2	5.5	8.7	7.4	5.3	3.9

Source: Mott MacDonald/LinSig V3

D.12 High Street Deritend / Adderley Street

This junction was included in the LinSig assessment of High Street Deritend / Alcester Street.

The 2015 Base Year results for the High Street Deritend / Adderley Street junction are shown in Table D.14.

Table D.20: High Street Deritend / Adderley Street 2015 Base Year Results

	AM Peak		PM Peak		Saturday Peak	
Movement	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
Adderley Street	6.6	0.1	39.6	1.5	11.5	0.2

Source: LinSig V3

The results for the Base Year assessment of High Street Deritend / Adderley Street show the junction operates within capacity over all the peak hours.

The LinSig model was compared with the surveyed queue lengths shown in Table D.15.

Table D.21: High Street Deritend / Adderley Street Surveyed Queue Lengths (PCUs)

	AM Peak		PM Peak		Saturday Peak	
Movement	Observed	Modelled	Observed	Modelled	Observed	Modelled
Adderley Street	0.0	0.1	0.3	1.5	0.0	0.2

Source: Mott MacDonald/LinSig V3

D.13 Moor Street Queensway / Masshouse Lane

Figure D.10 shows the staging of the Moor Street Queensway / Masshouse Lane junction.

Figure D.10: Current Staging of Moor Street Queensway / Masshouse Lane

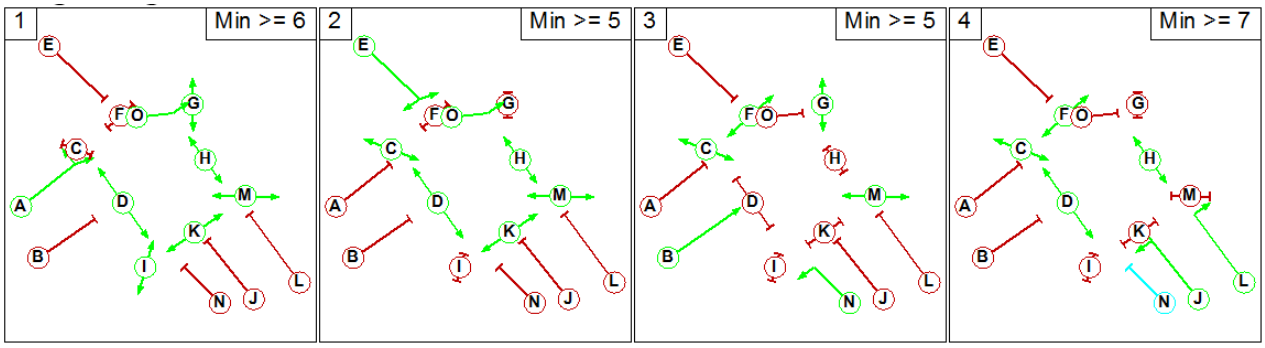


Figure D.10 shows the following staging:

- Stage 1 provides for left-turn only traffic from Moor Street Queensway (onto Priory Queensway) and Priory Queensway (onto Moor Street Queensway). Six pedestrian crossing phases are in operation during Stage 1.
- Stage 2 provides for all movements from Priory Queensway, and five pedestrian crossing phases.
- Stage 3 provides for a left-turn filter lane from Masshouse Lane onto Moor Street Queensway, as well as four pedestrian phases.
- Stage 4 provides for all movements off Masshouse Lane, along with four pedestrian phases.

This junction has been assessed within the LinSig model for the Moor Street Queensway / Albert Street junction due to the interconnected nature of the junctions. The results are shown in Table D.22.

Table D.22: Moor Street Queensway / Masshouse Lane 2015 Base Year Results

	AM Peak		PM Peak		Saturday Peak	
Movement	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
Priory Queensway	61.9	4.8	69.8	5.5	66.9	5.3
Masshouse Lane Ahead/Left	55.5	4.2	59.4	4.4	64.8	4.7
Masshouse Lane Right	37.0	3.1	50.1	3.9	25.9	1.8
Moor Street Queensway Left/Ahead	58.3	5.2	68.3	6.2	68.4	5.9
Moor Street Queensway Ahead (Lane 2)	37.7	4.9	52.5	9.7	50.4	7.9
Moor Street Queensway Ahead (Lane 3)	39.5	5.5	54.1	10.6	51.9	8.7
Cycle Time (s)	100		108		100	
PRC (%)	45.5		28.9		31.5	

Source: LinSig V3

The Moor Street Queensway / Masshouse Lane junction operates within capacity in all of the Base Year peak periods.

The LinSig model was compared with the surveyed queues lengths in Table D.23 and video footage of the junction.

Table D.23: Moor Street Queensway / Masshouse Lane Surveyed Queue Lengths (PCUs)

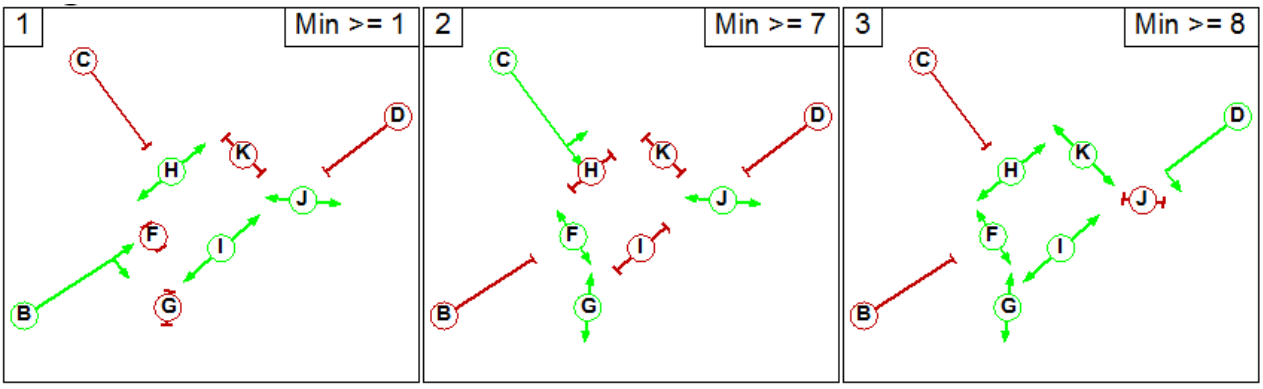
	AM Peak		PM Peak		Saturday Peak	
Movement	Observed	Modelled	Observed	Modelled	Observed	Modelled
Priory Queensway	4.8	4.8	5.9	5.5	5.9	5.3
Masshouse Lane Ahead/Left	2.9	4.2	4.8	4.4	3.8	4.7
Masshouse Lane Right	3.2	3.1	3.9	3.9	1.0	1.8
Moor Street Queensway Left	3.5	5.2	4.7	6.2	3.7	5.9
Moor Street Queensway Ahead (Lane 2)	7.6	4.9	13.0	9.7	12.5	7.9
Moor Street Queensway Ahead (Lane 3)	6.6	5.5	11.5	10.6	6.3	8.7

Source: Mott MacDonald/LinSig V3

D.14 Moor Street Queensway / James Watt Queensway (B4114)

The existing staging operates in two streams, with stream two operating due to pedestrian demand crossing the Moor Street Queensway leading to James Watt Queensway B4114 (see Figure D.11).

Figure D.11: Existing Staging of Moor Street Queensway / James Watt Queensway (B4114)



This junction has been assessed within the LinSig model for the Moor Street Queensway / Albert Street junction. Table D.24 shows the 2015 Base Year results for the Moor Street Queensway / James Watt Queensway (B4114) junction.

Table D.24: Moor Street Queensway / James Watt Queensway (B4114) 2015 Base Year Results

	AM Peak		PM Peak		Saturday Peak	
Movement	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
James Watt Queensway (B4114) Left/Ahead	63.9	12.2	69.4	14.7	65.4	12.4
James Watt Queensway (B4114) Ahead	66.1	14.2	71.5	17.1	67.1	14.0
Jennens Road Left (Lane 1)	61.1	4.9	66.2	7.0	65.5	5.7
Jennens Road Left (Lane 2)	63.3	5.5	68.3	7.8	67.7	6.4
Moor Street Queensway Left (Lane 1)	13.8	1.5	24.7	3.3	22.0	1.6
Moor Street Queensway Left (Lane 2)	16.3	2.1	27.1	3.9	19.4	2.5
Moor Street Queensway Ahead/Right (Lane 3)	63.8	9.2	70.7	11.7	68.7	10.8
Cycle Time (s)	100		110		100	
PRC (%)	36.2		26.0		31.0	

Source: LinSig V3

It is evident in Table D.24 that the junction operates within capacity in the Base Year peak periods, with a maximum degree of saturation of 71.5% (James Watt Queensway B4114 Ahead, PM Peak).

The LinSig model was compared with the surveyed queue lengths in Table D.25.

Table D.25: Moor Street Queensway / James Watt Queensway (B4114) Street Surveyed Queue Lengths (PCUs)

	AM Peak		PM Peak		Saturday Peak	
Movement	Observed	Modelled	Observed	Modelled	Observed	Modelled
James Watt Queensway (B4114) Left/Ahead	13.6	12.2	17.2	14.7	13.3	12.4
James Watt Queensway (B4114) Ahead	15.4	14.2	16.3	17.1	15.3	14.0
Jennens Road Left (Lane 1)	3.8	4.9	3.7	7.0	4.5	5.7
Jennens Road Left (Lane 2)	7.5	5.5	5.0	7.8	5.8	6.4
Moor Street Queensway Left (Lane 1)	0.3	1.5	0.2	3.3	0.2	1.6
Moor Street Queensway Left (Lane 2)	0.1	2.1	0.2	3.9	0.0	2.5
Moor Street Queensway Ahead/Right (Lane 3)	5.4	9.2	6.7	11.7	4.5	10.8

Source: Mott MacDonald/LinSig V3

D.15 Moat Lane Gyratory

The 2015 Base Year assessment of the entry and exit junctions to and from the Moat Lane gyratory from Digbeth (B4100) is shown in Table D.26, with the worst case degree of saturation and queue results taken at each junction. Cycle times have been obtained from on-site observations, and have been triple cycled within the model to represent on-site conditions.

Table D.26: Moat Lane Gyratory 2015 Base Year Results

	AM Peak		PM Peak		Saturday Peak	
Movement	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
Digbeth B4100 (east) Ahead (Lane 1)	63.7	5.0	73.2	6.1	67.7	5.7
Digbeth B4100 (east) Ahead (Lane 2)	48.5	3.7	37.7	2.8	37.3	2.9
Digbeth B4100 (east) Ahead (Lane 3)	49.6	3.8	40.1	2.9	38.0	2.9
Cycle Time (s)	180		180		165	
PRC (%)	41.4		22.9		32.9	
Digbeth B4100 (west) Ahead and Left (Lane 1)	32.9	3.2	53.6	5.8	43.4	5.3
Digbeth B4100 (west) Ahead (Lane 2/3)	18.9	1.1	36.7	2.4	32.1	2.2
Digbeth B4100 (west) Right-turn (Lane 4)	64.1	9.0	73.9	8.3	67.6	9.1
Cycle Time (s)	180		165		195	
PRC (%)	40.3		21.8		33.1	

Source: LinSig V3

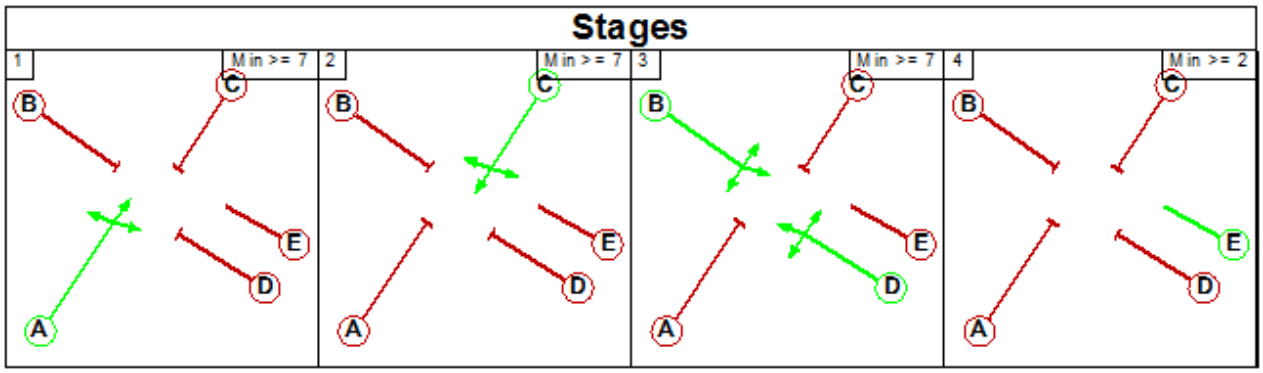
As evident in Table D.26 all junctions compromising the Moat Lane gyratory operate within capacity in the 2015 Base Year.

D.16 Heath Mill Lane / Liverpool Street

The Heath Mill Lane / Liverpool Street four-arm signalised junction (including Great Barr Street on the north-eastern arm and Fazeley Street on the north-western) has been designated as an off-line junction that may be impacted by the track alignment of the BEE.

The junction currently operates in four stages. Stages one and two allow all movements from Heath Mill Lane and Great Barr Street respectively. Stage three allows all movements from Fazeley Street and Liverpool Street. This is shown in Figure D.12.

Figure D.12: Current Staging of Heath Mill Lane / Liverpool Street



The 2015 Base Year results are shown in Table D.27.

Table D.27: Heath Mill Lane / Liverpool Street Base Year Results

	AM Peak		PM Peak		Saturday Peak	
Movement	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)	DoS (%)	Queue (PCU)
Great Barr Street	74.6	8.1	78.0	9.7	62.8	5.5
Liverpool Street	71.5	2.5	43.9	1.3	15.1	0.5
Heath Mill Lane	73.2	6.0	80.5	8.7	62.4	5.1
Fazeley Street	69.4	3.5	78.8	8.0	59.0	4.4
Cycle Time (s)	54		69		59	
PRC (%)	20.6		11.9		43.3	

Source: LinSig V3

Table D.27 shows the junction to operate within its practical capacity in the AM, PM and Saturday peaks in the base year.

The LinSig model was compared with the surveyed queue lengths in Table D.28.

Table D.28: Heath Mill Lane / Liverpool Street Surveyed Queue Results

	AM Peak		PM Peak		Saturday Peak	
Movement	Observed	Modelled	Observed	Modelled	Observed	Modelled
Great Barr Street	6.3	8.1	7.9	9.7	3.8	5.5
Liverpool Street	1.2	2.5	0.9	1.3	0.4	0.5
Heath Mill Lane	4.9	6.0	8.8	8.7	2.3	5.1
Fazeley Street	2.5	3.5	8.3	8.0	2.3	4.4

Source: Mott MacDonald/LinSig V3

Appendix E. BCC SATURN Model – Local Model Validation Report

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BCC Saturn Model Update - Local Model Validation Report

Report
January 2016

centro

Our ref: 22693502
Client ref:



steer davies gleave

BCC Saturn Model Update - Local Model Validation Report

Report
January 2016

centro

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A Midland Metro Business Case Modelling Approach

B Count Calibration Tables

C Journey Time Calibration Graphs

D SATURN Assignment Parameters

1 Introduction

Context

1.1 This report describes the work Steer Davies Gleave has undertaken to produce a base year highway model to forecast the impacts of the Birmingham Eastside Extension (BEE) and Edgbaston Extension Midland Metro Extension on the road network. Outputs from the model are proposed to be used in the cost benefit analysis and environmental and traffic assessments.

1.2 The model has been created from two existing source models:

- PRISM Model - provides travel demand data
- BCC SATRUN model – provides network data

1.3 The PRISM model has been recently calibrated to 2011, includes demand modelling to assess the impact of schemes on trip distribution and mode shares and the transport network covers the whole West Midlands conurbation so it can assess the impacts beyond the City Centre. However PRISM is a regional, strategic transport model and therefore is not able to model the impacts on the highway network in enough detail primarily because:

- PRISM is a strategic model covering the whole of the West Midlands and is therefore not suitable for testing the fairly micro impacts of these City Centre schemes. The size of the model also means model noise can influence results significantly when assessing schemes where the impacts are limited to a fairly small geographical area.
- The zoning system is coarser than required for City Centre modelling, with the alternative routes into traffic zones not being represented in enough detail. (within the ring road there are 36 Prism zones compared to 54 BCC zones in the original BCC model, this has been made even more disaggregate as part of the model development).

1.4 The best available tool to test the more detailed local level highway impacts of BEE and Edgbaston Extension is therefore Birmingham Council's, Birmingham City Centre (BCC) SATURN highway model. The model has a detailed representation of the roads and junction within and including the Birmingham Ring Road. There is also a refined zoning system which means that the loading of traffic onto the City Centre road network is accurate to a good level of detail. In addition the BCC model is constantly maintained and updated by Birmingham City Council and has been used to test a number of schemes with a similar level of impact across the city centre.

1.5 The BCC model has a base year which is now very old (2004) and does not have a suitable mechanism to forecast future growth. The methodology undertaken in development of the updated BCC model therefore uses the best available information, with the detailed network and zonal system in the BCC model, and also utilises the considerable work already carried out

on PRISM to produce calibrated base year matrices and the future year forecasts based on planning forecast (land-use, socio-economic) assumptions consistent with West Midlands districts' plans and constrained to TEMPRO based growth projections.

1.6 On one hand the linkages established with PRISM base and forecast matrices enable the new BCC model to be kept up to date with future PRISM updates. At the same time the detailed network and junction modelling and analysis that can be carried out using the updated BCC model enables assessment of local level impacts of proposed schemes within the Birmingham city centre.

1.7 Our Modelling Specification Report which further sets out the rationale behind the methodology is attached in Appendix A

1.8 The report is structured as follows:

- Model Overview
- Collection and Preparation of Data
- Model Network Review
- Model Calibration

2 Model Overview

Introduction

2.1 This chapter presents a summary of some of the key characteristics of the model.

Model Base Year

2.2 The base year for the updated BCC model is chosen to be 2011 to retain consistency with PRISM's base year model.

Modelled Area

2.3 The network model covers Central Birmingham Ring Road and is extended by around 1km West in the Edgbaston area. This covers all the likely rerouting options for traffic that is affected by the two proposed Metro schemes (see Figure 2.1 below).

2.4 The demand matrices are provided as an input from the PRISM model, which covers the West Midlands conurbation in detail and a skeleton network covering the rest of the UK.

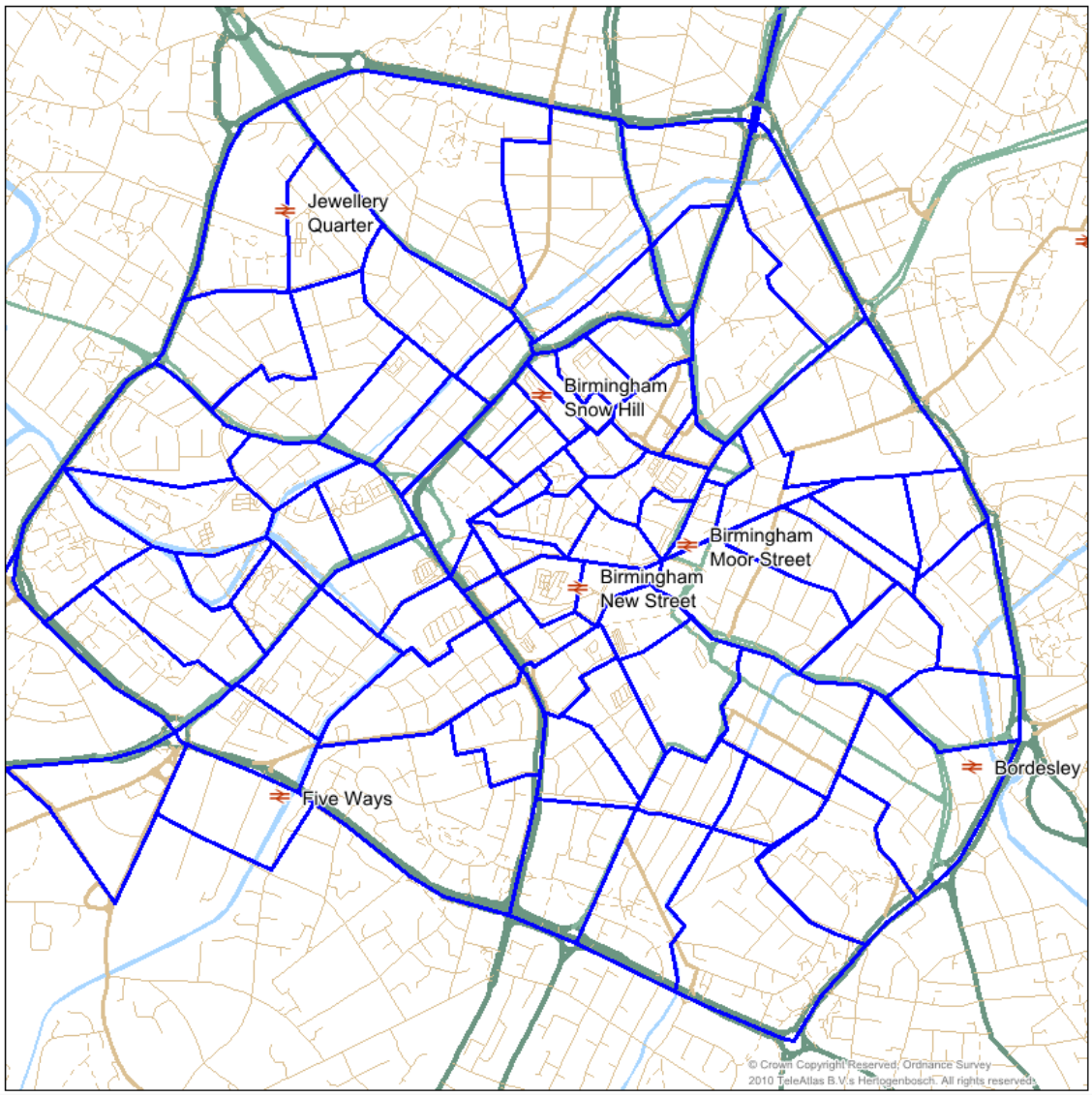
Figure 2.1: BCC Model Network



Zoning System

2.5 The model has 146 zones of which are 112 internal as shown in Figure 2.2 below, with 34 external zones feeding into the external links on the network shown in Figure 2.1 above.

Figure 2.2: Zonal Structure



Network Structure

2.6 The network has 1912 road links and 688 zone connectors. The majority of the network is fully simulated to represent the operation of junctions in detail with the following junction types coded into the network shown in Table 2.1 below.

Table 2.1: Junctions in the BCC Base Year model

Junction	Number
Priority Junction	565
Traffic Signals	86
Roundabouts	31
Dummy Nodes	17

External Nodes	173
All Junctions	**872**

Time Periods

2.7 The models cover the AM and PM peak hours:

- AM Peak (08:00-09:00)
- PM Peak (17:00-18:00)

User Classes

2.8 The model contains 4 user classes:

- Car Work
- Car Non-Work
- Light good vehicles (LGV)
- Heavy Goods Vehicles (HGV)

2.9 Buses are coded in as fixed flows. Buses and HGVs have a PCU factor of 2.5 to convert from vehicles into car equivalent units.

Assignment Methods

2.10 The traffic is assigned using the standard SATURN Frank-Wolfe algorithm, which is based on Wardrop's Principle of traffic equilibrium, where "Traffic arranges itself on congested networks such that the cost of travel on all routes used between each O-D pair is equal to the minimum cost of travel and all unused routes have equal or greater cost"[1].

Generalised Cost

2.11 The following values of time and vehicle operating costs were used in the assignment as shown in Table 2.2 and Table 2.3 below. These values are consistent with those used in the PRISM model, which are themselves source from WebTAG recommended values.[2]

Table 2.2: Value of time (pence per minute)

Time Period	Car Work	Car Non- Work	LGV	HGV
AM	54.60	13.26	21.83	36.38
PM	52.59	13.57	21.83	36.38

Table 2.3: Vehicle operating cost (pence per kilometre)

Time Period	Car Work	Car Non- Work	LGV	HGV
AM	18.10	9.40	19.30	74.00
PM	18.30	9.60	19.50	75.30

2.12 In addition to ensure that there was note unrealistic "rat-running" an additional distance based penalty was added to minor roads, with a 15% extra distance costs for cars and LGVs and an extra 33% for HGVs. These are only applied to very minor roads where it is difficult to

[1] SATURN Version 11.3 Manual, Section 7. Assignment – The Role of SATEASY/SATALL, Section 7.1.1, (ITS Leeds, Dirk Van Vliet, Atkins), 2015

[2] PRISM Local Model Validation Report, (PRISM Management Group), April 2015

represent users unwillingness to use them or lack of awareness of their existence, through conventional network coding.

Capacity Restraint Mechanisms

2.13 The main element of capacity constraint in the model is through SATURN junction simulation modelling, which represents junctions operation to a detailed level. Theoretical turn capacities are coded into each junction, with capacities calculated as part of the assignment/ simulation process, with signal timings and turn priorities taken into account.

2.14 Speed flow curves have also been added to links on the ring road and the A38 Tunnel through the city centre, in order to represent link delays on these longer grade separated sections of road. The curves are based on COBA and modified to be more representative of observed conditions.

Relationships with Variable Demand and Public Transport Assignment Models

2.15 The demand is taken from the PRISM model, which is a four-stage demand model with a public transport and highway assignment and mode choice model. The base demand is taken directly from the model, and then adjusted to go from peak period to peak hour. Matrix estimation was then applied to the model to improve the local calibration.

Calibration and Validation Criteria

2.16 The calibration and validation criteria that the model is measured against is based on WebTAG [3]guidance and is as follows:

Table 2.4: Screenline Flow Validation Criterion and Acceptability Guideline

Criteria	Acceptability Guideline
Differences between modelled flows and counts should be less than 5% of the counts .	All or nearly all screenlines

Table 2.5: 2 Link Flow Validation Criteria and Acceptability Guidelines

Criteria	Description of Criteria	Acceptability Guideline
1 (DMRRB)	individual flows within 100 veh/h of counts for flows less than 700 veh/h	> 85% of cases
	Individual flows within 15% of counts for flows from 700 to 2,700 veh/h	> 85% of cases
	Individual flows within 400 veh/h of counts for flows more than 2,700 veh/h	> 85% of cases
2 (GEH)		

[3] TAG Unit M3.1 – Highway Assignment Modelling, Department For Transport, January 2014

Table 2.6: 3 Journey Time Validation Criterion and Acceptability Guideline

Criteria	Acceptability Guideline
Modelled times along routes should be within 15% of surveyed times (or 1 minute, if higher than 15%)	> 85% of routes

3 Collection and Preparation of Model Data

Overview

3.1 In order to calibrate / validate the model, a variety of observed data was used to inform this process. This chapter describes the data, how it was collected, analysed and then used in the model update. The data used is summarised into the following 3 data types:

- Traffic Counts
- Journey time data
- Signal Data

Count Data

Count Sources

3.2 The count data collected in the course of the model update was from the Spectrum Traffic Count Database maintained by Mott Macdonald[4]. Spectrum is a repository for various transport related data available to governmental and public sector organisations in the West Midlands. There is therefore a large set of count data across the region and over a number of years.

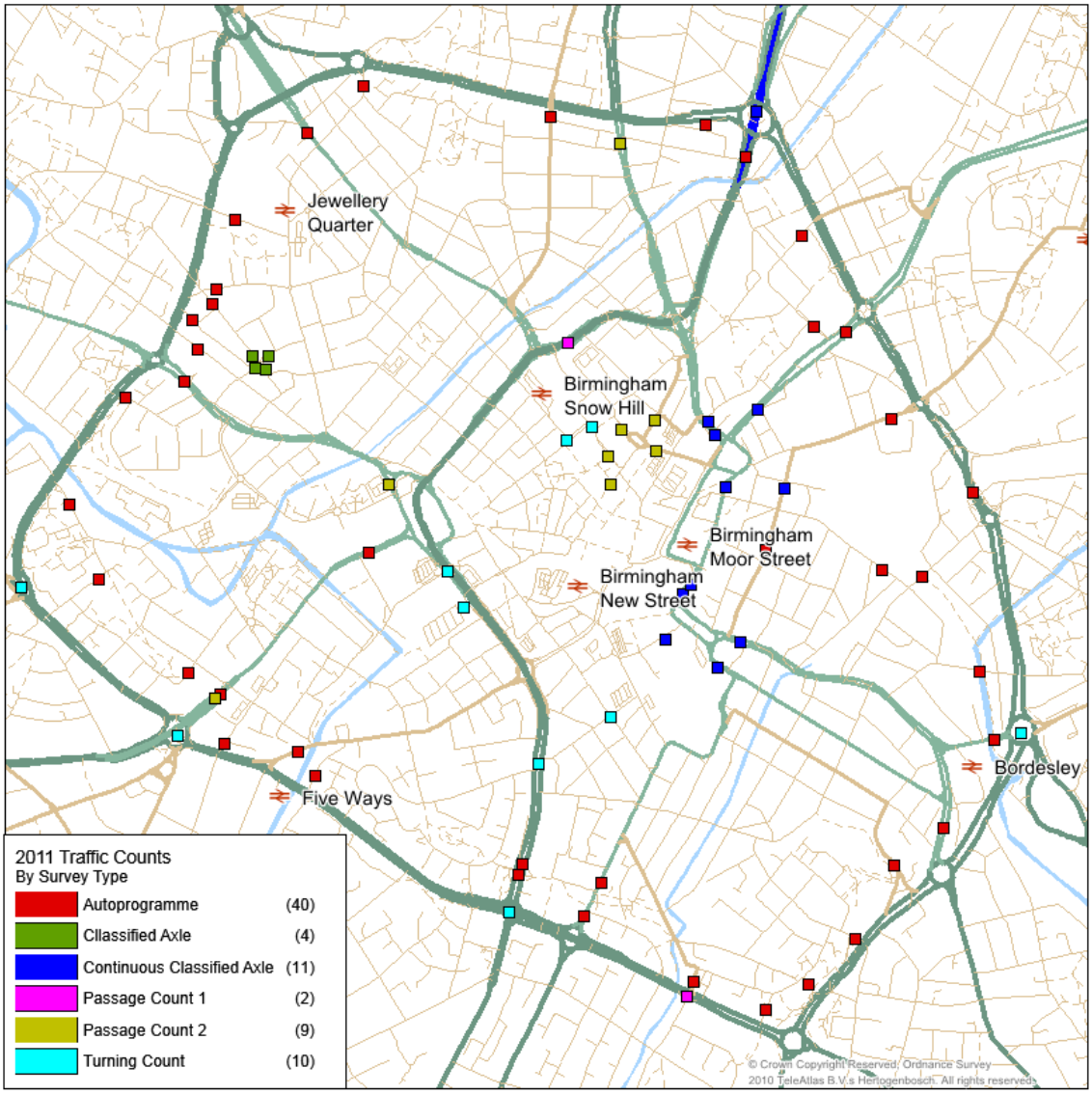
3.3 The 2011 traffic data in Birmingham City Centre was extracted from the Spectrum Traffic Count Database. There are a number of different traffic survey types from which the data was extracted and are as follows:

- Autoprogram Volume Traffic Count
- Classified Axle (Volume)
- CMAS: Continuous Classified Axle (Volume)
- Passage Count 1 [Vehicle/ Pedestrians]
- Passage Count 2 (6 Vehicle Categories) [Veh/Pedestrians]
- Turning Count

3.4 There are 66 count sites within the BCC model area, which provides around 230 link counts to be used in the model calibration process. The count sites are shown in Figure 3.1 below.

[4] http://www.spectrum-wm.com/interface/

Figure 3.1: Traffic Count Locations



Data Processing

3.5 The count data was processed into a format that could be used in the model analysis. The data was summarised into the following vehicle categories to match the modelled vehicle classes:

- Car (inc. Taxi)
- HGV
- LGV
- Bus

3.6 The data from each type of survey listed above had different vehicle categories. The conversion of the survey vehicle categories into the model vehicle categories are detailed below for each survey type:

- Autoprogram Volume Traffic Count
  - Total Vehicle Count only (Split based on other counts of similar link type)
- Classified Axle (Volume)
  - Car (inc. Taxi): Car and Light Van [single category]

    - HGV: All Other Axles [multiple categories]
    - LGV: 2 Axle Rigid and Unclassified Vehicles
    - Bus: Bus and Coach [single category]
- CMAS: Continuous Classified Axle (Volume)
    - Car (inc. Taxi): Motor Cycles, Cars and Light Vans [single category]
    - HGV: Articulated HGVs
    - LGV: Light Goods Vehicles
    - Bus: Bus and Coach [single category]
- Passage Count 1 [Veh/Pedestrians] (PCN)
    - Car (inc. Taxi): Most: Car and Taxi [single category]; Some: Cars, Private Hire, Black Cab and Blue Badge [single category]
    - HGV: Most: RIG >3T All Axles [multiple categories]; Some: HGV; Some: HGV (all categories)
    - LGV: Most: GDS <1.5T and LGV 1.5-3T; Some: Light Goods and Other Vehicles; Some: Light Goods
    - Bus: Bus and Coach [single category]
- Passage Count 2 (6 Vehicle Categories) [Veh/Pedestrians]
    - Car (inc. Taxi): Most: Car and Van [single category]; Some: Cars, Black Cab and Private Hire
    - HGV: HGV>3T
    - LGV: LGV<3T
    - Bus: Most: Bus and Coach [single category]; Some: Bus and Coach [single category] and Mini Buses
- Turning Count
    - Car (inc. Taxi): Cars and Light Vans [single category]
    - HGV: Goods >3T Veh
    - LGV: Goods <3T Veh
    - Bus: Bus and Coach [single category]

3.7 The data was processed into the following periods were collected to correspond to the peak period and peak hour periods, which correspond to the PRISM and BCC models' modelled periods, as follows:

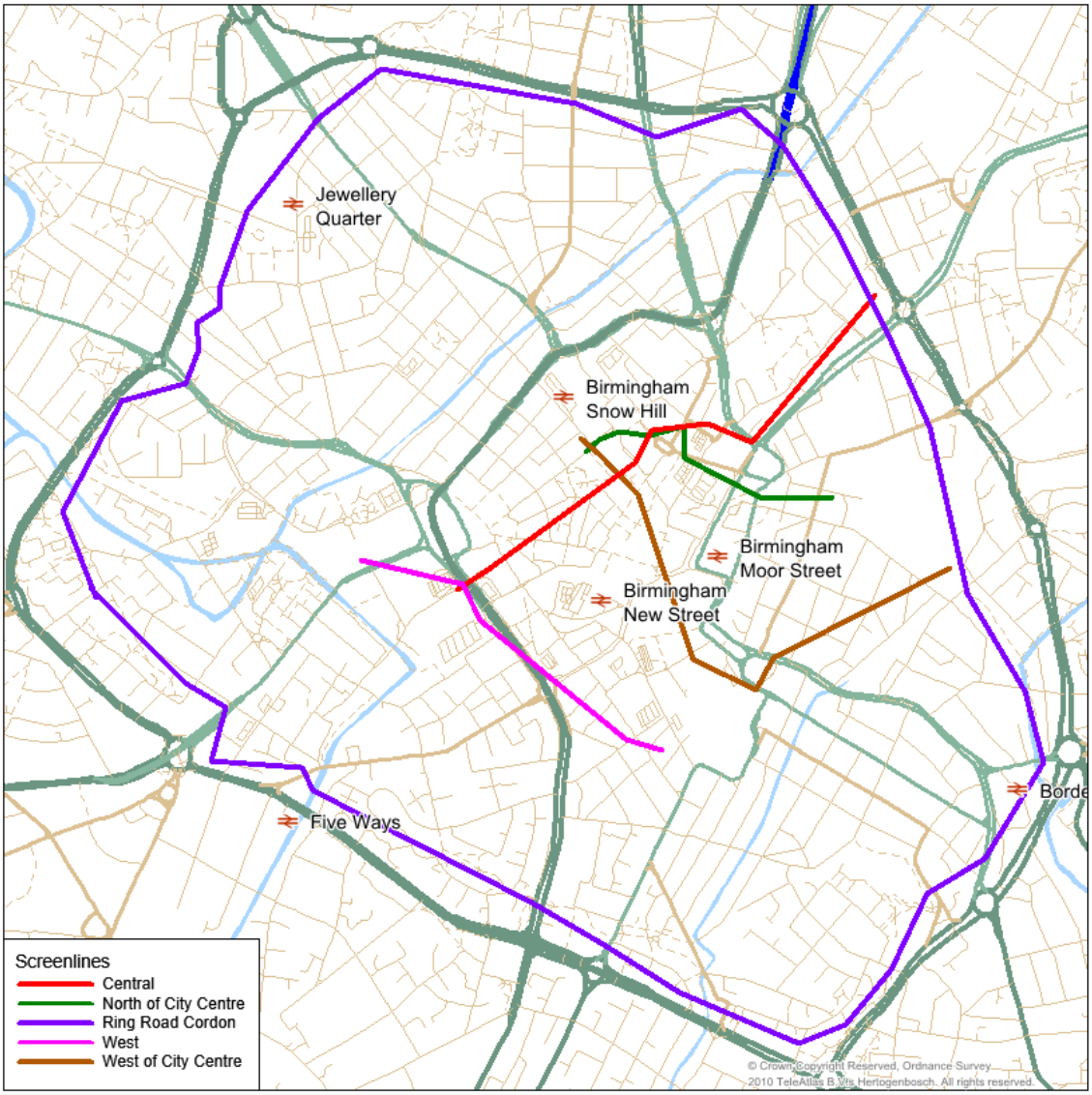
- AM Peak hour: 08:00 – 09:00
- AM Peak Period 0700 - 0930
- PM Peak: 17:00 – 18:00
- PM Peak Period - 1530 to 1900

3.8 The majority of the surveys were done in October/ November 2011 and covered a week's worth of count data. These are considered neutral months and provides enough of a spread of data to account for day to day variations in traffic counts. Therefore no seasonality or confidence factors were applied to the observed data.

Screenlines and Cordon

3.9 The counts have been combined into a number of screenlines to capture movements to/from the centre of Birmingham. There is also a cordon just inside the central Birmingham ring road. The cordon is used to calibrate the total traffic entering and leaving the area within the ring road Birmingham area. The screenlines and cordon are displayed in Figure 3.2 below:

Figure 3.2: Map of Birmingham City Centre with Screenlines and Cordon Used Shown



Journey Time Data

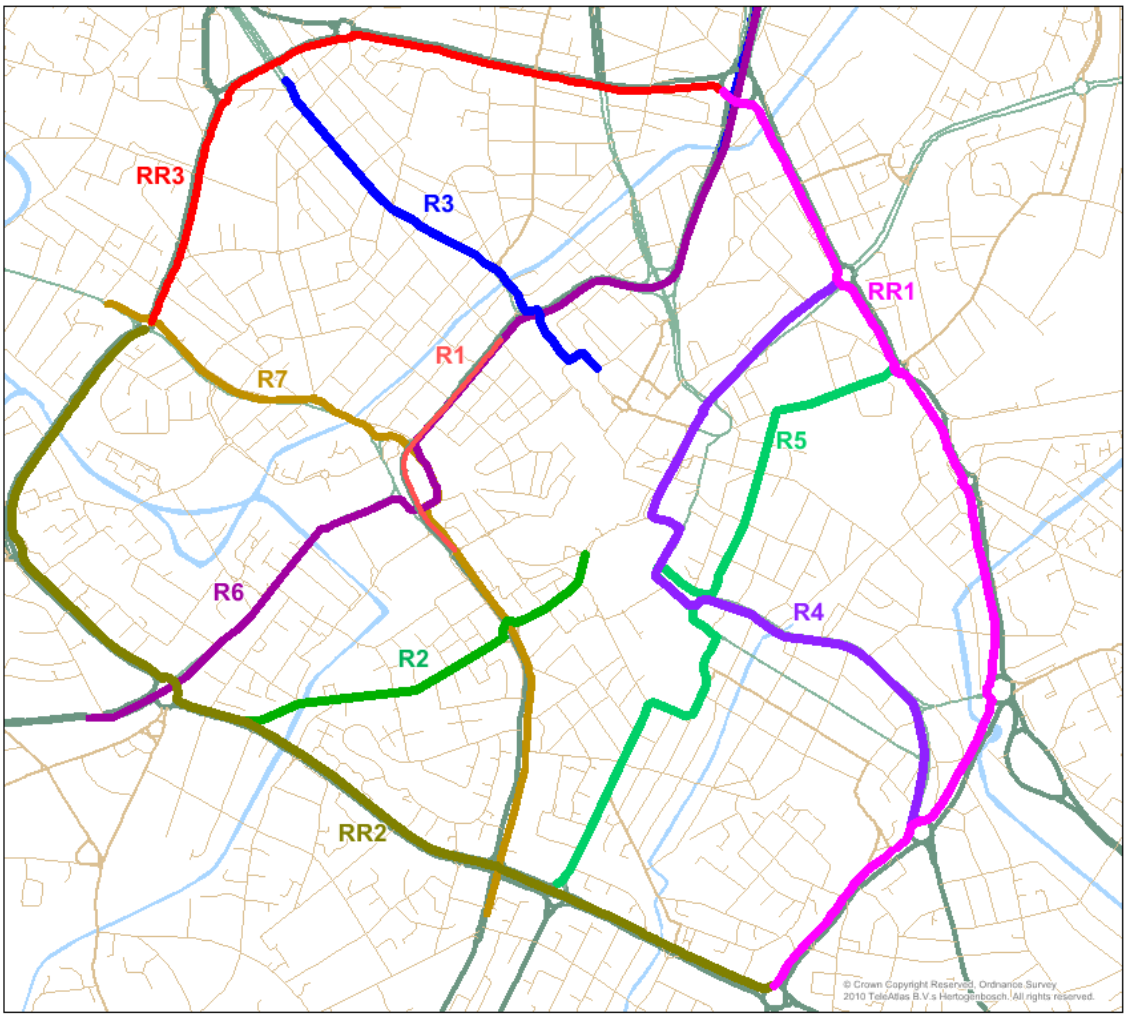
3.10 Trafficmaster data was used to provide journey time data for the model validation. A number of routes were specified and extracted by CENTRO from the Trafficmaster database. The data extracted was from 2011 and covered the two modelled peak hours.

3.11 Trafficmaster data is derived from GPS data and therefore has a large number of observations compared to traditional moving car surveys. The routes extracted are shown in Figure 3.3 on the following page with a brief description as follows:

- Ring Road Route 1 – Between Ashton Expressway and Haden Circus
- Ring Road Route 2 – Between Haden Circus and Spring Hill
- Ring Road Route 3 – Between Spring Hill and Haden Circus
- Route 1 – A38 Tunnel
- Route 2 - Bath Row to Smallbrook Green
- Route 3 - Great Hampton Street to Steelhouse Lane
- Route 4 – Nechells Parkway to Stratford Road
- Route 5 – Vauxhall to Pershore Road

- Route 6 – Aston Expressway to Hagley Road
- Route 7 - Spring Hill to Bristol Street

Figure 3.3:Journey Time Routes



Signal Plans

3.12 As part of the development of the PRISM model 2011 signal data is being collected across the West Midlands. The data for Birmingham city centre was provided in a processed format giving typical staging and timings for the AM and PM peaks (rather than the raw signal data). This data could therefore be used to check the coding of signals in the SATURN model, with the locations of the signals shown in Figure 3.4 below.

Figure 3.4: Locations of Observed Signal Data



4 Model Audit

Overview

4.1 The updated BCC model developed for this project started from the existing BCC SATURN model developed and maintained by Birmingham City Council. The basic model network coding therefore already existed as a starting point for this update. However before starting the count and journey time calibration a detailed audit of the network coding and assignment parameters was undertaken. This chapter describes the processes undertaken.

Network Audit

Remove Walk Links

4.2 The BCC Saturn model network contains links representing the walk access from where people park to their final destination. These links are banned to general traffic so did not cause incorrect routing in the traffic assignment. However visually the model has a confusing layout and a time consuming process of turning off the walk links needs to be undertaken before undertaking any on screen model checking or analysis. It also increases the risk of modelling errors with traffic being either incorrectly banned or allowed on walking links.

4.3 This walking element of the model is no longer used, so these walk links are effectively redundant to the modelling process. Given the risk in introducing model errors and the inefficiencies in model analysis caused by the links, the first step in the network updates was in deleting the walk links.

2011 conditions

4.4 The BCC base year model is 2004, and given that there had been considerable to the road layout in Birmingham between 2004 and 2011 it was necessary to update the model to ensure that these changes were incorporated into the 2011 model. Birmingham City Council provided us with a number of future year models where we could source coding for network changes between 2004 and 2011. However care was taken so that changes that have occurred since 2011 were not incorrectly added into the network.

4.5 The two most significant changes between 2004 and 2011 added to the model was:

- Changes in bus priority and road layout around Moor St (the current two way operation had not been introduced at this time)
- The Ladywood “Hamburger” layout on the ring road around

Network Coding Audit

General Standards

4.6 A full review of the model's network coding was undertaken. In the first place to assess that the general model coding had been done to industry standards and in line with best practice. Having checked a number of junctions and following on from an earlier review of the model we were confident that the model's network coding was generally to a good standard, with

- Saturation turn flows within standard ranges
- Priority marking correctly used
- Different junction types fully included with sensible assumptions.

SATURN warnings

4.7 A detailed error checking exercise was carried out using the warnings the SATURN software produces as part of the programmes network building step. SATURN classifies the errors in a number of seriousness types:

- Non-Fatal
- Serious Warning
- Warning

4.8 We checked and removed all non-fatal errors in the network. In addition we analysed the serious warnings and warnings produced by the model and selected a subset of these warnings that in our experience are most likely be down to coding errors.. These warnings were then gone through in detail and fixes made where appropriate. In total over 300 warnings were checked.

Check of Key Junctions

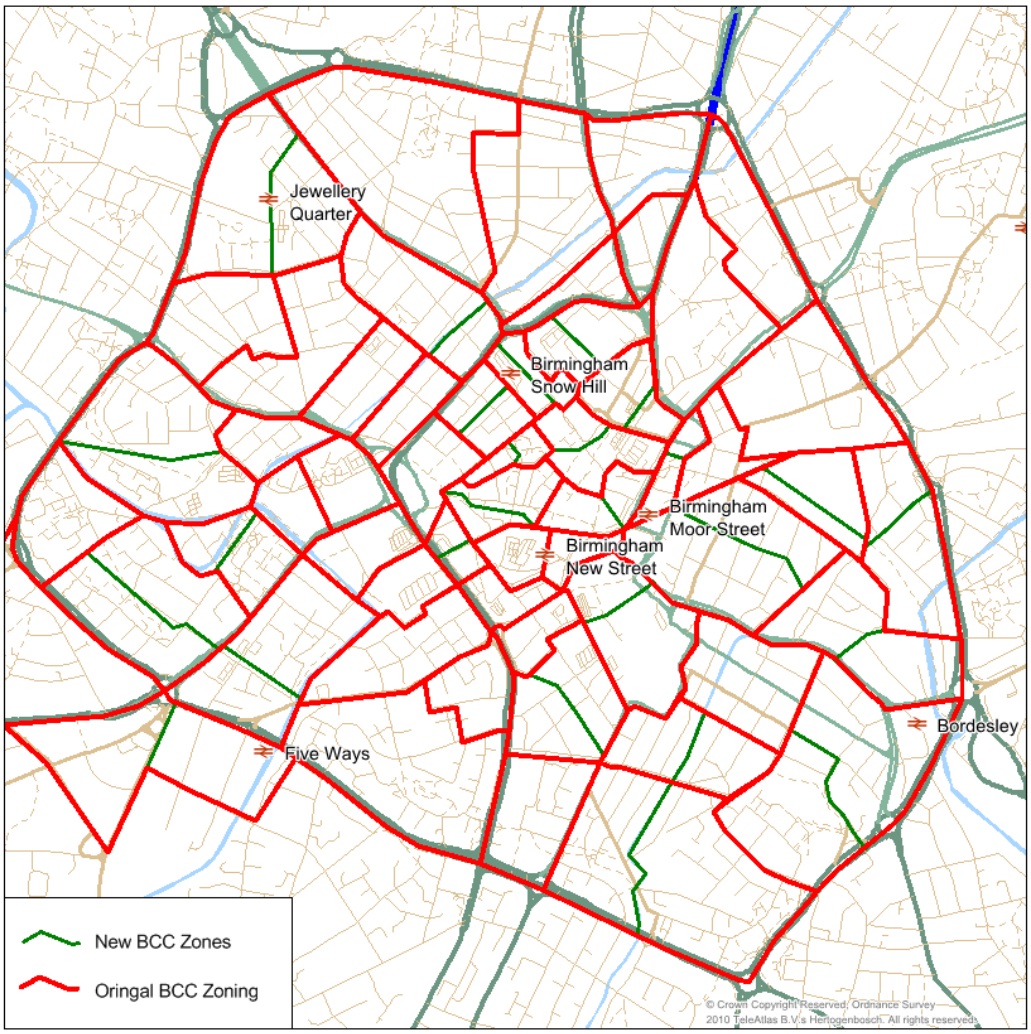
4.9 Key junctions along the proposed alignments and those that are significant in terms of carrying large numbers of flows were checked to ensure that the lane allocations, priority markings and signal settings were correct. Birmingham City Council provided us with the observed 2011 signal data and these were updated at the key junctions.

Zone Connector/ Splitting

4.10 A review of the zoning was undertaken. Firstly to ensure that the zone connectors load traffic onto the network on links most representative of where traffic would be expected to enter the network. Where possible traffic was not loaded directly onto main roads but on side roads or external "spigot" links. This included reducing the number of connectors to simplify the network and reduce the likelihood of traffic "flipping" between connectors introducing implausible changes between scenarios. We also ensured that links with counts used in the matrix estimation were not bridged by centroid connections as this can lead to problems during the ME process.

4.11 In addition to reviewing where the connectors are loaded onto the network, the detail of the zoning system was also updated. This was to done to improve the routing of traffic at the start/ end point of their journeys. This resulted in 13 new zones being created, as shown in Figure 4.1 below, increasing the total number of internal zones to 112.

Figure 4.1: BCC Updated Zonal System



Assignment Parameters

4.12 A review of the SATURN assignment parameters was undertaken. This involved making changes to parameters that effects the assumptions made on

- The modelling of traffic at junctions
- the number of assignment and simulation loops
- and the convergence criteria.

4.13 The majority of these updates were to put the model in line with latest SATURN recommended values. A full list of the updated criteria can be found in Appendix D. An important set of updates were to update the assignment convergence criteria so that the model would converge in line with WebTAG recommendations, these updates are outlined in Table 4.1

Table 4.1: Assignment Convergence Criteria

Parameter	Description	BCC Stopping Criteria	Updated Model Criteria
RSTOP	% of Links where links flows change by less than PCNEAR	94.5	98

PCNEAR	% Change in link flows between assignments assessed in RSTOP	2	1
STPGAP	GAP Value %	1%	0.1%
KONSTP	Stopping criteria method (0= ISTOP/ RSTOP, 5 =	0	5

5 Development of Prior Trip Matrices

PRISM

5.1 The prior matrices were taken from the PRISM 2011 base year model. The detailed process used in development of PRISM matrices is outlined in PRISM model calibration report[5].

5.2 In summary, to support the development of PRISM a substantial amount of data for the highway matrix build was collected. This dataset consisted of:

- Roadside interview survey (RSI) data collected at 90 sites;
- Manual classified counts (MCCs) at the 90 RSI sites;
- Automatic traffic counts (ATCs) for the RSI sites and for other additional sites across the West Midlands Metropolitan Area;
- Car park surveys for 53 urban sites; and
- GPS data (Trafficmaster and INRIX)

5.3 A comprehensive data merging exercise was undertaken to produce a prior matrix taking the best available data from the various surveys, for different movement types and journey purposes. This was complimented with a matrix synthesis to infill unobserved movements. A thorough calibration/ validation exercise was then undertaken to ensure the flows produced by the matrices replicated observed flows. Further details of the matrix building process can be found in the PRISM Local Model Validation Report.

5.4 The input matrices are therefore taken from the fully validated/ calibrated PRISM matrices, rather than the PRISM prior matrices. As the future year growth forecasts come directly from the PRISM model, it was important to keep the linkage between the two models as close as possible. The calibration process undertaken for the BCC model should be viewed as a further refinement of the PRISM matrix development rather than an independent matric building process.

Cordoning

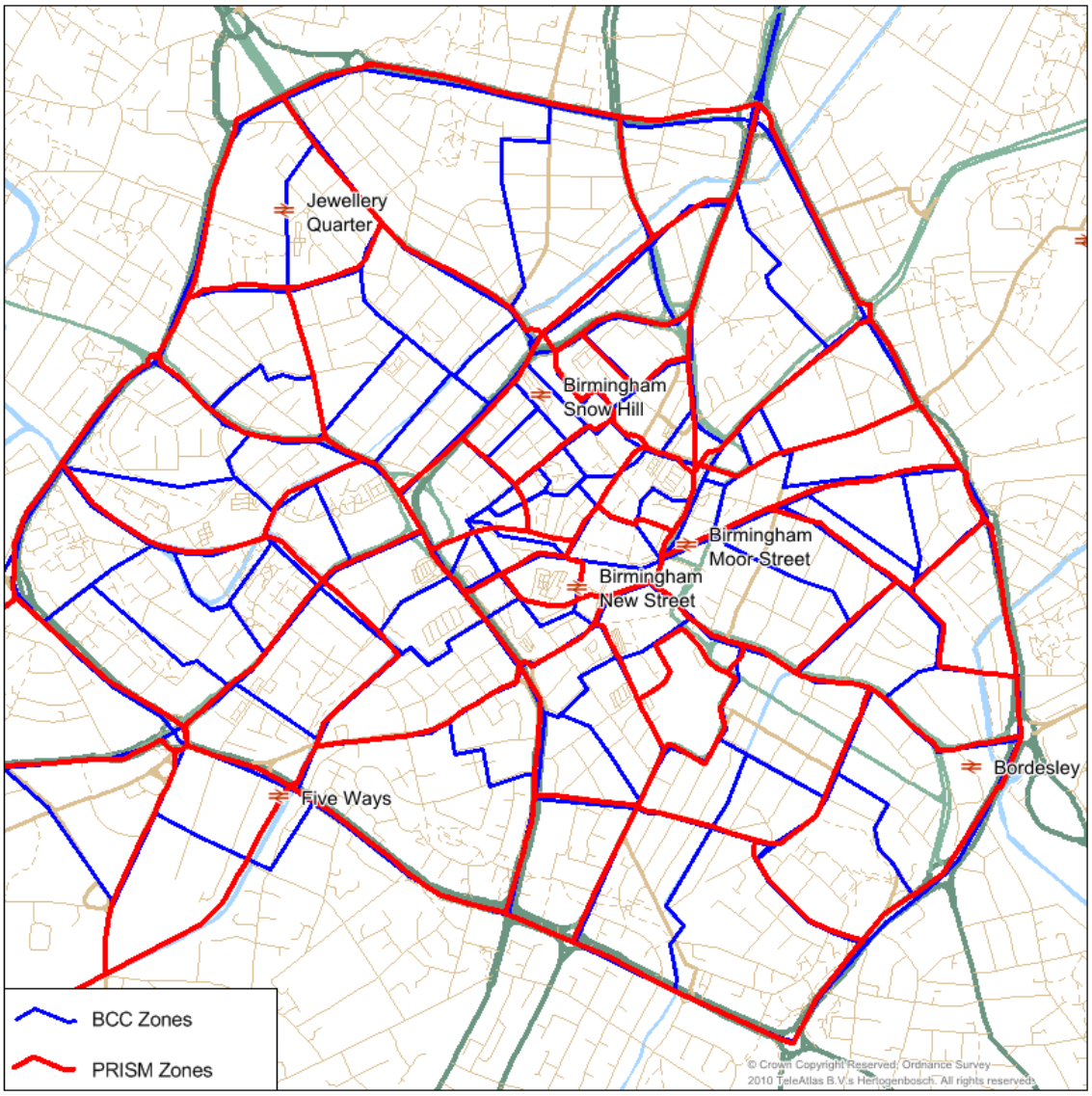
5.5 The PRISM matrix covers the West Midlands region, while the BCC model is a city centre model. In order to provide the matrices to the BCC model the PRISM model a cordoning and matrix disaggregation process was undertaken.

5.6 PRISM demand matrices for the updated BCC model were created using a =cordoning process which provided demand matrices for the same geographical area as the extent of the BCC model and then A GIS exercise was undertaken to match the PRISM zones to the BCC zones. PRISM and BCC zoning is very similar in the city centre with BCC zoning being more detailed

[5] PRISM Local Model Validation Report, (PRISM Management Group), April 2015

but mostly fitting within the PRISM zones. Given the close match between the PRISM and BCC zoning and the external BCC links matching the PRISM network, there was not a need for significant splitting and reallocating of the PRISM cordoned matrices. Figure 5.1 below shows the BCC and PRISM zoning systems, with the BCC zoning generally fitting within the borders of the PRSIM zones.

Figure 5.1: PRISM to BCC Zoning



5.7 This process was undertaken by the PRISM team at Mott Macdonald who maintain the PRISM model. The process is well established having been fed to the BCC model on previous projects. Checks were undertaken by ourselves to ensure that the zone matching had been correctly done and that we could replicate the input BCC matrices from the PRISM outputs. We are therefore confident that the input matrices used in the BCC calibration correctly replicate the validated PRISM matrices in Birmingham City Centre.

Factoring (Period to Hour)

5.8 The BCC model represents an average weekday "peak" hour whereas the PRISM matrices represent an average period hour. A factoring approach was therefore undertaken to go from the period to hour.

5.9 The factor was derived by assigning the period matrices to the BCC network and comparing the peak direction ring road cordon flows (effectively flows crossing/ entering the ring road to/ from the city centre). In the AM total inbound flows were then compared against the observed counts and in the PM total outbound flows. A flat factor was then applied to each vehicle type (car, LGV, HGV) so that the input matrices matched the flows as closely as possible. This means that the input trip distribution was not affected by the factoring (Table 5.1 below shows the factors applied).

Table 5.1: Matrix Factors

Period	Car	LGV	HGV	Average Factor
AM	1.29	0.74	0.82	1.20
PM	0.97	0.54	0.69	0.94

6 Model Calibration and Validation

6.1 This chapter presents the results of the model calibration and validation.

Calibration

Matrix Estimation

6.2 Following on from the network audit and production of the prior matrix, matrix estimation (ME) was carried out In order to improve the individual flow comparisons. The matrix estimation was carried out as follows:

- Counts from the 5 screenlines shown in Figure 3.2 are included in the matrix estimation
- Additional 12 counts on the ring road have been included
- A total of 113 counts are therefore used in the matrix estimation
- Matrix estimation run for 3 vehicle types; Car, LGV and HGV
- Counts included as individual flows rather than “mini-screenlines”
- There was not sufficient counts available to have an independent validation screenline

Count Calibration

6.3 The individual count calibration for the AM peak is shown in Table 6.1 below. The comparison is presented for total flows as the LGV and HGV proportions are fairly low. However the full tables showing the individual flows can be found in Appendix B for information.

6.4 Overall the modelled flows match the observed counts to a good level, with

- 86% of all counts meeting the DMRB criteria.
- The cordon has a good fit with 84% of inbound counts and 97% of outbound counts matching the criteria DMRB .
- The ring road links also have a good match with 83% matching the DMRB and GEH<5 criteria

Table 6.1: AM Peak Individual Count summary

Screenline	No. Observations	DMRB	GEH <5
North of City Centre – Inbound	7	57%	43%
North of City Centre – Outbound	4	100%	100%
West of City Centre – Inbound	5	100%	80%
West of City Centre – Outbound	6	83%	67%

Central - Northbound	6	83%	50%
Central - Northbound	5	80%	40%
West – Inbound	5	60%	80%
West – Outbound	4	100%	100%
Ring Road Cordon – Inbound	32	84%	78%
Ring Road Cordon – Outbound	31	97%	94%
Ring Road Counts	12	83%	83%
Total	**113**	**86%**	**79%**

6.5 The PM count comparisons are slightly weaker than the AM, but still fits well with:

- 83% of all counts meeting the DMRB criteria.
- The inbound cordon has a very good fit with 100% of counts meeting the DMRB criteria. The outbound direction has 77% meeting the DMRB criteria
- The ring road links also have a reasonable match with 75% matching the DMRB and GEH<5 criteria

Table 6.2: PM Peak Individual Count Summary

Screenline	No. Observations	DMRB	GEH <5
North of City Centre – Inbound	7	86%	86%
North of City Centre – Outbound	4	50%	25%
West of City Centre – Inbound	5	60%	60%
West of City Centre – Outbound	6	83%	83%
Central - Northbound	6	83%	50%
Central - Northbound	5	100%	100%
West – Inbound	5	60%	60%
West – Outbound	4	100%	75%
Ring Road Cordon – Inbound	32	100%	88%
Ring Road Cordon – Outbound	31	77%	71%
Ring Road Counts	12	75%	67%
Total	**113**	**83%**	**74%**

Validation

Matrix Validation

6.6 Table 6.3 and Table 6.4 below shows the difference between modelled and observed vehicle flows for the AM and PM peaks. For the AM Peak this shows:

- Overall good fit for car and total flows
- The cordon matches well and is within 6% for both directions

- LGV and HGVs do not match as well as cars or total flows. There are a number of factors that contribute to this:
  - LGVs and HGVs are a small proportion of total vehicles in the city centre., with only 7% of vehicles in the AM and 5% in the PM. Therefore the absolute differences are less significant.
  - There is some inconsistency between counts in the vehicle definitions which could lead to difficulties in getting the split between LGV and HGV correct.
  - There are a number of Automatic Traffic Counts where the vehicle splits are derived from classified counts on links with similar characteristics. This can lead to inconsistencies with the actual roads traffic makeup.

Table 6.3: AM Peak Screenline Summary

Screenline	No. Observations	% Diff Car	% Diff LGV	% Diff HGV	% Total
North of City Centre –Inbound	7	-6%	-2%	-18%	-9%
North of City Centre –Outbound	4	-4%	-7%	-13%	-5%
West of City Centre – Inbound	5	2%	-9%	-22%	0%
West of City Centre – Outbound	6	-12%	-6%	-52%	-14%
Central – Northbound	6	41%	-19%	-21%	30%
Central – Northbound	5	-12%	-2%	-2%	-11%
West – Inbound	5	-1%	-16%	-39%	-3%
West – Outbound	4	-3%	-5%	-42%	-4%
Ring Road Cordon – Inbound	32	-5%	-16%	-31%	-6%
Ring Road Cordon – Outbound	31	-2%	-35%	-27%	-5%

6.7 The PM peak has a good overall match with:

- The cordon being with 1% of the observed in both directions

Table 6.4: PM Peak Screenline Summary

Screenline	No. Observations	% Diff Car	% Diff LGV	% Diff HGV	% Total
North of City Centre –Inbound	7	9%	28%	-53%	8%
North of City Centre –Outbound	4	39%	37%	11%	39%
West of City Centre – Inbound	5	3%	-3%	-75%	0%
West of City Centre – Outbound	6	2%	10%	-73%	0%
Central – Northbound	6	-19%	-16%	-78%	-21%
Central – Northbound	5	4%	17%	12%	5%

West – Inbound	5	2%	-40%	-30%	1%
West – Outbound	4	0%	-44%	-44%	-1%
Ring Road Cordon – Inbound	32	0%	14%	-8%	0%
Ring Road Cordon – Outbound	31	0%	28%	38%	1%

Journey Time

6.8 The journey time validation summaries are shown in Table 6.5 and Table 6.6 . This shows a good match to the observed conditions particularly in the AM peak with:

- 89% of AM links within the validation criteria
- The PM peak has 72% within the criteria, but all but one route is within 20% of the observed.

6.9 The PM peak has higher levels of congestion compared to the AM peak, which was difficult to replicate whilst keeping consistent coding with the AM peak.

6.10 The journey time routes also replicate the distribution of delay across the routes to a good level, with junction delay being well replicated in the model. The individual graphs can be seen in appendix C.

Table 6.5: AM Peak Journey Time Validation

Ring Road Routes	Observed (Minutes)	Model (Minutes)	Difference (minutes)	Difference %	Pass?
Ring Road SB 1	09:32	10:19	00:47	8%	Pass
Ring Road NB 1	10:10	10:26	00:16	3%	Pass
Ring Road WB 2	10:25	09:20	-01:05	-10%	Pass
Ring Road EB 2	07:36	08:00	00:24	5%	Pass
Ring Road NB 3	06:10	05:30	-00:39	-11%	Pass
Ring Road SB 3	07:51	08:43	00:52	11%	Pass
A38 Tunnel Northbound	01:04	01:04	00:00	1%	Pass
A38 Tunnel Southbound	01:00	01:10	00:09	15%	Pass
Bath Row to Smallbrook Queenway	04:09	04:57	00:48	19%	Pass
AM Smallbrook Queensway to Bath Row	03:36	04:10	00:34	16%	Pass
AM Great Hampton St to Steelhouse La	06:07	06:10	00:03	1%	Pass
AM Steelhouse La to Great Hampton St	04:53	05:33	00:40	14%	Pass
AM Nechells Parkway to Stratford Rd	07:37	06:48	-00:49	-11%	Pass
AM Stratford Rd to Nechells Parkway	08:11	08:52	00:41	8%	Pass
AM Pershore Rd to Vauxhall	07:03	08:41	01:38	23%	Fail
AM Vauxhall to Pershore Rd	06:44	07:42	00:58	14%	Pass
AM Aston Expressway to Hagley Rd	12:10	14:58	02:48	23%	Fail
AM Spring Hill to Bristol St	07:19	08:25	01:05	15%	Pass

Table 6.6: PM Peak Journey Time Validation

Ring Road Routes	Observed (Minutes)	Model (Minutes)	Difference (minutes)	Difference %	Pass?
Ring Road SB 1	13:47	14:03	00:16	2%	Pass
Ring Road NB 1	12:25	10:54	-01:31	-12%	Pass
Ring Road WB 2	11:07	09:06	-02:01	-18%	Fail
Ring Road EB 2	08:57	08:45	-00:12	-2%	Pass
Ring Road NB 3	05:23	05:10	-00:13	-4%	Pass
Ring Road SB 3	06:43	06:54	00:12	3%	Pass
A38 Tunnel Northbound	02:21	01:00	-01:21	-57%	Fail
A38 Tunnel Southbound	01:38	01:08	-00:30	-31%	Pass
Bath Row to Smallbrook Queenway	06:20	06:13	-00:08	-2%	Pass
AM Smallbrook Queensway to Bath Row	07:10	07:09	-00:01	0%	Pass
AM Great Hampton St to Steelhouse La	06:21	06:30	00:09	2%	Pass
AM Steelhouse La to Great Hampton St	06:53	07:18	00:24	6%	Pass
AM Nechells Parkway to Stratford Rd	08:57	08:12	-00:45	-8%	Pass
AM Stratford Rd to Nechells Parkway	12:45	10:18	-02:27	-19%	Fail
AM Pershore Rd to Vauxhall	07:03	08:27	01:24	20%	Fail
AM Vauxhall to Pershore Rd	10:44	10:09	-00:35	-5%	Pass
AM Aston Expressway to Hagley Rd	15:29	15:46	00:17	2%	Pass
AM Spring Hill to Bristol St	10:54	12:45	01:52	17%	Fail

Change in Prior Matrix Distribution

6.11 Checks were made to ensure that there were not undue changes to the prior matrix as a result of matrix estimation. Table 6.7 to Table 6.9 shows the prior, post and the percentage change at the sector level for the AM peak. Three sectors have been created showing the centre, the outer areas within the city centre and external movements. By far the largest number of trips have a trip end external to the BCC model.

6.12 For the AM peak trips from the external areas the changes in flows are within 5%. This is the key movement in the morning peak. There are larger increases in the outbound direction. These flows are less likely to be journey to work trips and therefore more difficult to estimate and the matrix estimation has corrected for this underestimation.

6.13 Table 6.10 to Table 6.12 shows the same PM information, with the pattern a reverse of the AM peak, with the outbound direction showing modest changes, but the inbound having a higher correction.

Table 6.7: AM Peak – Prior Matrix

Movement	Centre	Outer	External
Centre	740	1,186	2,818
Outer	644	903	4,273
External	7,928	9,349	14,608

Table 6.8: AM Peak – Post ME Matrix

Movement	Centre	Outer	External
Centre	740	979	3,211
Outer	679	1,019	5,509
External	8,079	9,308	15,321

Table 6.9: AM Peak – Percentage Change as a results of Matrix Estimation

Movement	Centre	Outer	External
Centre	0%	-17%	14%
Outer	5%	13%	29%
External	2%	0%	5%

Table 6.10: PM Peak – Prior Matrix

Movement	Centre	Outer	External
Centre	410	954	7,050
Outer	382	639	8,436
External	3,021	5,165	11,166

Table 6.11: PM Peak – Post ME Matrix

Movement	Centre	Outer	External
Centre	369	962	6,525
Outer	475	880	8,871
External	3,955	6,899	12,277

Table 6.12: PM Peak – Percentage Change as a results of Matrix Estimation

Movement	Centre	Outer	External
Centre	-10%	1%	-7%
Outer	25%	38%	5%
External	31%	34%	10%

6.14 Figure 6.1 and Figure 6.2 shows the change in trip distribution between the post and prior matrix. The prior trip distribution is shown in white and the post ME in red. It can be seen that the distribution has not changed significantly so it is unlikely that there have been large numbers of short distance trips introduced to satisfy the counts.

Figure 6.1: Change in Trip Length Distribution AM Peak

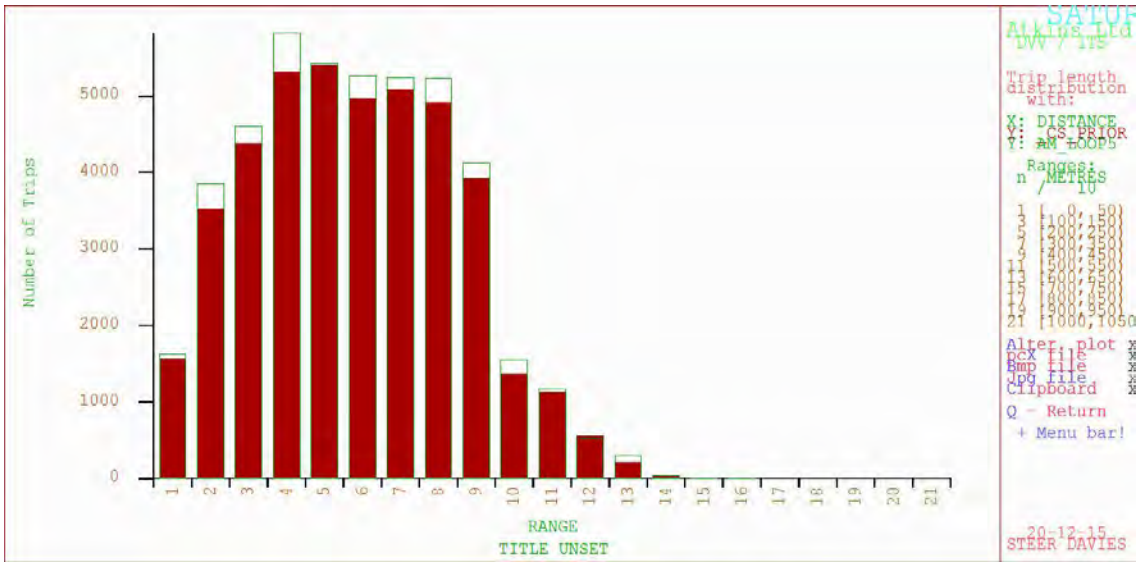
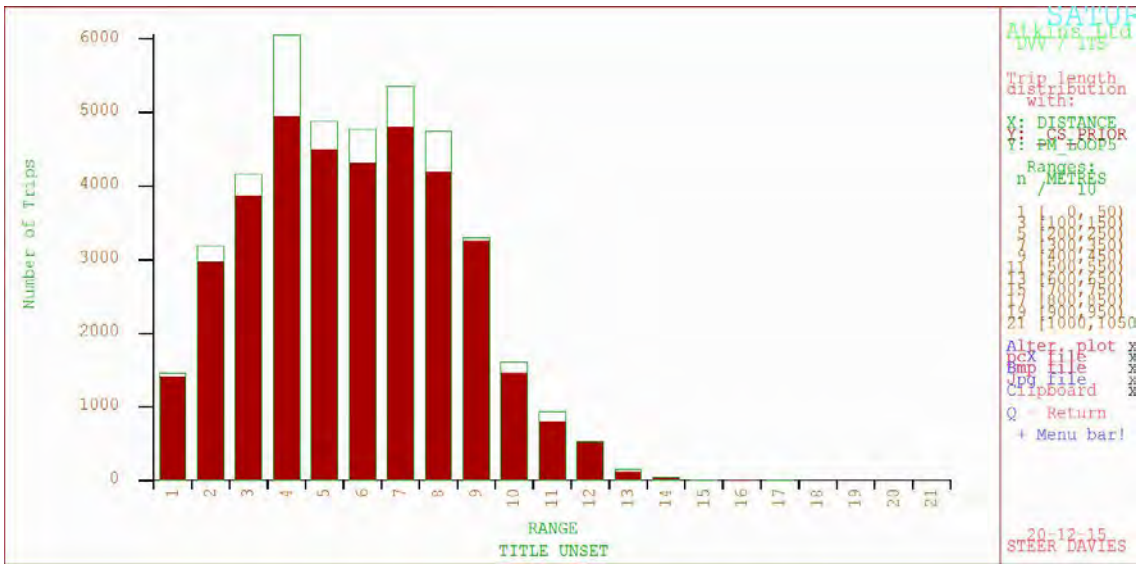


Figure 6.2: Change in Trip Length Distribution PM Peak



Routing Plausibility

6.15 Some sense checks have been carried out on the routing of trips through the model. This has demonstrated that the routing predicted by the model is broadly sensible on the key routes in the model. Figure 6.3 and Figure 6.4 has an example from the AM and PM peaks showing some of this analysis.

Figure 6.3: AM Peak (Hagley Rd to City Centre)

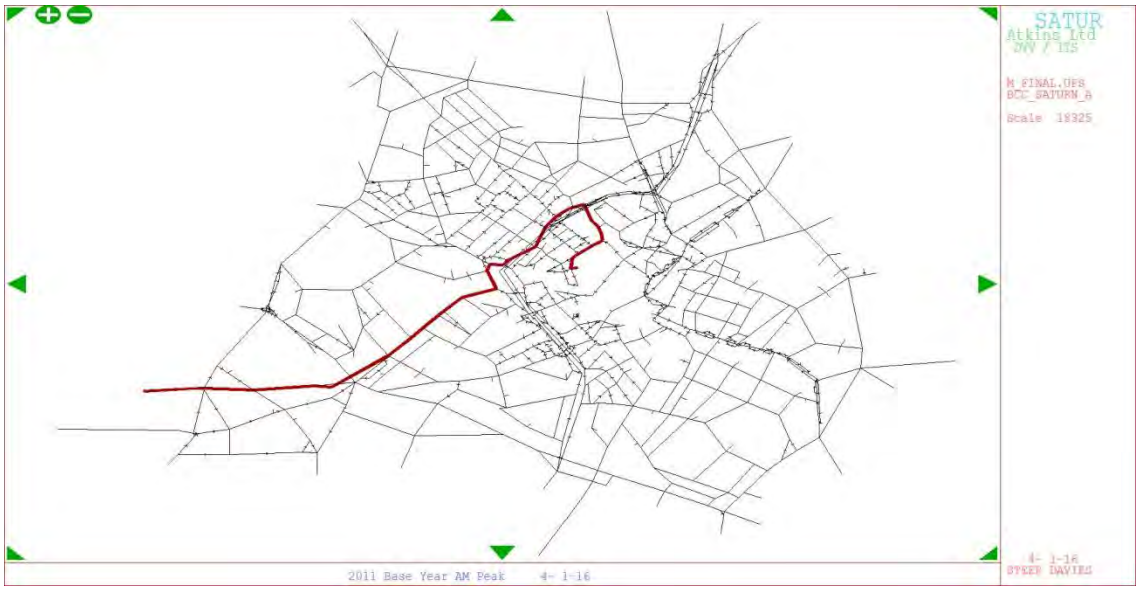
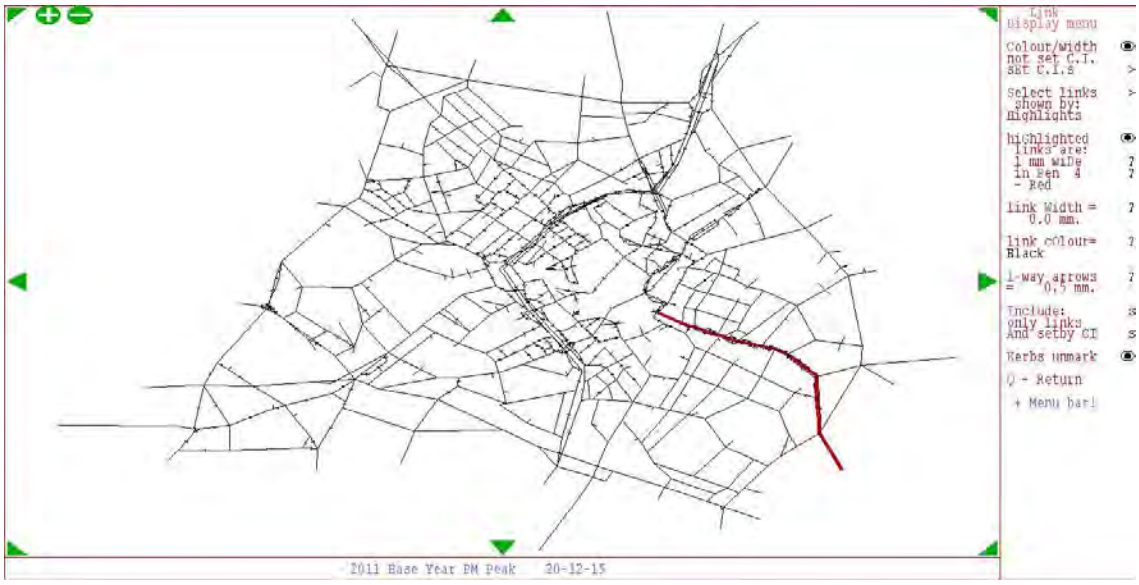


Figure 6.4: PM Peak (Stratford Rd to City Centre)



Convergence

6.16 The convergence criteria set for the model is as follows:

- %GAP 0.1%for 4 consecutive iterations
- 98% links changing by less than 1% for 4 consecutive iterations.

6.17 The AM peak meets the link criteria for 96% of links, however the gap value is well within the criteria with less than 0.09% for 4 iterations.

6.18 The PM peak meets the gap and link criteria for 98% of links.

Table 6.13: Model Convergence Acceptability

Criteria (4 consecutive iterations)	AM Peak	Peak
% Gap <0.1%	Pass	Pass
98% <1%	96%	Pass

7 Summary and Conclusions

7.1 The updated BCC model has taken the best available information available making use of the significant work done by the PRISM team in building base year matrices based on numerous data sources and done in line with government guidance. It also takes network information from the BCC SATURN network model which has been developed over a number of years to test the impacts of various schemes on the city centre road network.

7.2 A detailed audit of both models was undertaken before using the information with adjustments made where necessary to replicate the 2011 conditions.

7.3 Following these initial checking stages a model calibration was undertaken which has resulted in good levels of model calibration, with the model replicating observed counts and journey times to a good level.

7.4 The base year calibration has produced a robust 2011 model which can be used for testing the impacts of the proposed Metro schemes on the city centre in the AM and PM peak hours.

7.5 The model has maintained links to the PRISM demand model so can be easily used as a starting point for the scheme forecasting.

A Midland Metro Business Case Modelling Approach

steer davies gleave

Memo

To	Adam Williams, Paul Cobain, Peter Adams, Stuart Law (Centro)		
Cc	Chris Whitehouse, Kate Inston		
From	Serbjeet Kohli, Tom Caulfield, Beatriz Roldao		
Date	21 August 2015		
Project	Birmingham Eastside Extension (BEE) and Edgbaston Extension (EDG)	Project No.	22695302

Midland Metro Business Case Approach – Strategic and Economic Cases

Purpose of note

1. This note gives an outline of the proposed approach to be used for development of the business cases for Midland Metro's Birmingham Eastside Extension (BEE) and Edgbaston Extension (EDG), setting out details for the delivery of the Strategic Case and Economic Cases. The methodology will seek to be consistent for the modelling and appraisal of both schemes, with possible deviations if necessary. .

Strategic Case

2. The Strategic Case for each scheme will clearly articulate the rationale for investment in Metro extensions, through:

- Outlining the context, including the problem identified and the impact of not changing
- Presenting the strategic objectives of Centro and Birmingham City Council as the scheme promoters
- Presenting the scheme objectives and demonstrating their alignment with Centro/Birmingham City Council strategic objectives and wider regional policy e.g. LEP
- Setting out the options considered including the preferred option and demonstrating its fit with the objectives and local and wider policy

Economic Case

3. The Economic Case will present the assessment of value for money of the schemes.

4. The demand modelling and forecasting will be central to the robust assessment of the schemes; the proposed approach is summarised below. The outputs of the modelling work will be used in the appraisal process, also outlined.

Modelling Approach

5. From the modelling perspective the schemes consists of two major components:

- Extension of the Midland Metro Line 1 from New Street station to Birmingham Eastside/Edgbaston; and
- A series of associated highway capacity and traffic management measures around Moor Street Queensway and around the proposed HS2 Curzon Street station (BEE), and along Broad Street and Hagley Road (EDG).

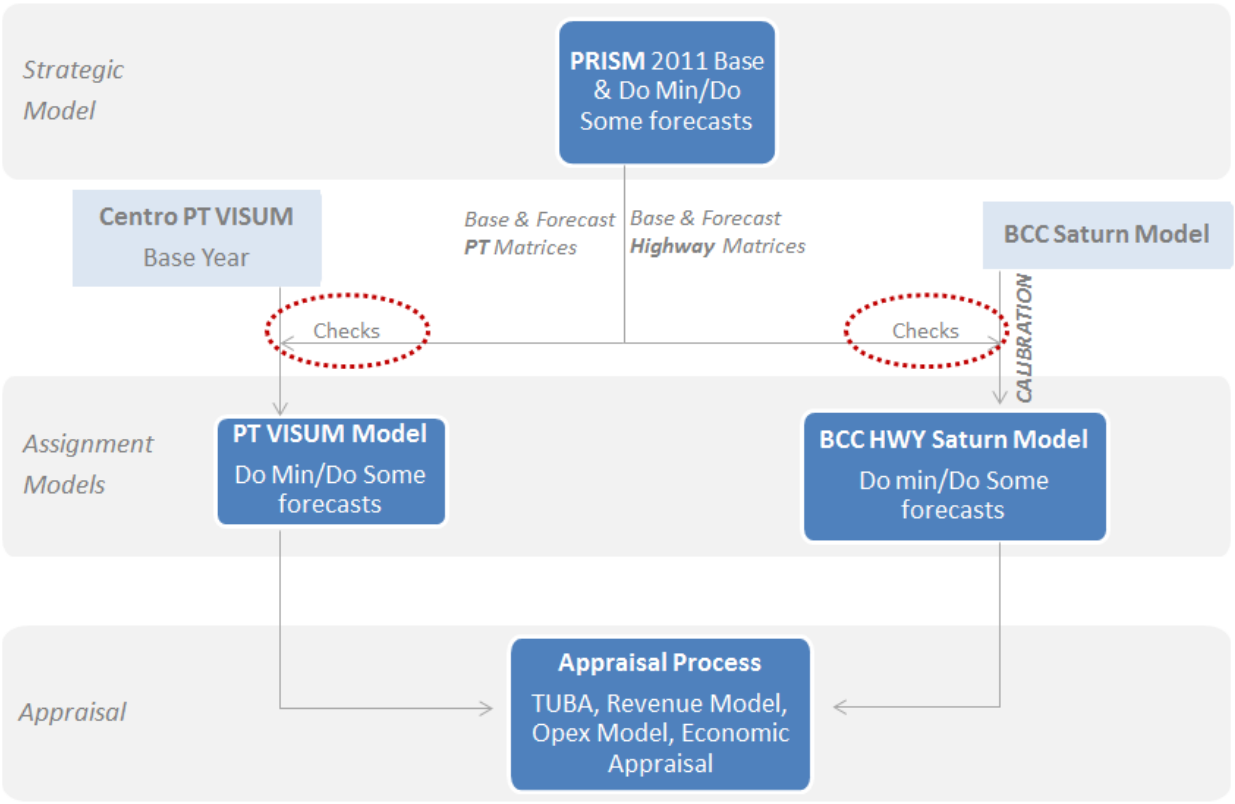
6. To assess the impacts of these components in detail it is proposed that the following modelling tools are used:

- **PRISM**: for evaluation of the strategic impacts of the Metro extensions, including mode shift (from public transport, highway and other modes), re-distribution and generation impacts of the scheme. The most recently updated version of PRISM has a detailed public transport (PT) assignment model based in VISUM linked to an equally detailed highway model, which interact with bespoke demand response models. The updated version, which has used a combination of 2011 census information and recently collected observed travel information (household interviews, traffic counts, public transport counts, new origin-destination information, journey time data), also offers higher granularity of zoning within Birmingham city centre compared to its predecessor, which will enable more accurate representation of the access/egress to/from the proposed extension.
  PRISM base year is 2011 and the calibration exercise was carried based on 2011 data collection (counts and surveys). This is considered to be up to date given the proximity to the current year. However, a present year validation exercise could involve estimating 2015 derived from an interpolation between 2011 and 2021 forecast year which would then be validated against additional 2015 collected data.
- **BCC Saturn Highway Model**: Birmingham City Council (BCC) has a detailed SATURN based highway assignment model of Birmingham city centre. It is proposed that an updated version of the BCC model is used to assess the impacts of traffic management and highway capacity measures in more detail. To ensure consistency between PRISM and the BCC model it is proposed that PRISM base and forecast matrices are used as inputs for creating the BCC model base and forecast year scenarios. The network representation will also be checked to ensure consistency between PRISM and the BCC highway model. The BCC model will also be re-based to the base year of 2011 with a focus on model calibration and validation being the east-west corridor that the proposed extension is expected to impact. This model will be best suited to represent the local nature of some of the highway impacts on proposed extension as past experience using PRISM to test the Metro extension from Snow Hill to New Street showed that it was not practical to use the model to assess impacts on the highway network to changes in the City Centre. This is primarily due to small changes in the highway demand and costs in relation to the large model size being dwarfed by the model noise. Various checks were done to ensure that the mode shift impacts were coherent but at the assignment level the cost changes were not plausible. The rational for this was included in Appendix B of the “Midland Metro Phase1 Business Case” and can be shared again.
  We believe that the BCC network is a better starting point for building a model to test highway impacts in the city centre. It will be better able to represent any rerouting due to capacity reductions caused by the tram because:

  - It has a more detailed zoning system 54 compared to 34 within the Ring Road;
  - A more detailed network (particularly in Eastside)
  - The model has been used to test numerous schemes in Birmingham City Centre over recent years, and the network coding is of a good standard and has been constantly updated and improved.

7. Figure 1 below illustrates the process described above graphically.

Figure 1: PRISM's use for Centro's PT model and BCC's Highway model forecasting and Appraisal



Models' Fitness for Purpose

8. Both the PRISM and Saturn models will have to be individually verified for their fitness of purpose for the purposes of this scheme.

9. PRISM has been developed following the latest WebTAG guidelines on variable demand modelling. It includes a detailed demand response modules which interact with highway and public transport assignment models. The model has been chosen to represent the strategic impacts of Midland metro extension as it can appropriately capture the – route changes, mode shift, distribution changes and any generation effects. To verify the model's responses specific to the scheme we would ensure that the base year public transport model's representation of the key public transport flows and network in the base year and the forecast years within Birmingham city centre are plausible. The base year PT model is well calibrated at aggregate cordon levels. For the purpose of scheme appraisal, the fit will be investigated at a local level. For the base year there are WebTAG guidelines which the overall model statistics will be checked against. A more detailed verification within Birmingham city centre will be undertaken. For the forecast years (and in some cases for the base year) the model forecasts for key public transport flows within the city centre e.g. New Street station demand, Birmingham city centre cordon flows, Midland Metro Line 1 boarding/alightings will be verified against information available from other sources such as ORR data, Centro monitoring data trends, Planet model forecasts, Network Rail RUS forecasts etc.

10. Any updates to the model that may be required to the base and forecast year scenarios with regards to the networks or demand assumptions will be clearly documented with supporting evidence included in the appraisal reports. The impacts of the scheme which are not captured by the model would be discussed in the appraisal report qualitatively with any supporting quantitative evidence available from existing sources e.g. the extension of Midland Metro to New Street.

11. For the BCC Saturn highway model a re-basing exercise (to 2011 base year) will be carried out, which will include:

    - Network updates to best reflect existing (2011) situation;
    - Demand updates based on the calibrated PRISM 2011 base year highway matrices using a cordoning and segmentation process;
    - Verification of model parameters to ensure robust model performance including WebTAG compliant convergence standards;
    - Calibration and validation of the model using 2011 observed travel data (counts, journey times) keeping consistency with data used for PRISM base year model calibration - using the same data sources as used in calibrating the PRISM model except where we are adding extra detail.

12. The base year model performance will be verified against WebTAG and DMRB guidelines. These guidelines are based on TAG Unit M3.1 - *Highway Assignment Modelling*. Some key criteria are:

    - Screenline Flow Validation - Differences between modelled flows and counts should be less than 5% of the counts (Table 1)
    - Link Flow - GEH < 5 for individual flows and "DMRB" criteria (Table 2)
    - Modelled times along routes should be within 15% of surveyed times (or 1 minute, if higher than 15%)

13. The routings, flows and delays around Moor Street Queensway, Navigation Street and Broad Street and other key east-west corridors will be sense checked.

14. The forecast year highway models will be created using PRISM forecast year matrices and will be checked to ensure that there is consistency between PRISM forecasts and the BCC model forecasts. BCC model is used as a sub(cordoned)-model where the changes in costs are informed by the PRISM matrices to forecast mode shift and any changes to trip generation/ distribution. The PRISM model has been developed in accordance with WEBTAG guidance on variable demand modelling. The cordoning and segmentation process used in the base year model would be used as the starting point. A pivot point approach will be developed to apply the growth implied by PRISM base and forecast year matrices on the calibrated base year matrices of the BCC model.

15. We believe that a more detailed city centre model is required to understand the rerouting and delays within the city centre and believe that the BCC SATURN model is the best tool to achieve this (as described above in point 6). We will apply the growth from PRISM directly to BCC using the pivot point approach as discussed (with some redistribution to development zones as discussed further in point 21).

16. Any anomalies noticed in this exercise will be discussed with Centro and a resolution agreed prior to utilising the outputs from the models for the development of the business case. These checks will include:

    - Changes in the highway matrices produced by PRISM as a result of introducing the Metro. Are they plausible given the scale and location of the schemes? Are they in line with the mode shift to public transport calculated?
    - Checks on the diversion away from the city centre (trips that will not be represented in the cordoned model). Again this will be assessed for plausibility. If there are significant diversion away from within the ring road an approach will need to be developed to account for this within the appraisal.
    - Checks that the levels of delay are consistent between PRISM and BCC models within the cordoned modelled area. This will done through checks on the network assignments.

17. The pivot point approach applies the growth from PRISM to the BCC calibrated matrices. Therefore to ensure consistency between the BCC and PRISM model matrices, our methodology uses the PRISM

calibrated matrices as the prior matrix for the BCC model update. The PRISM matrices have been fully validated and the changes in distribution and trip length distribution following matrix estimation (ME) have been checked and documented, and is therefore a reliable source of future growth. The verification exercise to be carried out to check the changes implied by PRISM matrices are correctly represented iin the BCC model will be documented and included in the model development report.

18. It is important that the highway model can replicate the conditions on the road network in the city centre so that the impact of putting in the tram can be modelled. To do this the model will be calibrated to ensure that the traffic levels and journey times are replicated to a good level. Given that the BCC model has a finer zoning system and more detailed road network ME will be an invaluable tool in infilling these missing trips and ensuring that the levels of trips generated/ attracted by these zones are more accurate.

19. The PRISM cordoned base year matrix will be segmented to the BCC zoning system and ME undertaken. We will check and report the changes in matrix distribution following the ME, including at the aggregated PRISM matrix level so that the changes from the input matrix is fully documented.

20. We will use a cordon round the ring road as an independent validation screenline to ensure that trips coming from outside of the cordoned area are not unduly distorted. We will also freeze through trips as part of the ME. There is likely to be some pre-matrix estimation factoring given the different time periods being modelled, with PRISM representing an average peak period hour and BCC a peak hour model. Any factoring will be presented in the model development report.

Do Minimum

21. It is proposed that two fully modelled forecast years are used, 2021 and 2031, as based on the forecast inputs available for PRISM forecast years. The Do Minimum scenario for the scheme would consist of:

Anticipated network changes

- On the public transport network this will include Midland Metro Line 1 extension to New Street station with a frequency of 10tph. All associated bus network changes within the city centre, for which reliable information is available, will also be incorporated in this scenario. The accessibility improvements delivered as part of the Birmingham New Street Gateway scheme will be represented in the network model.
- On the highway network all committed and fully funded schemes will also be included in the BCC highway model's Do Minimum scenario. There are plans to introduce a series of traffic management measures within Birmingham city centre which would also be included in the Do Minimum scenario.
- HS2 is to be included in the 2031 Do Minimum. The 'With HS2' scenario will reflect the completion of Phase 1 of the High Speed 2 project between London and Birmingham and its local demand impacts. The existing PRISM runs do not have HS2 included so the network changes associated with the scheme will be coded into the models (demand adjustment as described below).
- For the highway modelling we are assuming that the network impacts of HS2 will be in place by 2021 as the latest construction programme involves putting in place the most significant changes to the network a number of years in advance of opening.
- The proposed changes to improve the frequency of the stopping rail service between Wolverhampton and Coventry will also be verified within the public transport network model.
- On the highway network side the following assumptions have been made to create the DM network. Non-Metro related highway improvements, which include the committed schemes:
    - The signalisation of Bordesley Circus (providing one way Hamburger);
    - Adding a left slip at Haden Circus; and
    - Adding two left slips at Holloway Circus.

Anticipated demand changes:

- There is significant development currently being planned to take place within the city centre e.g. Arena Central, Eastside development, Curzon Street and Paradise Circus etc. It is important that realistic assumptions about these developments are taken into account when developing the Do Minimum demand matrices.
- PRISM forecasts are developed to create the Do Minimum and Do Something (without HS2 scenario) for 2021 and 2031 forecast years. The public and private transport demand levels included in these forecasts will be analysed in order to confirm that all the major developments located within Birmingham city centre, Digbeth and Edgbaston areas have been taken into account and the appropriate scale and location of development is represented. . Where required a bottom-up trip rate approach will be carried out to estimate the trip generation / attraction from these developments.
- PRISM forecast matrices will form the starting point for evaluating the demand changes as predicted by PRISM by comparing the forecast and base year matrices. PRISM forecasts are based on known planned developments with overall TEMPRO constraints being applied to the input population and employment growth assumptions as per WebTAG.[1] The trip growth at mode and zonal level, as implied by PRISM forecasts, will be compared against the trip rate based bottom-up analysis carried out for the developments within the city centre. These demand level verifications and associated changes will be carried out for both the public transport model and the BCC highway model.
- It has been concluded from previous studies that the public transport demand levels within some of the model zones where major developments are proposed have been underestimated. Further updates will include:
    - Estimation of trip generation / attraction from new developments;
    - Net additional population and employment generated by these new developments;
    - The public transport demand growth within PRISM is based on analysis of local plans and planning approvals and driven by population and employment growth inputs. We will estimate the difference between the development focused population and employment growth and that assumed in PRISM inputs for 2021 and 2031 forecasts;
    - The percentage of underestimated employment and population will be estimated in order to determine the amount of Public Transport and Highway demand to be added from the new developments;
    - To account for the underestimation of development led trips, the additional trips will be calculated by applying percentages to the development trip estimates in order to calculate the final trips to be added to the final matrices;
    - The distribution applied to this trips will be based on similar zones with the same type of developments;
    - To maintain the overall matrix growth consistent with the PRISM based matrix forecasts the additional trips to be added to the development zones are reduced from the rest of the trip matrix so that the matrix total remains the same. This operation is carried out at an individual period and matrix level.
- PRISM forecasts currently do not take into account the demand impacts of HS2. Therefore for the '*with HS2 scenario*' it is necessary to accommodate HS2 impact on the local demand patterns, ensuring the PT and Highway models are fit for purpose. This included reflecting the additional public transport trips generated/attracted by the two HS2 stations within the West Midlands – HS2 Curzon

[1] A separate note will discuss the use of NTEM based or locally developed constraints.

Street and HS2 Interchange. Since a proportion of these trips are expected to be abstracted from classic rail stations – New Street and Birmingham International - it is also necessary to reflect the corresponding reduction in trips to/from these stations due to introduction of HS2. The total trips forecast to be generated/attracted by the new HS2 stations and those abstracted from classic rail stations are presented in the table below. These are based on the data received from HS2[2].

Table 1: Rail Demand at Birmingham stations with and without HS2 – Phase 1

Daily Boardings and Alightings (including interchanges)	2031 Without HS2	2031 With HS2	Impact of HS2
Moor Street	29,511	29,155	-387
New Street	194,188	187,987	-5,874
International	19,342	12,460	-6,882
HS2 Curzon Street	-	28,083	28,083
HS2 Birmingham Interchange	-	22,180	22,180
TOTAL	243,040	279,865	37,120

- The representation of these HS2 impacts on the rail user demand patterns within the PT VISUM model is undertaken in two stages:
  - Addition of local leg of the public transport trips accessing/egressing the HS2 stations: This is done by taking the distribution of the corresponding classic rail station (New Street for HS2 Curzon Street and Birmingham International for HS2 Interchange) and the demand totals obtained from HS2 station forecasts (shown above). The assumption here is that HS2 rail users at Birmingham stations will have similar trip patterns of their local leg of the journey as rail users at the corresponding classic rail stations. The demand is added to the zones representing the HS2 station zones within the PT VISUM model – 28,083 for HS2 Curzon Street and 22,180 for HS2 Interchange.
  - Reduction of the classic rail demand based on the HS2 forecasts (shown above): The demand at New Street and Birmingham International stations is decreased to reflect the abstraction by HS2. This is carried out by using the 'select link' ('flow bundle' in VISUM) approach which allows selection of specific trips using these stations from the overall matrix and their reduction to required levels.
- This adjustment is carried out for 2031 models only as HS2 is assumed to be introduced in 2026. This adjustment is implemented in the Do Minimum and Do Something scenarios and AM peak, PM peak and Interpeak VISUM models by allocating the trips proportionally to the different demand segments.

Do Something

22. The Do Something is the scenario in which the Midland Metro extension is introduced to the public transport network and the associated highway network changes are also implemented. The scenario is defined by:

- The proposed alignment and stop locations;
- The new service specification, including service pattern, fares, frequency and journey times; and
- All associated highway capacity and traffic management measures implemented.

[2] Data from HS2 PLANET framework model, June 2014

23. The changes will be incorporated appropriately within both PRISM and BCC models and the outputs for model runs will be checked against the Do Minimum model run outputs. Various plausibility checks and verifications will be carried out prior to using the outputs for business case assessment. These will include line loading analysis, boarding/alighting analysis, GIS based analysis of generalised cost changes at zonal level, highway matrix changes, highway routing changes and network wide statistics etc.

Model Runs and Sense Checks

24. There will be several model runs performed for the different scenarios (Do Minimum and Do Something), time periods (AM, IP and PM) and modelling years (2021 and 2031). The results will be analysed in detail and sense checks performed to ensure that the model outputs from all the runs are plausible and robust, prior to using the model outputs for any further analysis or appraisal. The checks undertaken will include:

- Checking that the input matrices are consistent between the Do Minimum and Do Something;
- Checking that the demand response is consistent between DM and DS for all modes;
- Checking that the model assignments run through completely with all required outputs being created;
- Checking that the total line loadings outputs for the metro scheme being considered are plausible in both the Do Minimum and Do Something scenarios, and also that the 2021 and 2031 forecasts of absolute and incremental patronage are sensible;
- Checking that stop level boarding/alighting are plausible and the changes between the Do Minimum and Do Something scenarios at stop level are reasonable;
- Checking results against previous studies carried out for Centro considering the same or similar route alignments; and
- Checking changes between Do Minimum and Do Something scenarios confirming that skims are sensible.

Appraisal Approach

25. The benefits, revenues and costs will be estimated and fed into an appraisal model to form inputs to the Economic Case for the Metro extensions (BEE and EDG).

26. The following benefit streams will be included in the economic appraisal:

Existing user and new user journey time benefits

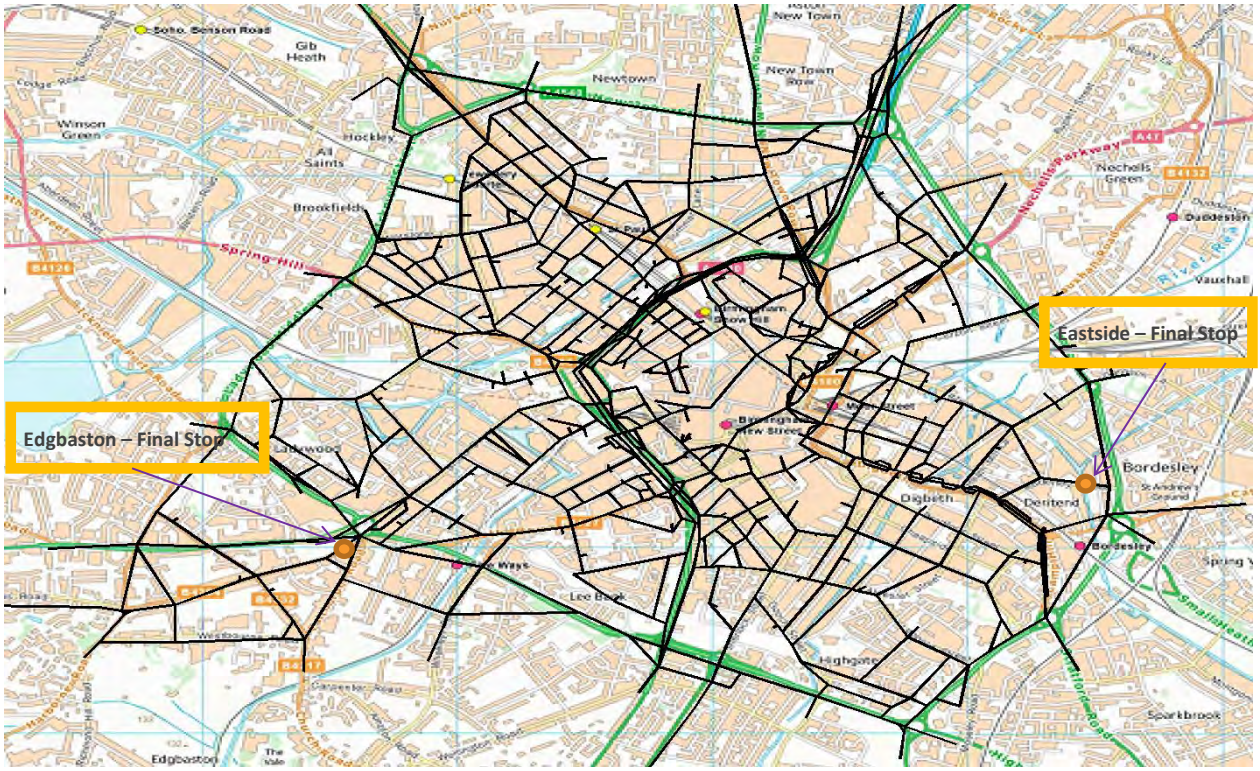
27. The outputs from Centro's public transport model will be fed into DfT's transport user benefit estimation software, TUBA, to produce estimates of new and existing user journey time benefits.

Non-user benefits

28. Birmingham City Council's highway model will estimate the journey time impact of the scheme on non-users. The outputs from this model will also be fed into TUBA to estimate the monetary value of these decongestion benefits and wider externalities.

29. The BCC network covers the whole of the two Metro alignments (BCC network shown in figure 2 below), however the end of the stops are towards the edge of the modelled area. There is likely to be some diversion away from the city centre which cannot be represented in the BCC model. We will use the PRISM model to make an assessment of the impacts of any diversion and feed this into the appraisal.

Figure 2: BCC Network Coverage

30. 

Revenues

31. The incremental revenue generated by the scheme will be estimated using a bespoke revenue model - a spreadsheet based model developed by SDG for previous studies[3] - that requires stop to stop matrices and fare as inputs. It is assumed fares as of January 2015 will be used in the Revenue Model.

32. Stop to stop matrices are directly extracted from the Do Minimum and Do Something VISUM models for each forecast year and each time period.

Capital costs

33. The latest capital cost estimates, reflecting the latest alignment plans will be incorporated in the appraisal model. Optimism bias will be applied.

Operating costs

34. The operating costs will be estimated using a bespoke operating costs model (previously developed for the assessment of the Birmingham City Centre Extension). Optimism bias will be applied.

Wider Impacts

35. The wider impacts of the scheme will be estimated in line with DfT's published methodology. In line with WebTAG, three benefits will be calculated:

- Agglomeration impacts - the productivity gains generated by reducing journey times to other firms and larger labour markets
- Output change in imperfectly competitive markets - the increase in firms' outputs due to decreasing transport costs

[3] Birmingham City Centre Extension and Centenary Square Extension

- Tax revenue resulting from labour market impacts - the changes in tax revenue resulting from an increase in labour supply

36. The annual monetary value of each of these impacts will be calculated for 2031. For the appraisal this value will be profiled to be consistent with the benefits profile produced by TUBA

Economic Appraisal

37. An economic appraisal of the scheme will be undertaken in line with the latest DfT guidance, WebTAG.

38. The outputs of the modelling work will be treated in TUBA and applied in the economic appraisal along with the other benefit and cost estimates.

39. A selection of 'up-side' and 'down-side' appraisal model based sensitivity tests will be carried out, to determine the sensitivity of the scheme's performance to changes in variables. In line with the Department for Transport's requirements, sensitivity tests will be undertaken to test the impact of increasing and decreasing the VoT by 25%. The following sensitivities will be tested:

- A. Increase work VoT by 25%
- B. Decrease work VoT by 25%
- C. Increase non-work VoT by 25%
- D. Decrease non-work VoT by 25%

40. The level of optimism bias to apply to scheme capital costs is dependent on the stage of the scheme's development. A sensitivity test will be undertaken to the optimism bias applied to the Midland Metro extension costs and highway costs. A further sensitivity test will be undertaken in which the non-user benefits are excluded.

41. The central case will assume HS2 is implemented as part of the Do Minimum scenario; however a 'Without HS2' sensitivity will also be conducted.

42. The results will be presented in the DfT's WebTAG based formats for business cases, including:

- Economic Efficiency of the Transport System (TEE)
- Public Accounts (PA)
- Analysis of Monetised Costs and Benefits (AMBC)
- Appraisal Summary Table (AST)

43. In addition, assessments will be undertaken outlining the environmental, social and distributional impacts of the scheme. These may include both quantitative and qualitative assessments.

44. These will be presented in the Economic Case document and summarised in the Appraisal Summary Table.

B Count Calibration Tables

AM Peak Hour (08:00 – 09:00)

Am Peak (8-9)

North of City Centre - Inbound			Observed				Modelled					
Location	**A Node**	**B Node**	**Car (inc. Taxi)**	**LGV**	**HGV**	**Total**	**Car**	**LGV**	**HGV**	**Total**	**DMRB**	**GEH**
LIVERY STREET/COLMORE ROW	5197	6101	377	6	8	403	420	6	8	446	1	2.1
COLMORE CIRCUS/COLMORE ROW/BULL STREET	7908	6119	265	8	10	298	142	2	0	144	0	10.3
PRIORY QUEENSWAY WEST OF OLD SQUARE	6117	6201	128	53	6	196	135	36	6	186	1	0.7
CORPORATION STREET NORTH OF OLD SQUARE	6307	6201	99	20	14	154	177	34	10	237	1	6.0
PRIORY QUEENSWAY EAST OF OLD SQUARE	6419	6201	128	21	7	167	248	23	0	272	0	7.1
PARK STREET north of Fazeley Street	6107	7105	961	25	29	1,059	736	30	14	801	0	8.5
NEW CANAL STREET south of Banbury Street	6110	7301	236	4	2	245	200	4	2	209	1	2.4
Cordon Total			2,193	138	76	2,522	2,059	135	41	2,296	1	4.6

North of City Centre - Outbound			Observed				Modelled					
	A Node	**B Node**	**Car (inc. Taxi)**	**LGV**	**HGV**	**Total**	**Car**	**LGV**	**HGV**	**Total**	**DMRB**	**GEH**
COLMORE CIRCUS/COLMORE ROW/BULL STREET	6119	7908	226	4	11	258	239	3	11	269	1	0.7
PRIORY QUEENSWAY WEST OF OLD SQUARE	6201	6717	28	7	2	40	67	7	1	77	1	4.8
CORPORATION STREET NORTH OF OLD SQUARE	6201	6307	99	18	6	132	77	17	2	99	1	3.1
NEW CANAL STREET south of Banbury Street	7301	6110	209	4	2	218	158	4	2	168	1	3.6
Cordon Total			562	33	21	647	541	31	16	613	1	1.4

			Observed				Modelled					
West of City Centre - Inbound	**A Node**	**B Node**	**Car (inc. Taxi)**	**LGV**	**HGV**	**Total**	**Car**	**LGV**	**HGV**	**Total**	**DMRB**	**GEH**
LIVERY STREET/COLMORE ROW	6101	6104	214	2	5	229	235	2	5	250	1	1.4
UPPER DEAN STREET west of Moat Lane	7132	9502	247	9	12	285	164	7	9	194	1	5.9
BRADFORD STREET west of Mill Lane	7147	7127	405	13	6	433	421	14	2	440	1	0.4
DIGBETH east of Meriden Street	7252	7250	668	12	12	708	669	11	10	706	1	0.1
FAZELEY STREET South of River Street	7149	7148	167	9	5	190	242	7	4	259	1	4.6
Cordon Total			1,701	45	39	1,844	1,731	41	31	1,850	1	0.1

			Observed				Modelled					
West of City Centre - Outbound	**A Node**	**B Node**	**Car (inc. Taxi)**	**LGV**	**HGV**	**Total**	**Car**	**LGV**	**HGV**	**Total**	**DMRB**	**GEH**
LIVERY STREET/COLMORE ROW	6104	6101	289	10	14	334	353	12	7	382	1	2.5
CORPORATION STREET SOUTH OF BULL STREET	6102	7319	89	25	9	137	87	24	4	121	1	1.4
UPPER DEAN STREET west of Moat Lane	9502	7132	513	10	4	534	434	9	4	453	1	3.6
BRADFORD STREET west of Mill Lane	7127	7147	226	5	5	244	156	4	2	164	1	5.6
DIGBETH east of Meriden Street	7250	7252	493	14	19	556	368	12	10	405	0	6.9
FAZELEY STREET South of River Street	7148	7149	126	12	7	154	139	9	2	152	1	0.2
Cordon Total			1,736	75	59	1,958	1,536	70	28	1,677	1	6.6

			Observed				Modelled					
Central - Northbound	**A Node**	**B Node**	**Car (inc. Taxi)**	**LGV**	**HGV**	**Total**	**Car**	**LGV**	**HGV**	**Total**	**DMRB**	**GEH**
NAVIGATION STREET/ROYAL MAIL STREET/MAILBOX CAR PAR	8334	8404	18	-	-	18	94	5	2	102	1	10.9
BULL STREET WEST OF CORPORATION STREET	6102	6118	55	22	13	110	215	11	12	256	0	10.9
PRIORY QUEENSWAY WEST OF OLD SQUARE	6201	6717	28	7	2	40	67	7	1	77	1	4.8
CORPORATION STREET NORTH OF OLD SQUARE	6201	6307	99	18	6	132	77	17	2	99	1	3.1
JAMES WATT QUEENSWAY north of Jennens Road	6315	1007	563	18	17	624	562	19	17	622	1	0.1
WOODCOCK STREET South Heneage Street West	6172	7640	99	9	5	122	199	1	1	203	1	6.4
Cordon Total			862	74	44	1,046	1,215	60	34	1,361	0	9.1

			Observed				Modelled					
Central - Southbound	**A Node**	**B Node**	**Car (inc. Taxi)**	**LGV**	**HGV**	**Total**	**Car**	**LGV**	**HGV**	**Total**	**DMRB**	**GEH**
NAVIGATION STREET/ROYAL MAIL STREET/MAILBOX CAR PAR	8404	8334	115	-	-	115	195	5	3	207	1	7.3
PRIORY QUEENSWAY WEST OF OLD SQUARE	6117	6201	128	53	6	196	135	36	6	186	1	0.7
CORPORATION STREET NORTH OF OLD SQUARE	6307	6201	99	20	14	154	177	34	10	237	1	6.0
JAMES WATT QUEENSWAY south of Coleshill Street	6174	1007	863	12	11	902	537	7	8	565	0	12.4
WOODCOCK STREET South Heneage Street West	7640	6172	44	5	2	53	53	5	4	69	1	2.1
Cordon Total			1,249	90	32	1,420	1,098	88	32	1,266	1	4.2

			Observed				Modelled					
West - Inbound	**A Node**	**B Node**	**Car (inc. Taxi)**	**LGV**	**HGV**	**Total**	**Car**	**LGV**	**HGV**	**Total**	**DMRB**	**GEH**
BROAD STREET North of Bridge Street Partial data site vandali	8107	8127	577	27	7	623	713	16	1	732	0	4.2
HOLLIDAY STREET/SUFFOLK STREET QUEENSWAY	8422	8123	188	1	3	197	177	3	3	188	1	0.6
NAVIGATION STREET/ROYAL MAIL STREET/MAILBOX CAR PAR	8133	8650	157	-	-	157	173	2	2	181	1	1.8
BROMSGROVE STREET/PERSHORE STREET	7717	7134	255	1	14	291	187	2	14	223	1	4.2
BROMSGROVE STREET/PERSHORE STREET	7138	7134	338	7	11	373	248	7	1	259	0	6.4
Cordon Total			1,515	36	35	1,640	1,498	30	22	1,583	1	1.4

			Observed				Modelled					
West - Outbound	**A Node**	**B Node**	**Car (inc. Taxi)**	**LGV**	**HGV**	**Total**	**Car**	**LGV**	**HGV**	**Total**	**DMRB**	**GEH**
BROAD STREET North of Bridge Street Partial data site vandali	8127	8107	764	36	10	824	742	18	1	763	1	2.2
HOLLIDAY STREET/SUFFOLK STREET QUEENSWAY	8123	8422	151	1	-	152	137	15	1	155	1	0.2
BROMSGROVE STREET/PERSHORE STREET	7134	7717	1	-	-	1	13	1	0	15	1	4.9
BROMSGROVE STREET/PERSHORE STREET	7134	7138	301	3	8	324	292	4	8	316	1	0.5
Cordon Total			1,217	40	18	1,301	1,184	38	10	1,248	1	1.5

			Observed				Modelled					
Ring Road Cordon - Inbound	**A Node**	**B Node**	**Car (inc. Taxi)**	**LGV**	**HGV**	**Total**	**Car**	**LGV**	**HGV**	**Total**	**DMRB**	**GEH**
ASTON EXPRESSWAY beneath Dartmouth Circus	6170	6161	3,125	49	21	3,225	3,267	55	21	3,373	1	2.6
ASTON ROAD Dartmouth Circus South Slips	6164	6162	811	38	10	875	786	11	7	814	1	2.1
LISTER STREET West of Venture Way	6301	6173	234	22	9	277	164	16	7	199	1	5.1
JENNENS ROAD South of Lawley Street	6202	7142	559	26	7	603	520	21	5	553	1	2.1
CURZON STREET East of Penn Street	6203	8943	278	26	11	330	275	24	10	323	1	0.4
GREAT BARR STREET South of Glover Street	7188	7171	438	28	9	487	368	28	7	414	1	3.4
ADDERLEY STREET West of Glover Street	7152	7157	45	5	2	54	42	5	1	49	1	0.7
COVENTRY ROAD East of Bowyer Street	7205	7309	499	23	6	538	590	20	6	626	1	3.7
CAMP HILL South of Bradford Street	7294	7311	905	42	12	977	812	32	9	865	1	3.7
MOSELEY ROAD South of Moseley Street	7161	7164	207	12	7	236	301	13	-	315	1	4.8
LEOPOLD STREET West of Highgate Middleway	7172	7607	77	9	3	93	116	7	2	129	1	3.4
FRANK STREET South of Highgate Street	7614	7603	23	3	1	27	2	-	-	2	1	6.7
SHERLOCK STREET South of St Lukes Road	7203	7757	581	27	7	627	491	20	6	527	0	4.2
BRISTOL STREET South of Rickman Drive	8312	8407	2,886	212	21	3,150	2,556	186	20	2,792	1	6.6
BATH ROW West of Bishopgate Street	8164	8163	494	23	6	533	590	42	0	633	0	4.1
TENNANT STREET South of Moss House Close	7645	7698	132	12	7	162	157	4	2	166	1	0.3
FIVE WAYS ROUNDABOUT	8204	8429	441	7	-	448	321	6	1	329	0	6.0
BROAD STREET AT FIVE WAYS MR19	7665	8190	1,142	118	2	1,265	1,090	96	1	1,188	1	2.2
GROSVENOR STREET WEST South of Ryland Street	8425	8413	44	5	2	53	23	1	1	27	1	4.2
ST VINCENT STREET WEST West of Ledsam Street	8177	8414	99	9	5	122	103	1	0	106	1	1.5
LEDSAM STREET North of Rodney Close	5148	8168	68	8	2	82	61	1	0	63	1	2.2
KING EDWARD'S ROAD West of St Marks Road	5182	5530	54	6	2	65	53	4	2	61	1	0.5
SUMMER HILL ROAD West of Goodman Street	5203	5169	1,458	68	16	1,565	1,384	58	12	1,472	1	2.4
CAMDEN STREET East of Icknield Street One way east only	5156	5412	106	10	6	130	109	4	0	113	1	1.5
CARVER STREET West of Moreton Street One way east only	5159	5152	69	8	2	83	-	-	2	4	1	12.0
WARSTONE LANE West of Pemberton Street	5159	7654	402	26	8	448	294	17	6	326	0	6.2
PITSFORD STREET West of Vyse Street	5174	9710	88	8	5	109	110	7	3	125	1	1.5
GREAT HAMPTON STREET South of Key Hill	5155	5144	478	22	6	516	579	27	3	613	1	4.1
UNETT STREET South of New John Street	5153	5175	551	26	7	595	533	23	5	569	1	1.1
SUMMER LANE North of Hatchett Street	5303	7631	614	29	8	663	514	22	-	536	0	5.2
NEWTOWN ROW JUST NORTH OF PRITCHETT STREET MR02	6303	6159	1,295	136	7	1,449	1,153	125	7	1,296	1	4.1
NEWTOWN MIDDLEWAY Access to New John Street One way	6701	7754	46	5	2	55	45	4	1	52	1	0.4
Cordon Total			18,250	1,047	218	19,840	17,409	879	149	18,661	0	8.5

			Observed				Modelled					
Ring Road Cordon - Outbound	**A Node**	**B Node**	**Car (inc. Taxi)**	**LGV**	**HGV**	**Total**	**Car**	**LGV**	**HGV**	**Total**	**DMRB**	**GEH**
ASTON ROAD Dartmouth Circus South Slips	6176	6169	966	45	10	1,037	1,017	14	10	1,057	1	0.6
ASTON EXPRESSWAY beneath Dartmouth Circus	6163	6171	1,896	43	30	2,015	1,920	44	29	2,036	1	0.5
LISTER STREET West of Venture Way	6173	6301	71	8	2	85	72	6	2	82	1	0.3
JENNENS ROAD South of Lawley Street	7142	6202	305	28	12	362	279	24	6	318	1	2.4
CURZON STREET East of Penn Street	8943	6203	157	15	9	193	159	12	7	188	1	0.4
GREAT BARR STREET South of Glover Street	7171	7188	365	23	7	406	326	20	6	362	1	2.2
ADDERLEY STREET West of Glover Street	7157	7152	35	4	1	41	36	2	1	40	1	0.2
COVENTRY ROAD East of Bowyer Street	7309	7205	224	12	7	254	188	11	6	216	1	2.5
CAMP HILL South of Bradford Street	7311	7294	264	25	10	314	295	28	9	347	1	1.8
MOSELEY ROAD South of Moseley Street	7164	7161	35	4	1	42	32	3	1	37	1	0.9
LEOPOLD STREET West of Highgate Middleway	7607	7172	64	7	2	77	60	6	2	69	1	0.9
FRANK STREET South of Highgate Street	7603	7614	72	8	3	87	93	2	1	98	1	1.2
SHERLOCK STREET South of St Lukes Road	7757	7203	381	24	7	424	379	23	7	418	1	0.3
BRISTOL STREET South of Rickman Drive	8157	8312	1,695	79	18	1,819	1,699	69	17	1,810	1	0.2
WHEELEY'S LANE Y South of Bath Row One way southbound o	9709	8305	466	22	6	503	396	19	5	428	1	3.5
BATH ROW West of Bishopgate Street	8163	8164	75	8	3	90	78	7	-	85	1	0.5
TENNANT STREET South of Moss House Close	7698	7645	37	4	1	44	39	7	3	54	1	1.4
FIVE WAYS ROUNDABOUT	8429	8204	398	10	-	408	340	9	1	352	1	2.9
BROAD STREET AT FIVE WAYS MR19	8190	7665	842	104	10	971	807	33	2	847	1	4.1
GROSVENOR STREET WEST South of Ryland Street	8413	8425	200	11	7	227	243	10	1	255	1	1.8
ST VINCENT STREET WEST West of Ledsam Street	8414	8177	57	6	2	69	15	5	0	22	1	7.0
LEDSAM STREET North of Rodney Close	8168	5148	48	5	2	58	59	0	1	61	1	0.5
KING EDWARD'S ROAD West of St Marks Road	5530	5182	27	3	1	33	30	2	1	34	1	0.1
SUMMER HILL ROAD West of Goodman Street	5169	5203	651	30	8	702	705	26	7	749	1	1.7
POPE STREET West of Moreton Street One way west only	5160	5161	59	7	2	70	66	2	4	78	1	0.9
WARSTONE LANE West of Pemberton Street	7654	5159	141	13	8	173	147	8	1	158	1	1.1
PITSFORD STREET West of Vyse Street	9710	5174	17	2	1	21	18	2	0	21	1	0.1
GREAT HAMPTON STREET South of Key Hill	5144	5155	407	26	8	453	397	23	3	428	1	1.2
UNETT STREET South of New John Street	5175	5153	141	13	8	173	164	10	6	188	1	1.1
SUMMER LANE North of Hatchett Street	7631	5303	186	10	6	211	191	8	-	199	1	0.9
NEWTOWN ROW JUST NORTH OF PRITCHETT STREET MR02	6159	6303	617	103	6	735	480	21	6	516	0	8.8
Cordon Total			9,934	659	187	11,061	9,714	443	135	10,495	0	5.5

			Observed				Modelled					
Ring Road	**A Node**	**B Node**	**Car (inc. Taxi)**	**LGV**	**HGV**	**Total**	**Car**	**LGV**	**HGV**	**Total**	**DMRB**	**GEH**
LAWLEY MIDDLEWAY North of Garrison Street	6191	7750	2,038	108	37	2,237	2,243	46	19	2,335	1	2.1
LAWLEY MIDDLEWAY North of Garrison Street	7750	6191	1,752	82	19	1,880	1,816	25	7	1,858	1	0.5
BORDESLEY CIRCUS ROUNDABOUT	7205	7204	1,243	42	15	1,323	1,153	35	14	1,224	1	2.8
BORDESLEY CIRCUS ROUNDABOUT	7204	7205	1,464	32	14	1,531	1,415	31	14	1,480	1	1.3
FIVE WAYS ROUNDABOUT	7645	8204	2,121	24	14	2,180	1,915	23	14	1,973	1	4.5
FIVE WAYS ROUNDABOUT	8204	7645	1,595	26	6	1,636	1,750	55	9	1,828	1	4.6
FIVE WAYS ROUNDABOUT	8187	8204	1,156	20	1	1,179	1,476	24	3	1,508	0	9.0
FIVE WAYS ROUNDABOUT	8204	8187	1,497	12	8	1,529	1,530	12	8	1,561	1	0.8
LADYWOOD MIDDLEWAY/WOOD STREET/ALSTON STREET	8177	8801	797	12	5	822	812	14	5	839	1	0.6
LADYWOOD MIDDLEWAY/WOOD STREET/ALSTON STREET	8801	8177	1,100	14	2	1,119	1,274	17	4	1,300	0	5.2
LADYWOOD MIDDLEWAY/WOOD STREET/ALSTON STREET	8810	8809	988	18	4	1,016	1,030	18	5	1,061	1	1.4
LADYWOOD MIDDLEWAY/WOOD STREET/ALSTON STREET	8809	8813	1,361	9	5	1,383	1,302	25	5	1,340	1	1.2

PM Peak Hour (17:00 – 18:00)

PM Peak (17-18)

North of City Centre - Inbound			Observed				Modelled					
Location	A Node	B Node	Car (inc. Taxi)	LGV	HGV	TOTAL	Car	LGV	HGV	TOTAL	DMRB	GEH
LIVERY STREET/COLMORE ROW	5197	6101	497	1	1	501	640	4	1	647	0	6.1
COLMORE CIRCUS/COLMORE ROW/BULL STREET	7908	6119	230	1	1	234	166	1	0	167	1	4.7
PRIORY QUEENSWAY WEST OF OLD SQUARE	6117	6201	178	21	4	209	201	21	3	230	1	1.4
CORPORATION STREET NORTH OF OLD SQUARE	6307	6201	93	9	-	102	138	8	1	148	1	4.1
PRIORY QUEENSWAY EAST OF OLD SQUARE	6419	6201	210	7	2	222	267	9	0	276	1	3.4
PARK STREET north of Fazeley Street	6107	7105	1,073	13	23	1,144	1,080	14	8	1,114	1	0.9
NEW CANAL STREET south of Banbury Street	6110	7301	225	1	0	226	250	11	1	263	1	2.4
Cordon Total			2,506	52	31	2,638	2,741	67	15	2,845	1	4.0

North of City Centre - Outbound			Observed				Modelled					
	A Node	B Node	Car (inc. Taxi)	LGV	HGV	TOTAL	Car	LGV	HGV	TOTAL	DMRB	GEH
COLMORE CIRCUS/COLMORE ROW/BULL STREET	6119	7908	368	-	2	373	513	7	2	526	0	7.2
PRIORY QUEENSWAY WEST OF OLD SQUARE	6201	6717	32	2	1	37	81	2	0	82	1	5.9
CORPORATION STREET NORTH OF OLD SQUARE	6201	6307	132	18	-	150	168	18	1	189	1	3.0
NEW CANAL STREET south of Banbury Street	7301	6110	366	3	1	372	486	5	1	494	0	5.9
Cordon Total			898	23	4	931	1,248	32	4	1,291	0	10.8

West of City Centre - Inbound			Observed				Modelled					
	A Node	B Node	Car (inc. Taxi)	LGV	HGV	TOTAL	Car	LGV	HGV	TOTAL	DMRB	GEH
LIVERY STREET/COLMORE ROW	6101	6104	339	-	1	342	490	3	1	496	0	7.6
UPPER DEAN STREET west of Moat Lane	7132	9502	317	9	9	348	191	8	1	202	0	8.8
BRADFORD STREET west of Mill Lane	7147	7127	255	6	2	266	308	7	0	315	1	2.8
DIGBETH east of Meriden Street	7252	7250	539	13	13	584	486	11	3	505	1	3.4
FAZELEY STREET South of River Street	7149	7148	141	6	1	150	165	3	1	171	1	1.7
Cordon Total			1,592	34	26	1,690	1,640	33	7	1,689	1	0.0

West of City Centre - Outbound			Observed				Modelled					
	A Node	B Node	Car (inc. Taxi)	LGV	HGV	TOTAL	Car	LGV	HGV	TOTAL	DMRB	GEH
LIVERY STREET/COLMORE ROW	6104	6101	259	1	3	268	244	5	0	250	1	1.1
CORPORATION STREET SOUTH OF BULL STREET	6102	7319	204	5	1	212	203	5	1	211	1	0.0
UPPER DEAN STREET west of Moat Lane	9502	7132	400	5	3	412	388	5	0	394	1	0.9
BRADFORD STREET west of Mill Lane	7127	7147	254	1	4	265	301	3	0	306	1	2.4
DIGBETH east of Meriden Street	7250	7252	899	11	19	957	803	11	5	826	1	4.4
FAZELEY STREET South of River Street	7148	7149	275	14	2	293	401	11	1	415	0	6.5
Cordon Total			2,291	37	31	2,406	2,340	41	9	2,402	1	0.1

			Observed				Modelled					
Central - Northbound	**A Node**	**B Node**	**Car (inc. Taxi)**	**LGV**	**HGV**	**TOTAL**	**Car**	**LGV**	**HGV**	**TOTAL**	**DMRB**	**GEH**
NAVIGATION STREET/ROYAL MAIL STREET/MAILBOX CAR PARI	8334	8404	13	-	-	13	19	1	0	21	1	1.9
BULL STREET WEST OF CORPORATION STREET	6102	6118	58	11	1	72	100	9	1	112	1	4.3
PRIORY QUEENSWAY WEST OF OLD SQUARE	6201	6717	32	2	1	37	81	2	0	82	1	5.9
CORPORATION STREET NORTH OF OLD SQUARE	6201	6307	132	18	-	150	168	18	1	189	1	3.0
JAMES WATT QUEENSWAY north of Jennens Road	6315	1007	650	16	15	702	386	13	1	401	0	12.8
WOODCOCK STREET South Heneage Street West	6172	7640	91	4	1	96	38	1	0	40	1	6.9
Cordon Total			975	51	17	1,070	792	43	4	845	0	7.3

			Observed				Modelled					
Central - Southbound	**A Node**	**B Node**	**Car (inc. Taxi)**	**LGV**	**HGV**	**TOTAL**	**Car**	**LGV**	**HGV**	**TOTAL**	**DMRB**	**GEH**
NAVIGATION STREET/ROYAL MAIL STREET/MAILBOX CAR PARI	8404	8334	132	2	-	134	135	2	1	139	1	0.5
PRIORY QUEENSWAY WEST OF OLD SQUARE	6117	6201	178	21	4	209	201	21	3	230	1	1.4
CORPORATION STREET NORTH OF OLD SQUARE	6307	6201	93	9	-	102	138	8	1	148	1	4.1
JAMES WATT QUEENSWAY south of Coleshill Street	6174	1007	850	9	8	879	817	20	8	856	1	0.8
WOODCOCK STREET South Heneage Street West	7640	6172	72	3	1	77	90	2	1	94	1	1.9
Cordon Total			1,325	45	12	1,401	1,381	52	14	1,468	1	1.8

			Observed				Modelled					
West - Inbound	**A Node**	**B Node**	**Car (inc. Taxi)**	**LGV**	**HGV**	**TOTAL**	**Car**	**LGV**	**HGV**	**TOTAL**	**DMRB**	**GEH**
BROAD STREET North of Bridge Street Partial data site vandali:	8107	8127	530	17	4	556	711	6	1	720	0	6.5
HOLLIDAY STREET/SUFFOLK STREET QUEENSWAY	8422	8123	156	-	-	156	201	2	1	207	1	3.8
NAVIGATION STREET/ROYAL MAIL STREET/MAILBOX CAR PARI	8133	8650	144	2	-	146	153	2	1	157	1	0.9
BROMSGROVE STREET/PERSHORE STREET	7717	7134	354	-	2	359	283	1	2	288	1	3.9
BROMSGROVE STREET/PERSHORE STREET	7138	7134	278	2	2	285	149	2	0	152	0	9.0
Cordon Total			1,462	21	8	1,502	1,498	13	5	1,523	1	0.5

			Observed				Modelled					
West - Outbound	**A Node**	**B Node**	**Car (inc. Taxi)**	**LGV**	**HGV**	**TOTAL**	**Car**	**LGV**	**HGV**	**TOTAL**	**DMRB**	**GEH**
BROAD STREET North of Bridge Street Partial data site vandali:	8127	8107	641	20	4	672	671	8	1	681	1	0.3
HOLLIDAY STREET/SUFFOLK STREET QUEENSWAY	8123	8422	80	1	-	81	16	1	1	19	1	8.7
BROMSGROVE STREET/PERSHORE STREET	7134	7717	4	-	-	4	1	0	0	2	1	1.3
BROMSGROVE STREET/PERSHORE STREET	7134	7138	431	-	1	434	471	3	1	476	1	2.0
Cordon Total			1,156	21	5	1,191	1,159	12	3	1,178	1	0.4

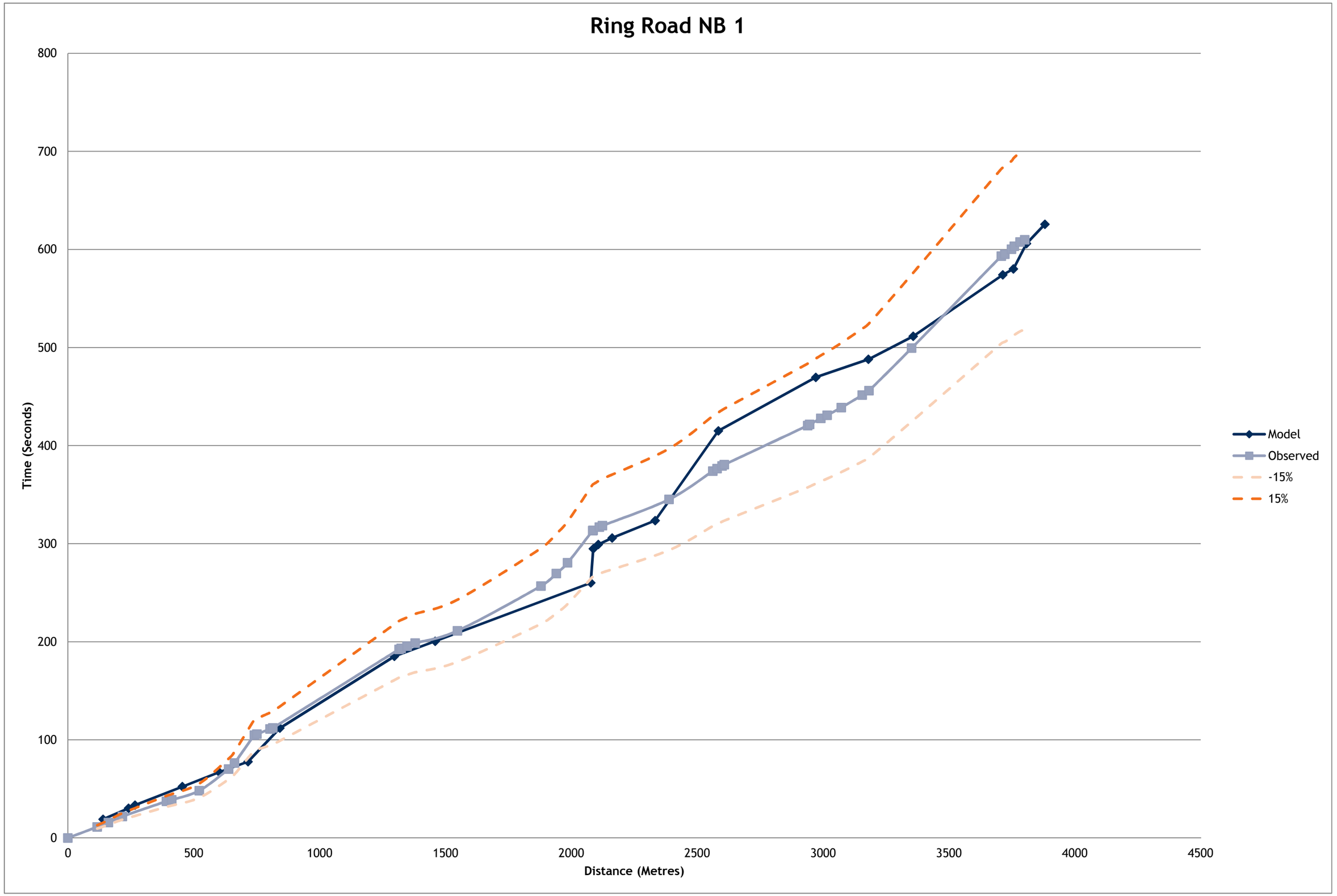
			Observed				Modelled					
Ring Road Cordon - Inbound	**A Node**	**B Node**	**Car (inc. Taxi)**	**LGV**	**HGV**	**TOTAL**	**Car**	**LGV**	**HGV**	**TOTAL**	**DMRB**	**GEH**
ASTON EXPRESSWAY beneath Dartmouth Circus	6170	6161	1,991	19	11	2,038	2,057	27	11	2,111	1	1.6
ASTON ROAD Dartmouth Circus South Slips	6164	6162	796	25	6	835	867	6	1	876	1	1.4
LISTER STREET West of Venture Way	6301	6173	166	5	1	174	112	13	4	134	1	3.2
JENNENS ROAD South of Lawley Street	6202	7142	377	12	3	396	384	13	0	397	1	0.1
CURZON STREET East of Penn Street	6203	8943	292	9	2	306	316	21	4	347	1	2.3
GREAT BARR STREET South of Glover Street	7188	7171	423	13	2	442	421	27	2	454	1	0.6
ADDERLEY STREET West of Glover Street	7152	7157	88	4	1	94	67	6	4	83	1	1.2
COVENTRY ROAD East of Bowyer Street	7205	7309	455	14	3	478	448	16	4	474	1	0.1
CAMP HILL South of Bradford Street	7294	7311	365	12	3	383	400	16	4	426	1	2.1
MOSELEY ROAD South of Moseley Street	7161	7164	86	4	1	92	82	4	-	86	1	0.6
LEOPOLD STREET West of Highgate Middleway	7172	7607	27	1	0	29	31	2	1	36	1	1.4
FRANK STREET South of Highgate Street	7614	7603	27	1	0	29	2	-	-	2	1	6.9
SHERLOCK STREET South of St Lukes Road	7203	7757	617	19	4	647	694	24	2	723	1	2.9
BRISTOL STREET South of Rickman Drive	8312	8407	1,625	62	7	1,705	1,810	117	12	1,956	1	5.9
BATH ROW West of Bishopgate Street	8164	8163	409	13	3	429	445	6	0	451	1	1.1
TENNANT STREET South of Moss House Close	7645	7698	162	8	1	172	154	1	0	156	1	1.3
FIVE WAYS ROUNDABOUT	8204	8429	340	1	3	349	320	1	0	321	1	1.5
BROAD STREET AT FIVE WAYS MR19	7665	8190	405	50	4	465	442	14	3	464	1	0.0
GROSVENOR STREET WEST South of Ryland Street	8425	8413	102	5	1	109	73	0	1	76	1	3.4
ST VINCENT STREET WEST West of Ledsam Street	8177	8414	102	5	1	109	20	1	0	22	1	10.8
LEDSAM STREET North of Rodney Close	5148	8168	52	3	0	55	41	3	0	45	1	1.5
KING EDWARD'S ROAD West of St Marks Road	5182	5530	79	4	1	84	47	2	0	50	1	4.1
SUMMER HILL ROAD West of Goodman Street	5203	5169	972	15	3	995	844	26	2	874	1	4.0
CAMDEN STREET East of Icknield Street One way east only	5156	5412	49	2	0	52	17	3	1	23	1	4.7
CARVER STREET West of Moreton Street One way east only	5159	5152	78	4	1	83	-	-	2	5	1	11.8
WARSTONE LANE West of Pemberton Street	5159	7654	332	11	2	346	254	19	0	273	1	4.2
PITSFORD STREET West of Vyse Street	5174	9710	36	2	0	38	36	2	1	40	1	0.3
GREAT HAMPTON STREET South of Key Hill	5155	5144	427	13	3	448	467	19	1	489	1	1.9
UNETT STREET South of New John Street	5153	5175	360	11	3	378	370	17	1	389	1	0.6
SUMMER LANE North of Hatchett Street	5303	7631	245	8	2	257	216	7	-	223	1	2.2
NEWTOWN ROW JUST NORTH OF PRITCHETT STREET MR02	6303	6159	852	27	2	884	843	23	2	872	1	0.4
NEWTOWN MIDDLEWAY Access to New John Street One way	6701	7754	54	3	0	58	51	4	1	58	1	0.0
Cordon Total	**Cordon Total**		12,391	386	72	12,957	12,330	441	66	12,936	1	0.2

			Observed				Modelled					
Ring Road Cordon - Outbound	**A Node**	**B Node**	**Car (inc. Taxi)**	**LGV**	**HGV**	**TOTAL**	**Car**	**LGV**	**HGV**	**TOTAL**	**DMRB**	**GEH**
ASTON ROAD Dartmouth Circus South Slips	6176	6169	573	9	2	586	566	7	1	577	1	0.4
ASTON EXPRESSWAY beneath Dartmouth Circus	6163	6171	2,980	18	21	3,052	2,989	45	21	3,086	1	0.6
LISTER STREET West of Venture Way	6173	6301	197	10	1	210	178	17	5	207	1	0.2
JENNENS ROAD South of Lawley Street	7142	6202	525	16	4	551	409	20	1	432	0	5.3
CURZON STREET East of Penn Street	8943	6203	394	19	2	419	512	28	7	558	0	6.3
GREAT BARR STREET South of Glover Street	7171	7188	494	16	2	516	489	14	7	522	1	0.3
ADDERLEY STREET West of Glover Street	7157	7152	53	3	0	56	35	3	1	40	1	2.3
COVENTRY ROAD East of Bowyer Street	7309	7205	476	21	4	506	447	21	6	482	1	1.1
CAMP HILL South of Bradford Street	7311	7294	756	24	5	793	663	54	15	755	1	1.4
MOSELEY ROAD South of Moseley Street	7164	7161	105	5	1	112	87	5	1	94	1	1.9
LEOPOLD STREET West of Highgate Middleway	7607	7172	115	6	1	123	113	9	2	126	1	0.3
FRANK STREET South of Highgate Street	7603	7614	196	10	1	209	235	3	3	246	1	2.4
SHERLOCK STREET South of St Lukes Road	7757	7203	662	21	3	691	831	42	21	926	0	8.3
BRISTOL STREET South of Rickman Drive	8157	8312	2,085	31	7	2,134	2,097	82	19	2,226	1	2.0
WHEELEY'S LANE Y South of Bath Row One way southbound o	9709	8305	685	22	5	719	524	23	1	549	0	6.8
BATH ROW West of Bishopgate Street	8163	8164	213	10	2	228	199	17	-	216	1	0.8
TENNANT STREET South of Moss House Close	7698	7645	167	8	1	178	170	13	3	191	1	0.9
FIVE WAYS ROUNDABOUT	8429	8204	431	-	1	434	448	2	0	450	1	0.8
BROAD STREET AT FIVE WAYS MR19	8190	7665	759	39	1	801	957	29	1	989	0	6.3
GROSVENOR STREET WEST South of Ryland Street	8413	8425	253	11	2	270	254	2	1	258	1	0.8
ST VINCENT STREET WEST West of Ledsam Street	8414	8177	84	4	1	89	33	2	0	36	1	6.8
LEDSAM STREET North of Rodney Close	8168	5148	111	5	1	118	76	-	0	76	1	4.3
KING EDWARD'S ROAD West of St Marks Road	5530	5182	65	3	0	69	62	1	1	64	1	0.6
SUMMER HILL ROAD West of Goodman Street	5169	5203	1,088	34	8	1,141	1,393	53	1	1,450	0	8.6
POPE STREET West of Moreton Street One way west only	5160	5161	101	5	1	108	95	1	1	97	1	1.0
WARSTONE LANE West of Pemberton Street	7654	5159	455	22	3	484	375	22	1	399	1	4.0
PITSFORD STREET West of Vyse Street	9710	5174	52	2	0	55	18	3	1	23	1	5.1
GREAT HAMPTON STREET South of Key Hill	5144	5155	710	22	4	742	699	42	3	747	1	0.2
UNETT STREET South of New John Street	5175	5153	390	19	2	414	385	27	2	416	1	0.1
SUMMER LANE North of Hatchett Street	7631	5303	454	20	4	484	434	25	-	459	1	1.1
NEWTOWN ROW JUST NORTH OF PRITCHETT STREET MR02	6159	6303	842	85	2	932	677	51	2	733	0	6.9
Cordon Total			15,898	512	91	16,637	15,878	658	126	16,851	1	1.7

			Observed				Modelled					
Ring Road	**A Node**	**B Node**	**Car (inc. Taxi)**	**LGV**	**HGV**	**TOTAL**	**Car**	**LGV**	**HGV**	**TOTAL**	**DMRB**	**GEH**
LAWLEY MIDDLEWAY North of Garrison Street	6191	7750	1,687	55	5	1,754	1,818	16	9	1,855	1	2.4
LAWLEY MIDDLEWAY North of Garrison Street	7750	6191	1,799	27	6	1,841	1,688	16	7	1,721	1	2.9
BORDESLEY CIRCUS ROUNDABOUT	7205	7204	1,259	9	5	1,281	1,019	6	5	1,037	0	7.2
BORDESLEY CIRCUS ROUNDABOUT	7204	7205	1,422	8	7	1,448	1,313	8	7	1,338	1	2.9
FIVE WAYS ROUNDABOUT	7645	8204	2,065	6	5	2,084	1,812	28	5	1,853	1	5.2
FIVE WAYS ROUNDABOUT	8204	7645	1,647	5	6	1,667	1,676	15	6	1,705	1	0.9
FIVE WAYS ROUNDABOUT	8187	8204	1,232	1	-	1,233	1,315	3	2	1,324	1	2.5
FIVE WAYS ROUNDABOUT	8204	8187	1,535	5	2	1,545	1,193	4	2	1,202	0	9.3
LADYWOOD MIDDLEWAY/WOOD STREET/ALSTON STREET	8177	8801	1,088	3	1	1,094	885	3	1	891	0	6.4
LADYWOOD MIDDLEWAY/WOOD STREET/ALSTON STREET	8801	8177	1,098	2	2	1,105	1,239	3	2	1,247	1	4.1
LADYWOOD MIDDLEWAY/WOOD STREET/ALSTON STREET	8810	8809	1,645	4	-	1,649	1,462	6	1	1,471	1	4.5
LADYWOOD MIDDLEWAY/WOOD STREET/ALSTON STREET	8809	8813	1,125	5	1	1,133	981	6	2	991	1	4.3

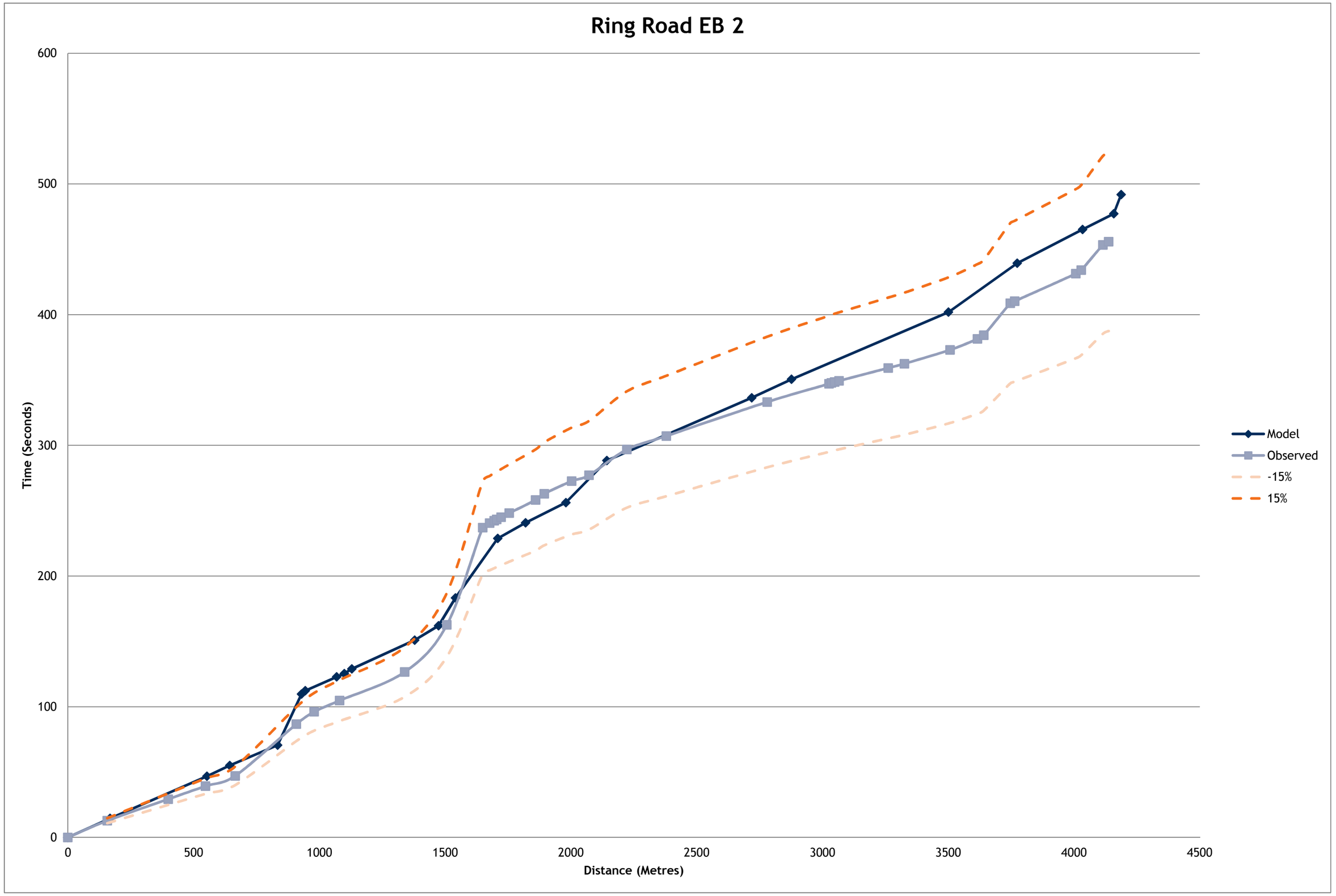
C Journey Time Calibration Graphs

AM Peak Hour (08:00 – 09:00)

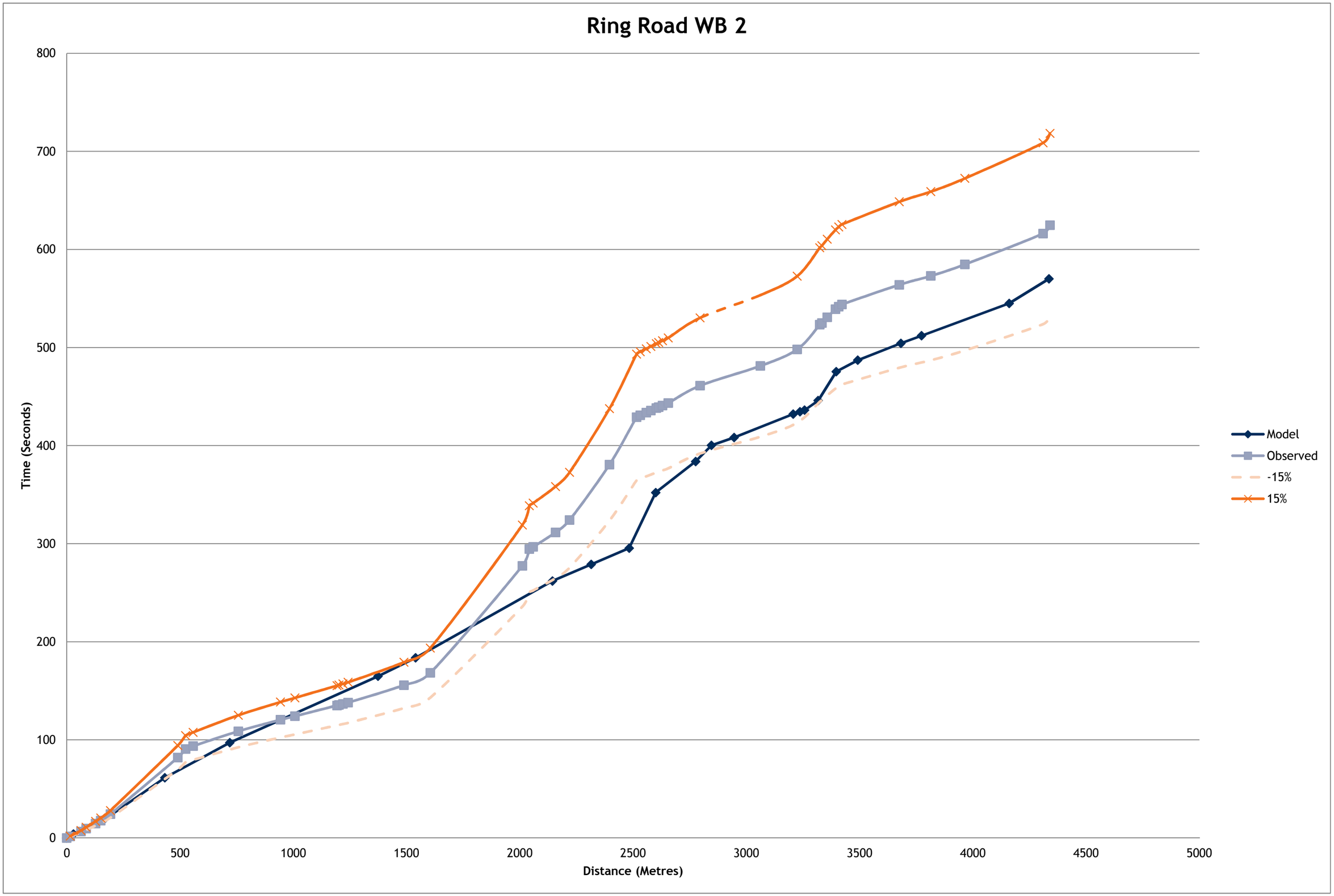

Ring Road NB 1
800
700
600
500
400
300
200
100
0
Time (Seconds)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Distance (Metres)
Model
Observed
-15%
15%

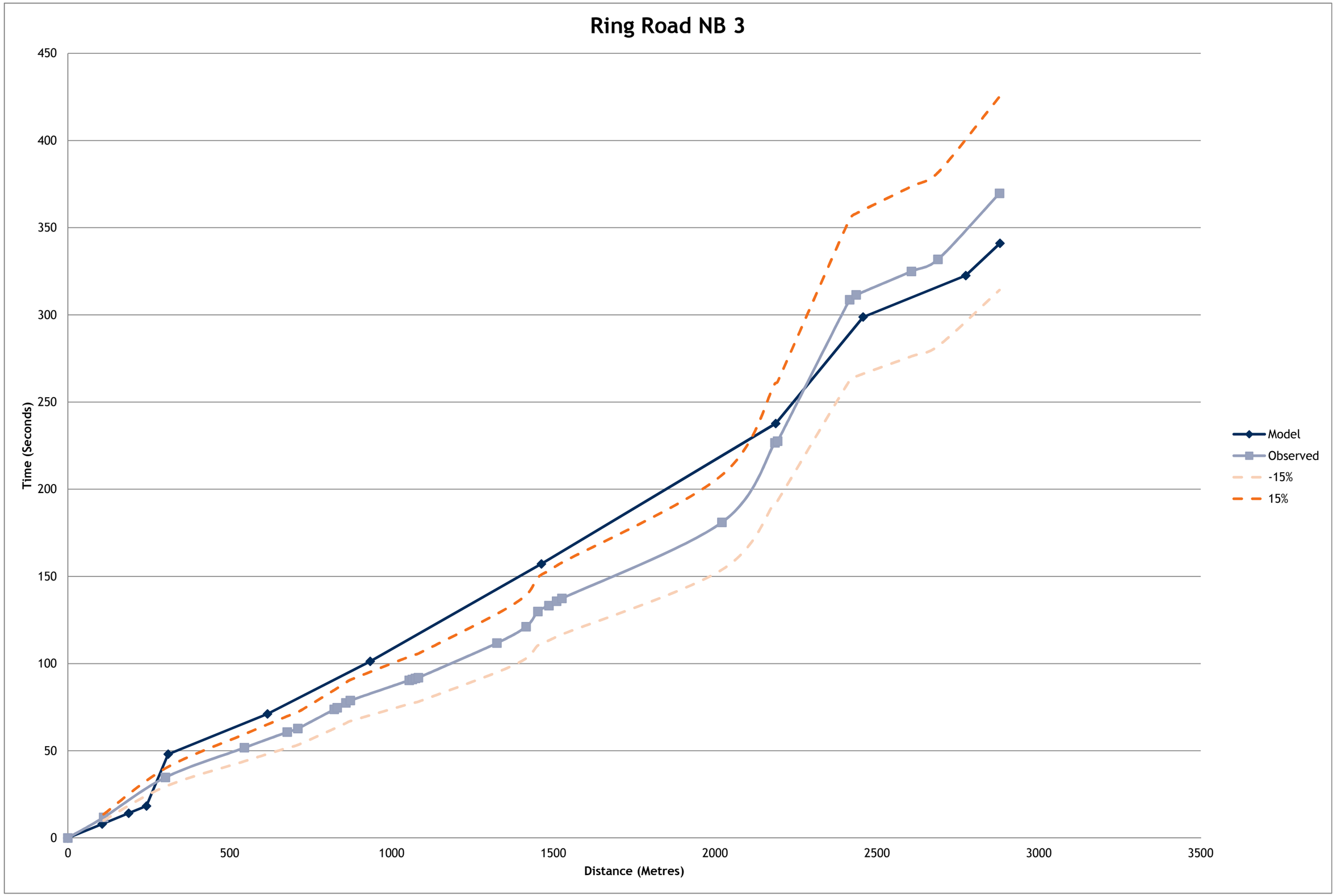
Ring Road SB 1



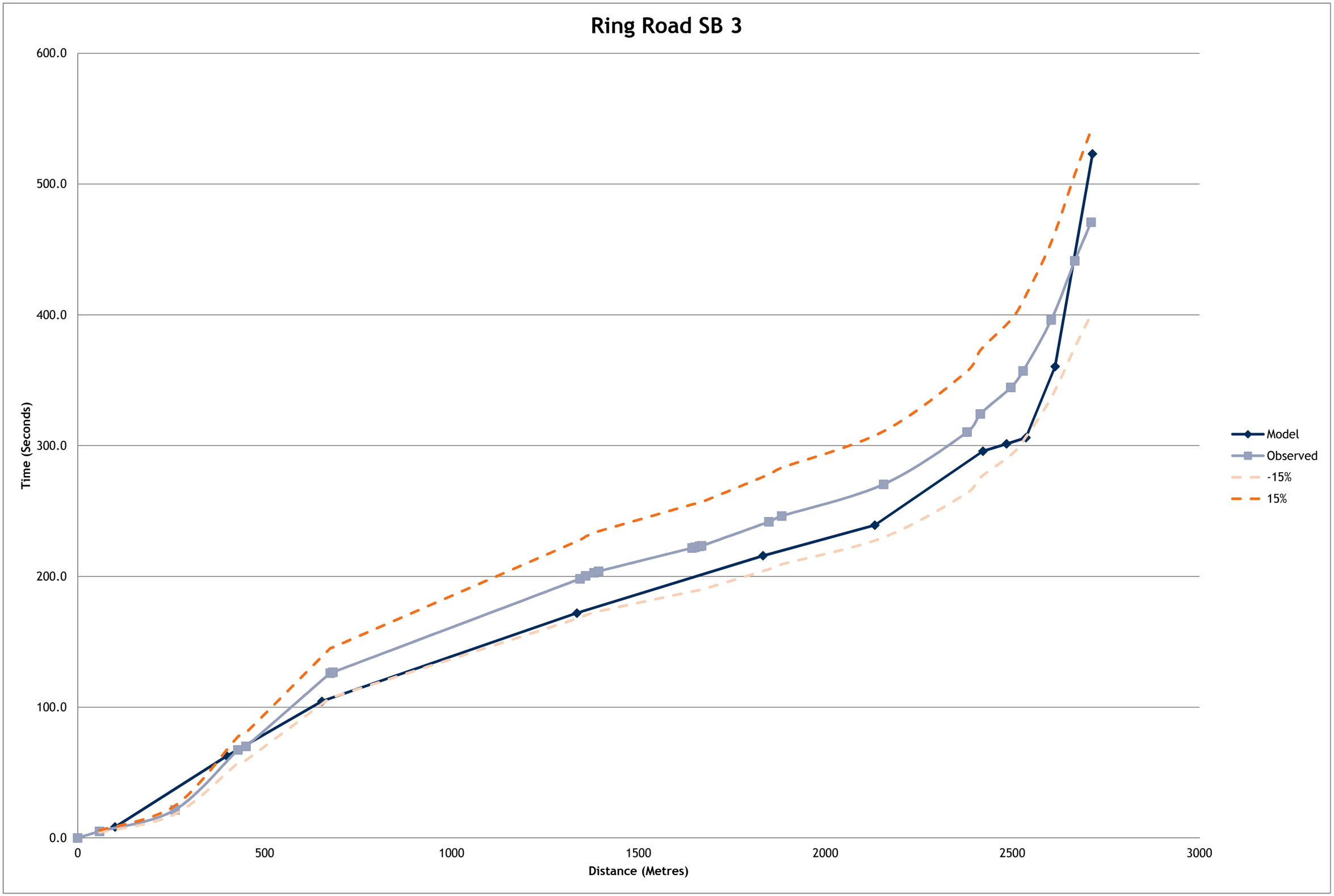

Ring Road EB 2
600
500
400
300
200
100
0
Time (Seconds)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Distance (Metres)
Model
Observed
-15%
15%

Ring Road WB 2

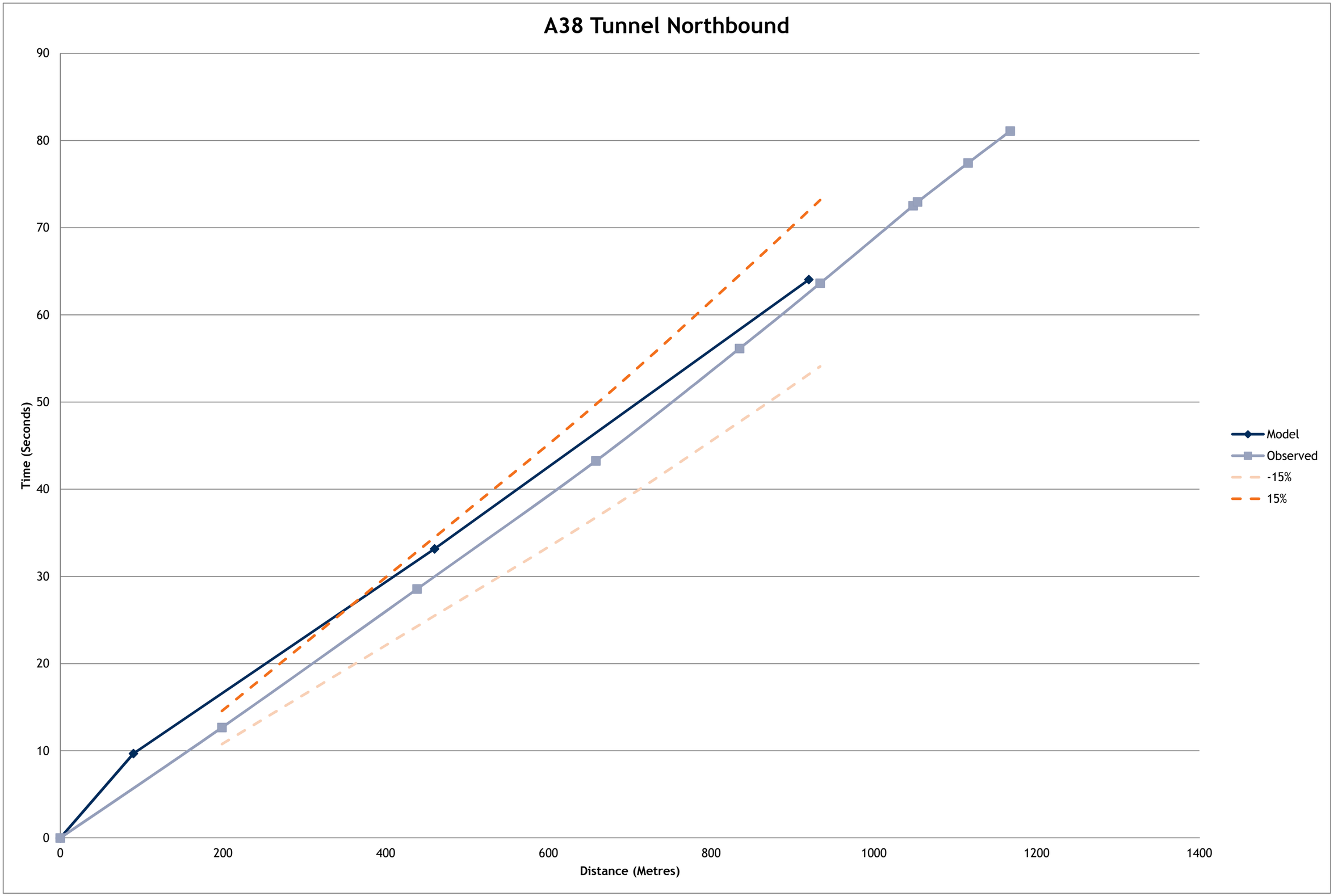



Ring Road NB 3
Time (Seconds)
450
400
350
300
250
200
150
100
50
0
0
500
1000
1500
2000
2500
3000
3500
Distance (Metres)
Model
Observed
-15%
15%

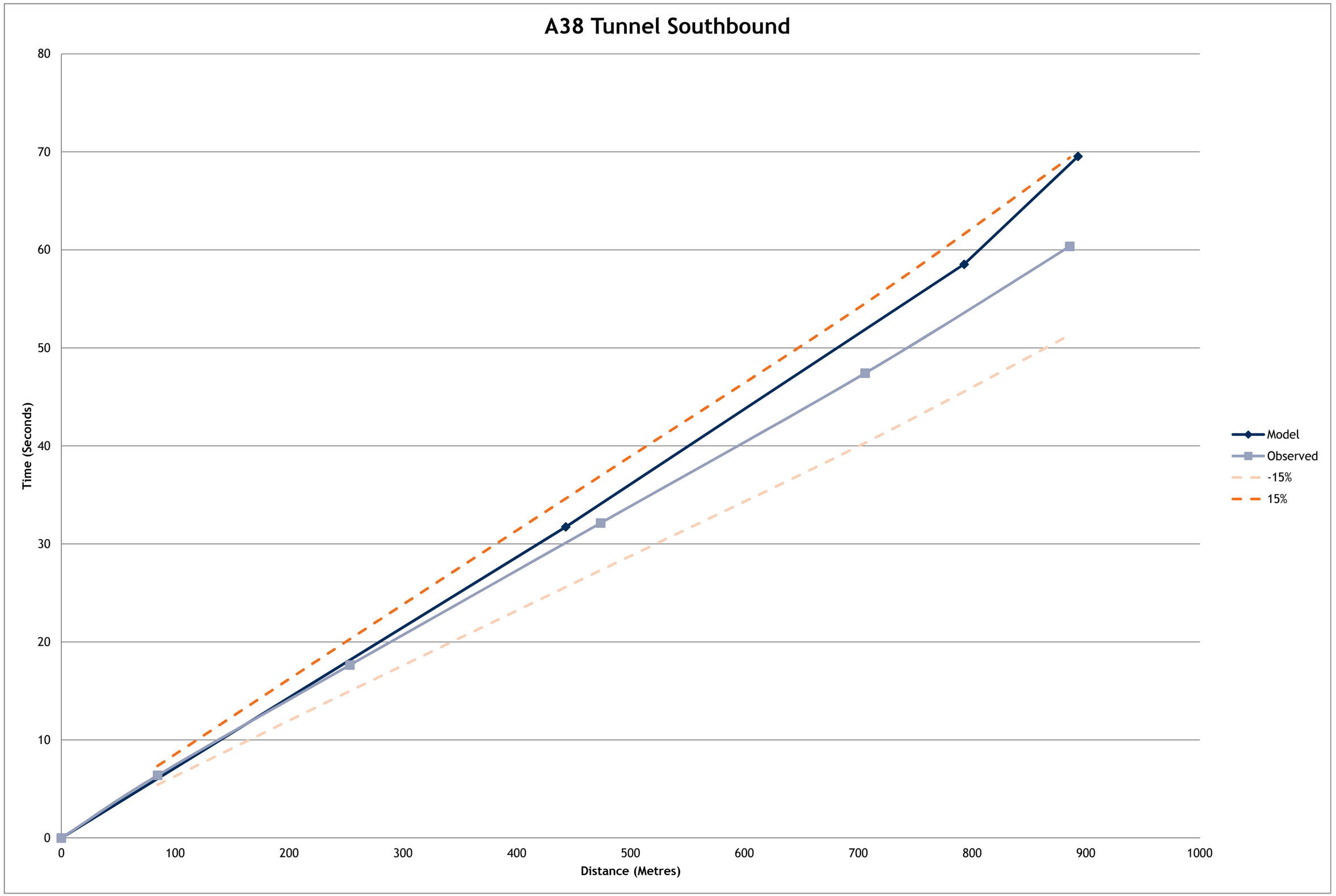
Ring Road SB 3



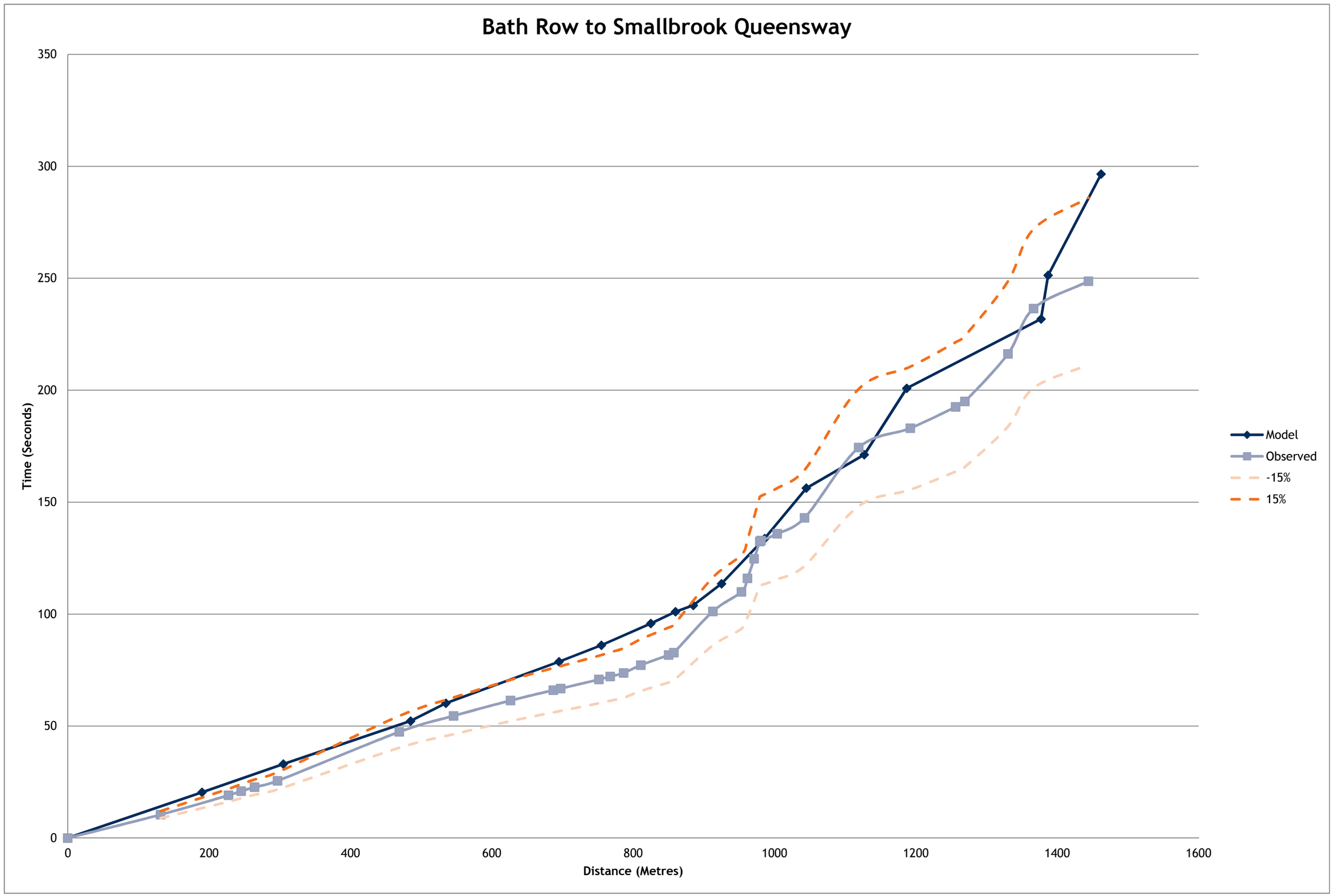
A38 Tunnel Northbound



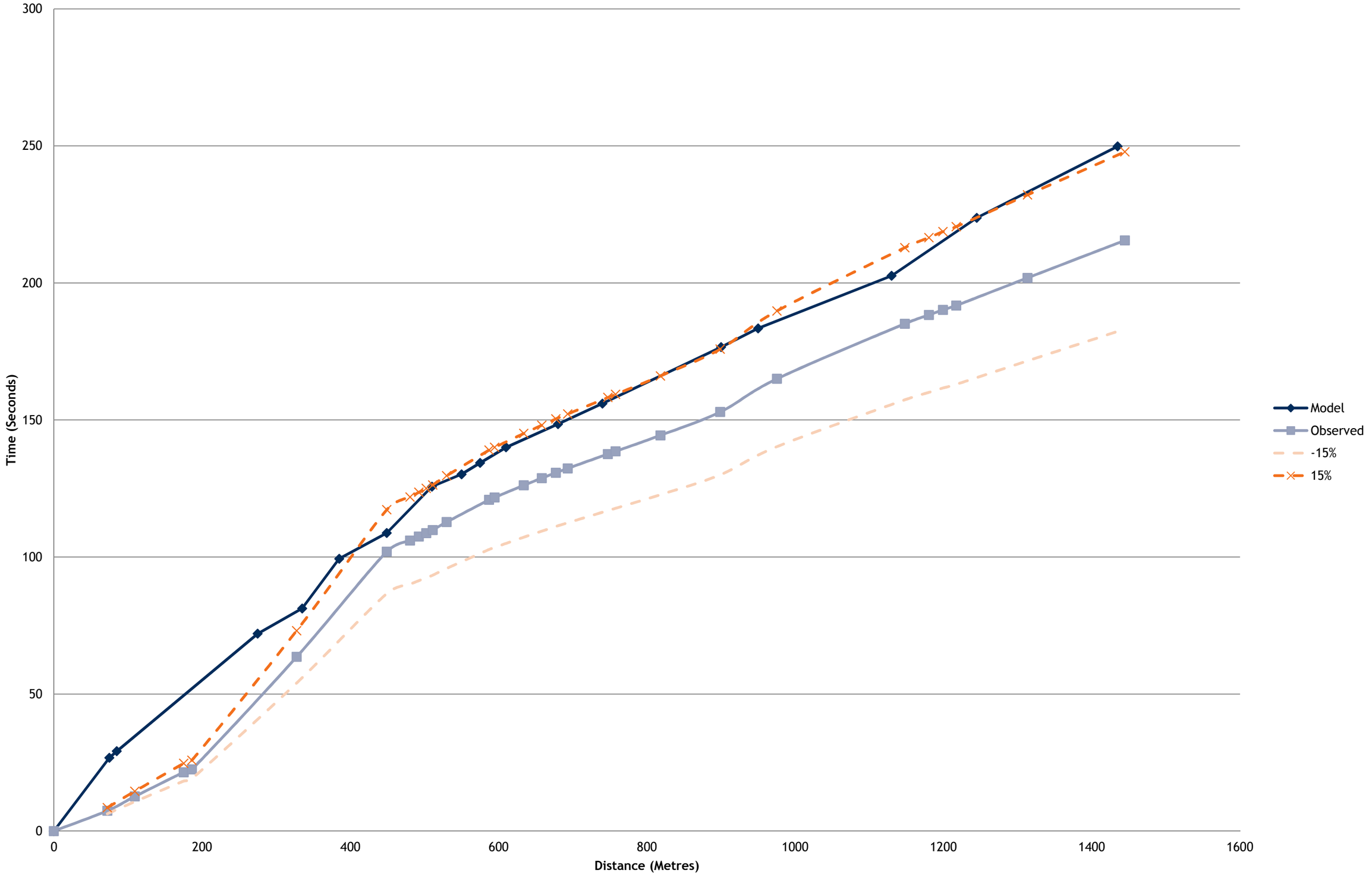
A38 Tunnel Southbound



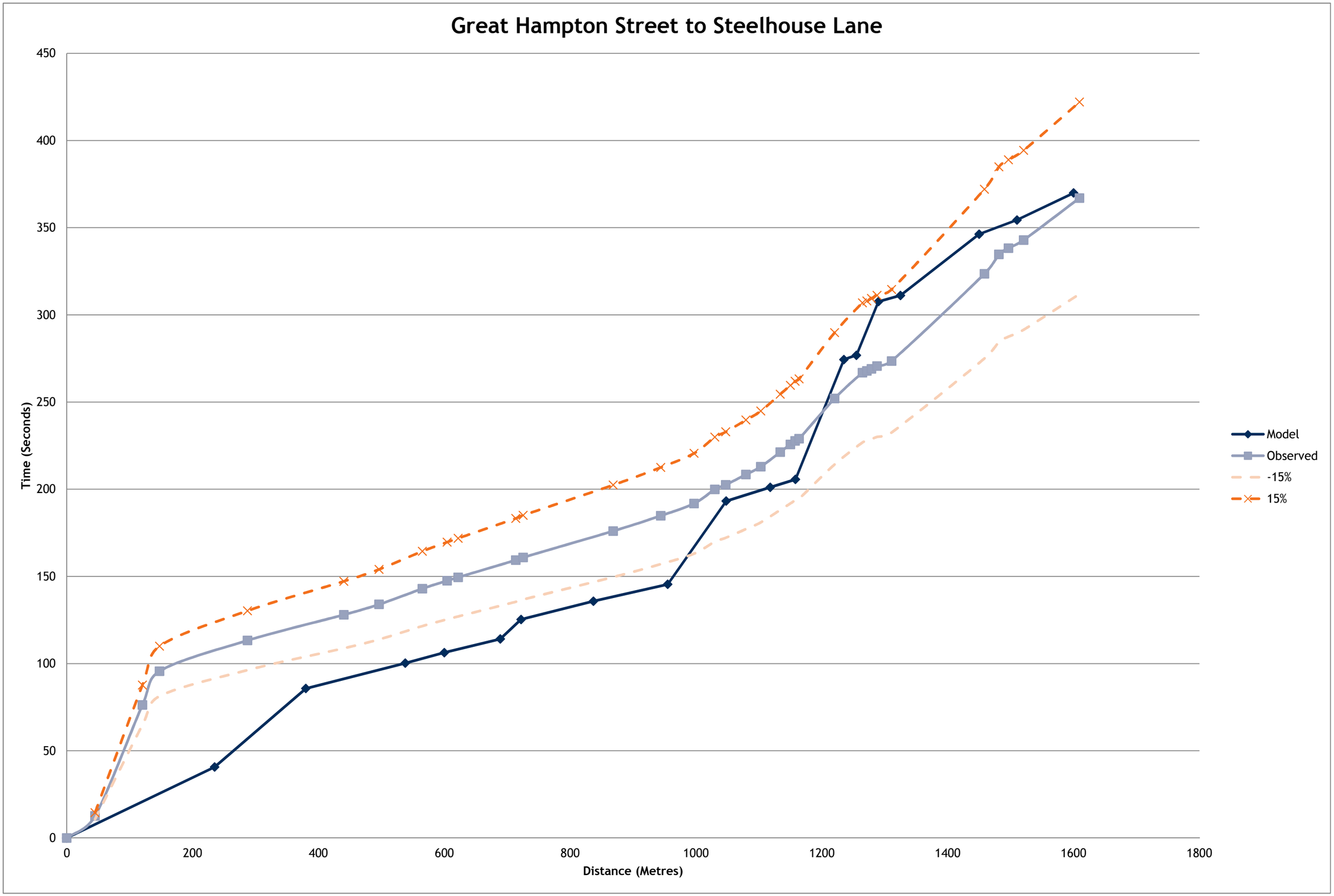
Bath Row to Smallbrook Queensway



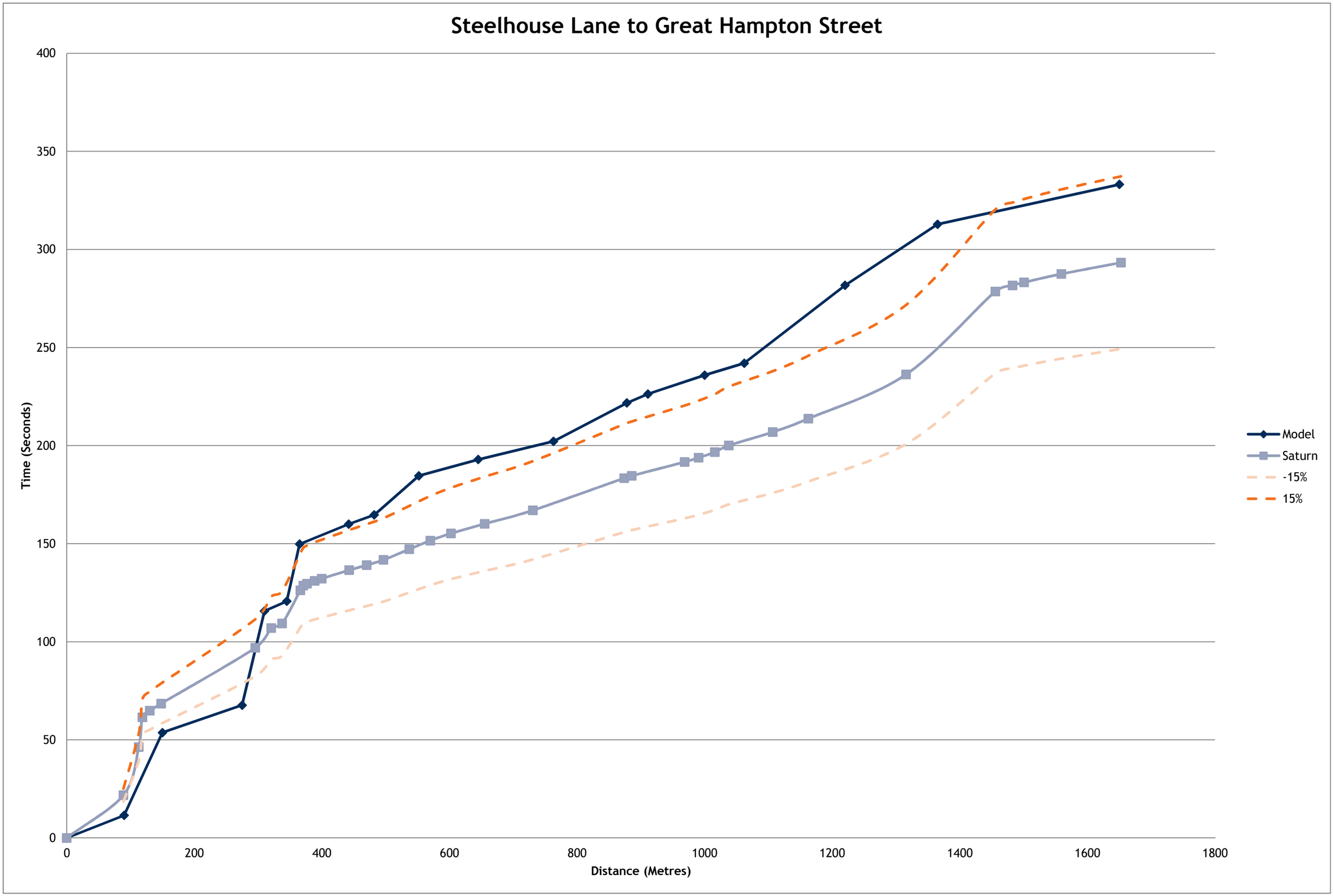
Smallbrook Queensway to Bath Row



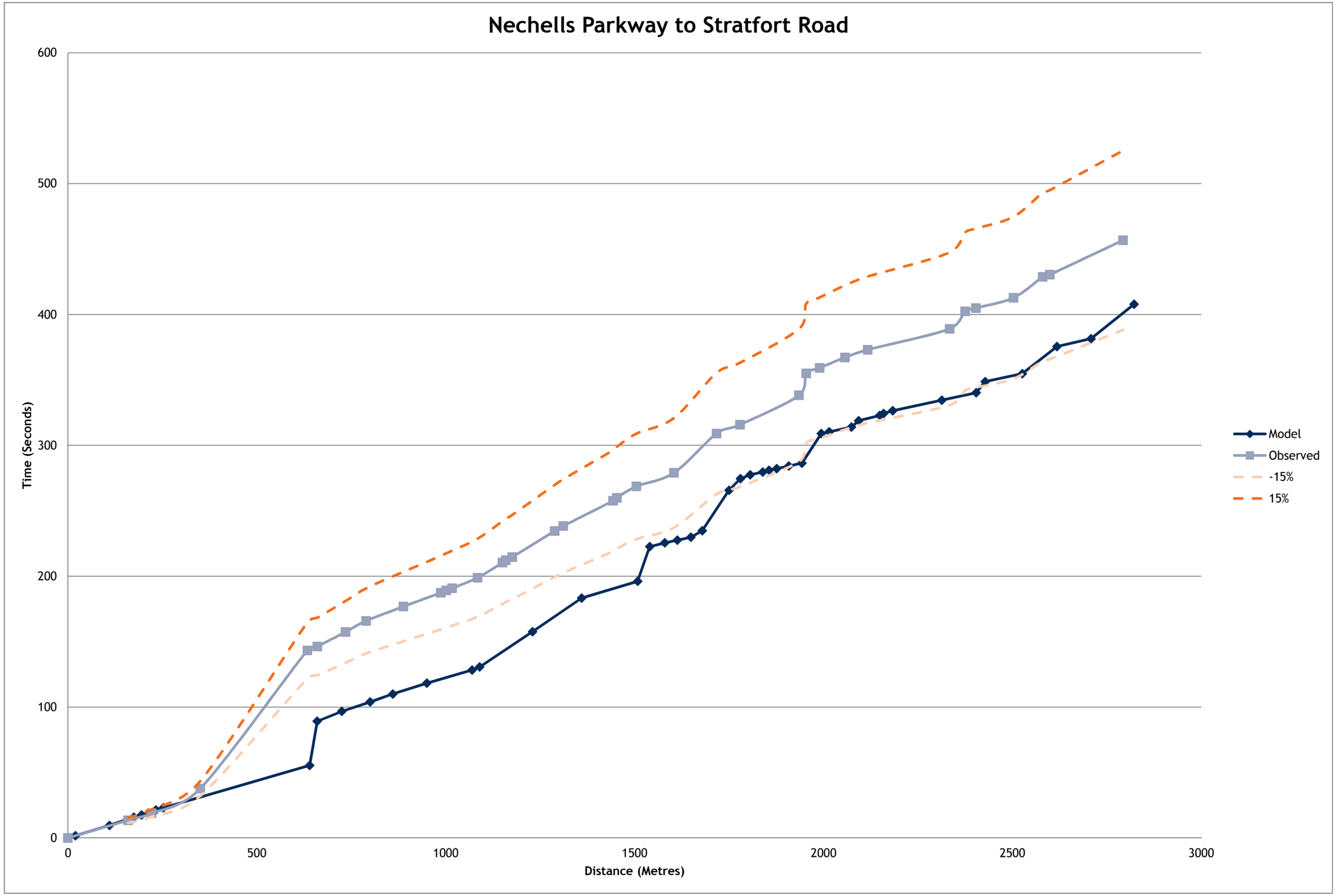
Great Hampton Street to Steelhouse Lane



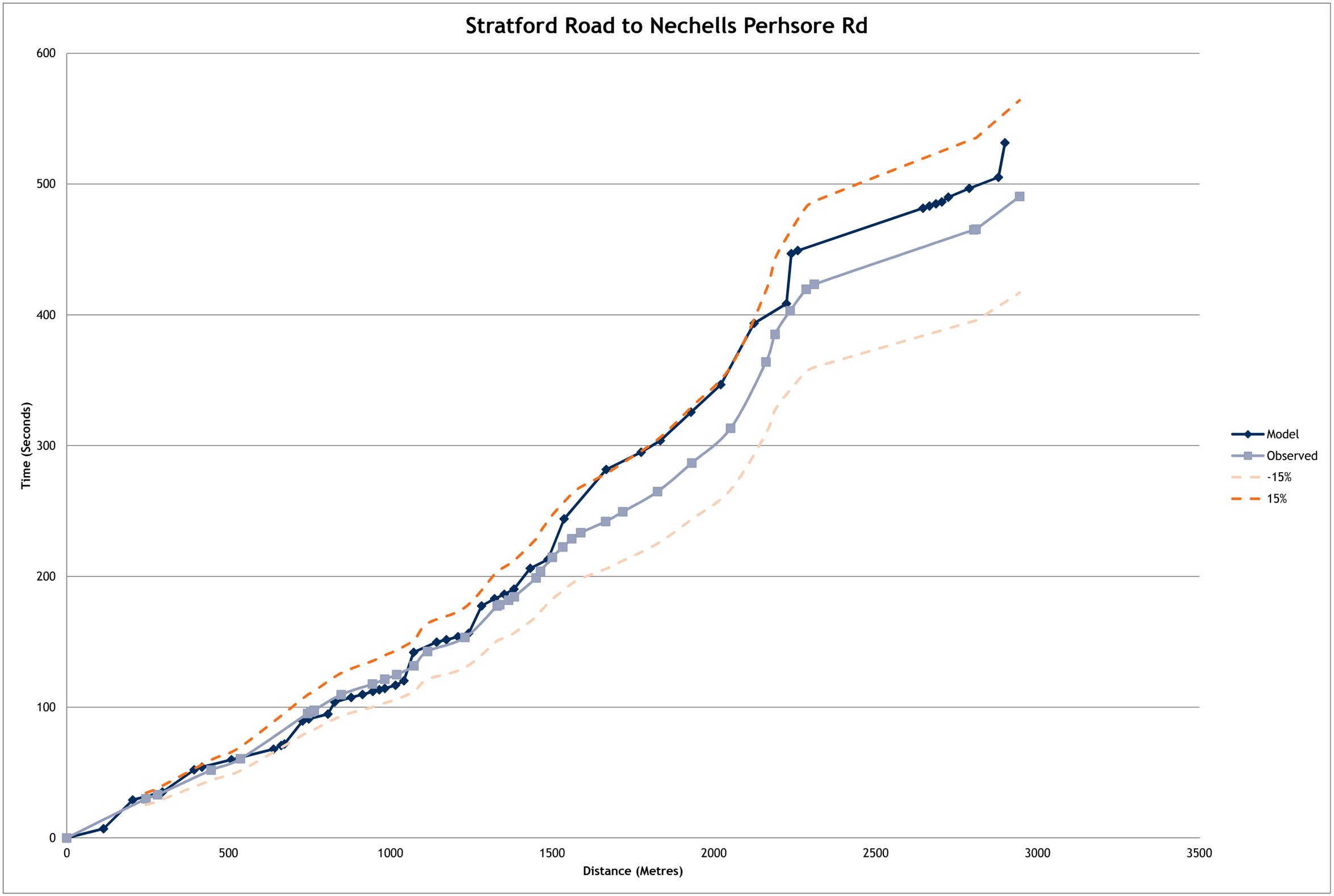
Steelhouse Lane to Great Hampton Street



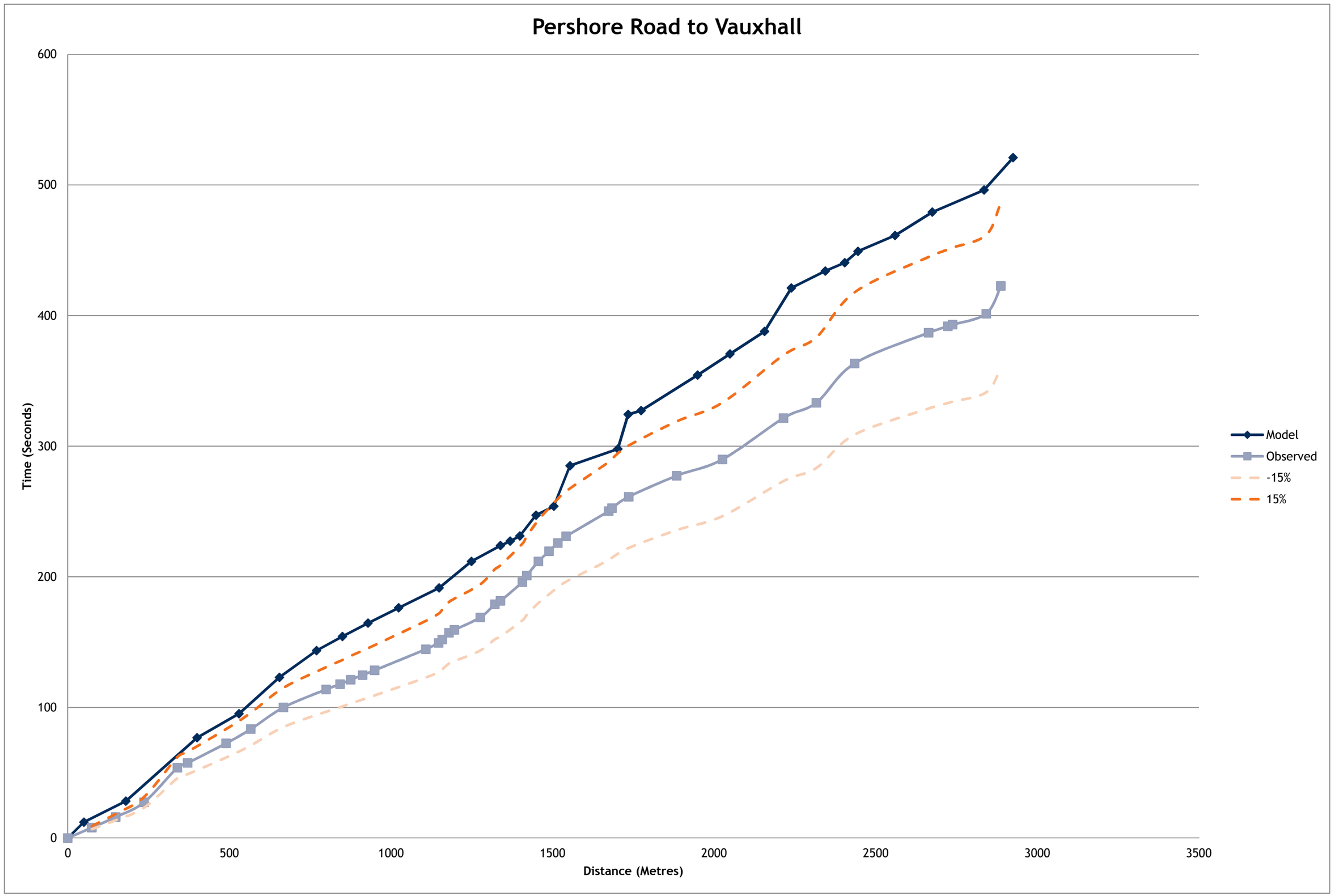
Nechells Parkway to Stratfort Road



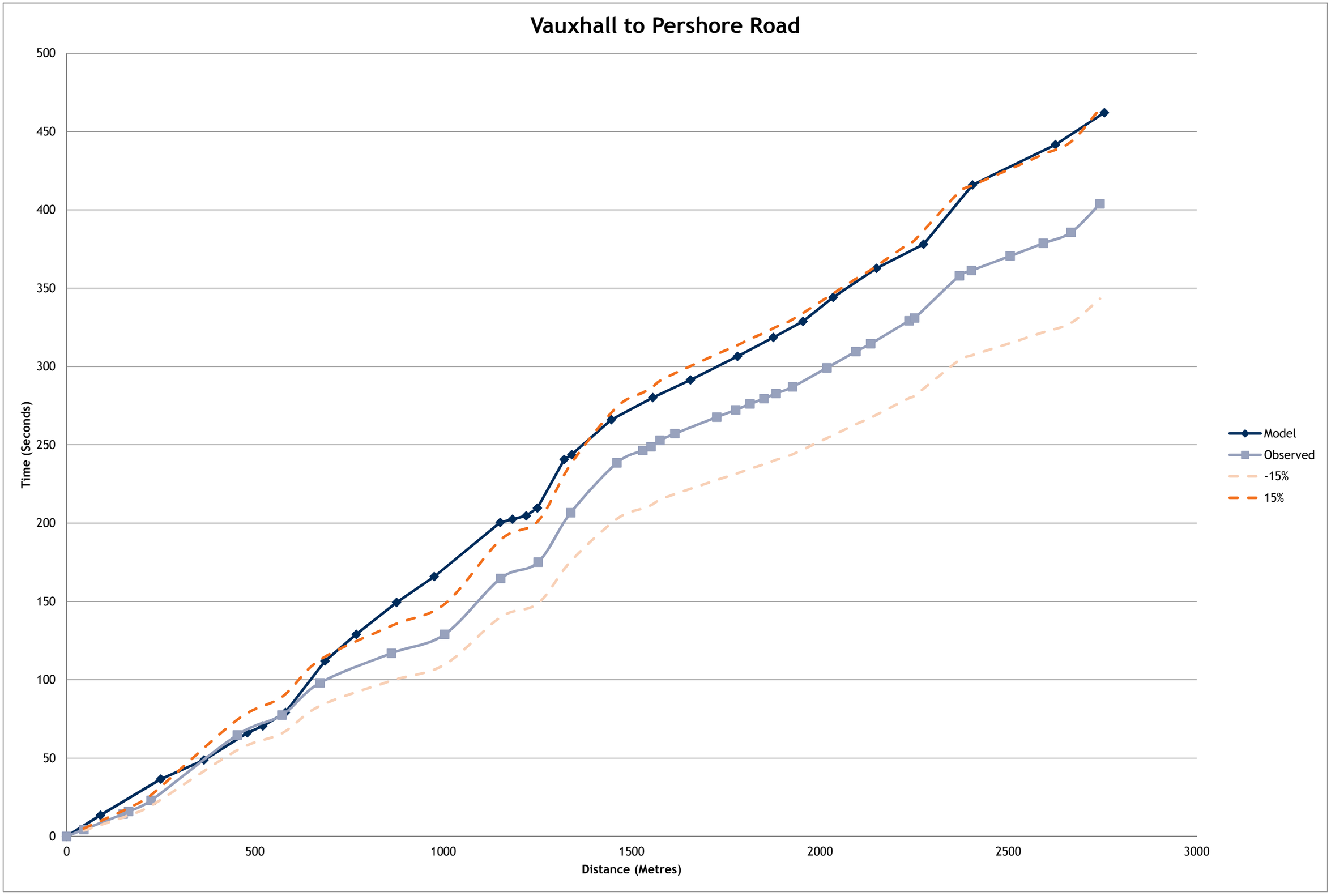
Stratford Road to Nechells Perhsore Rd



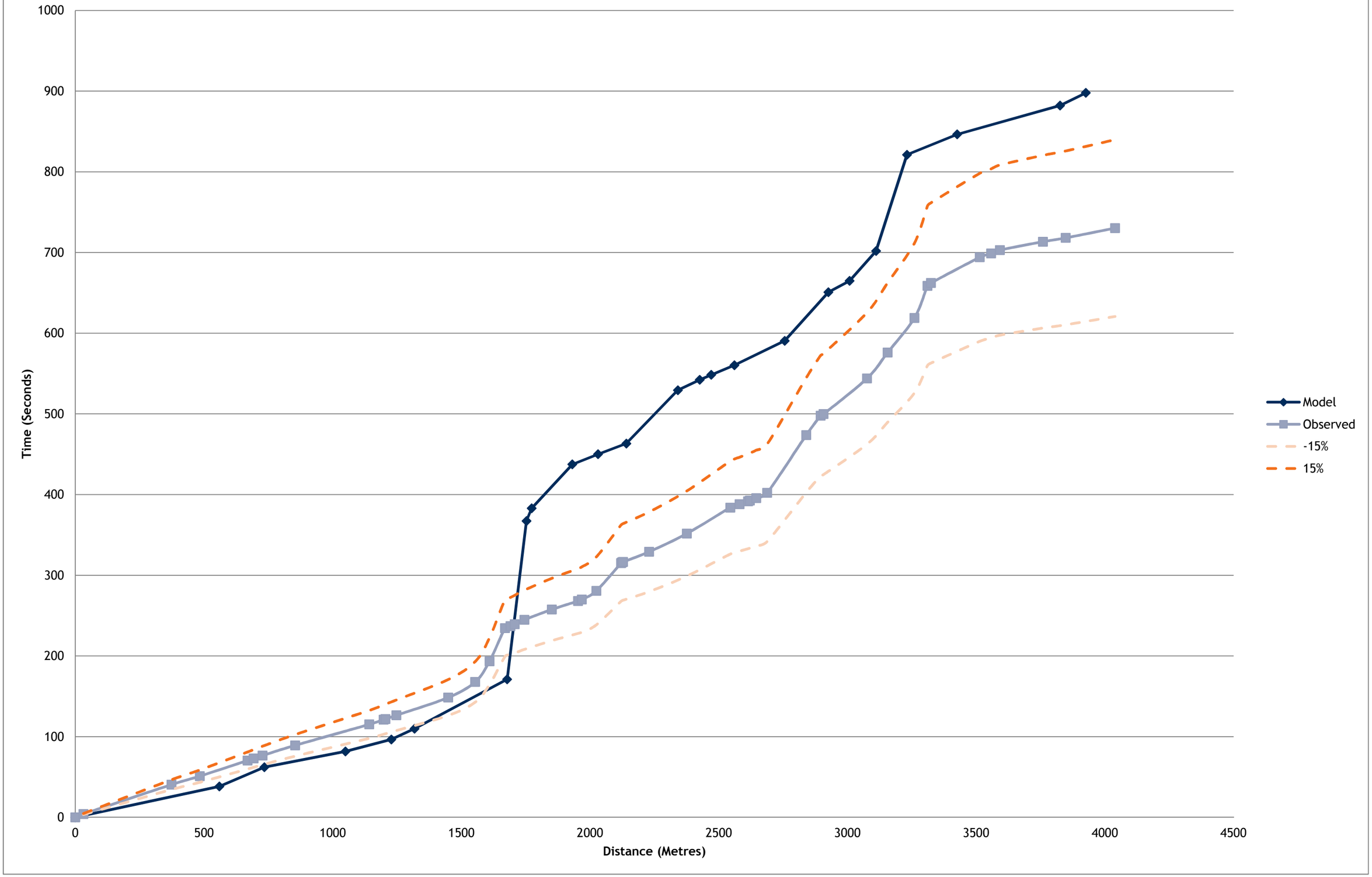
Pershore Road to Vauxhall



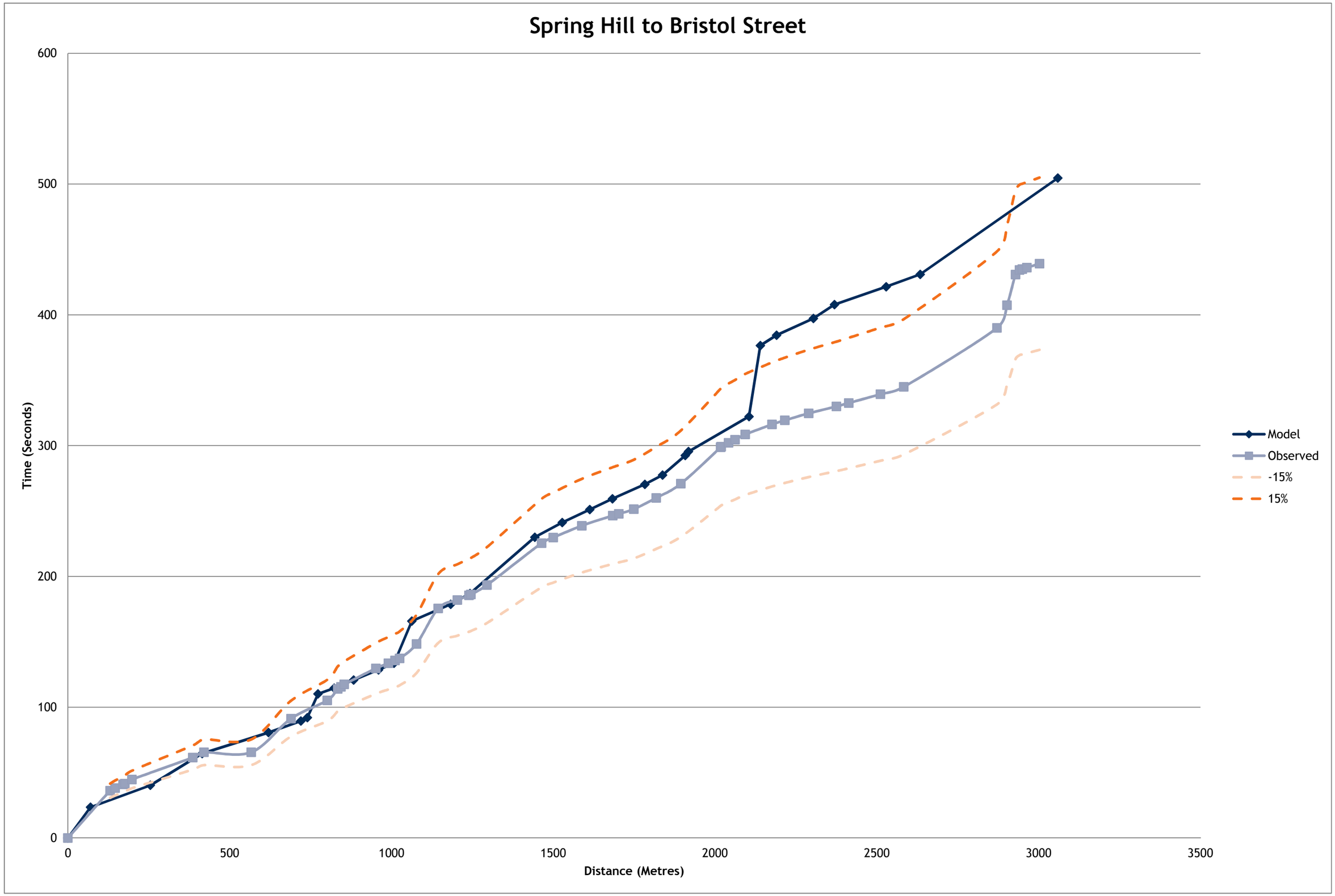
Vauxhall to Pershore Road



Aston Expressway to Hagley Road

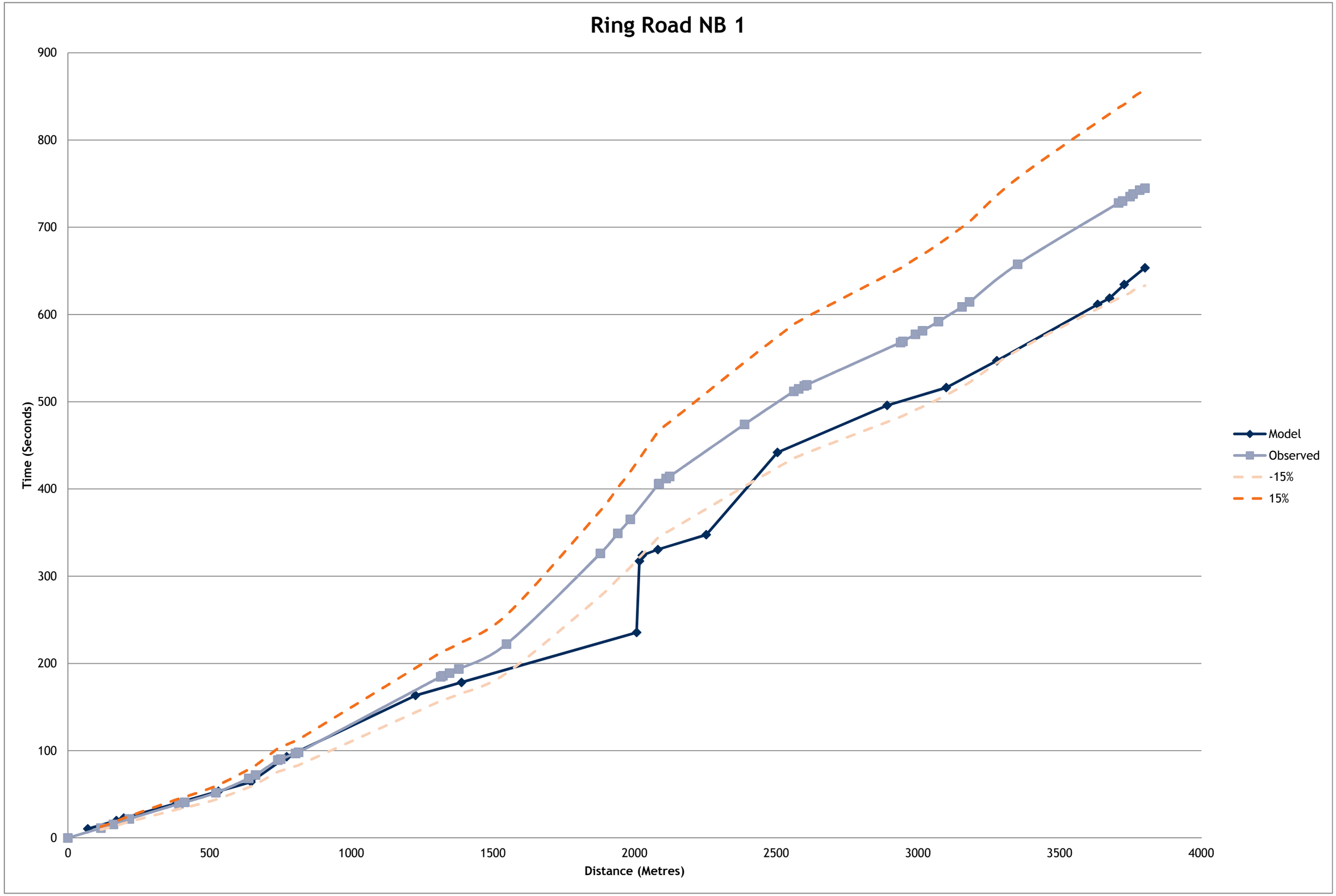


Spring Hill to Bristol Street

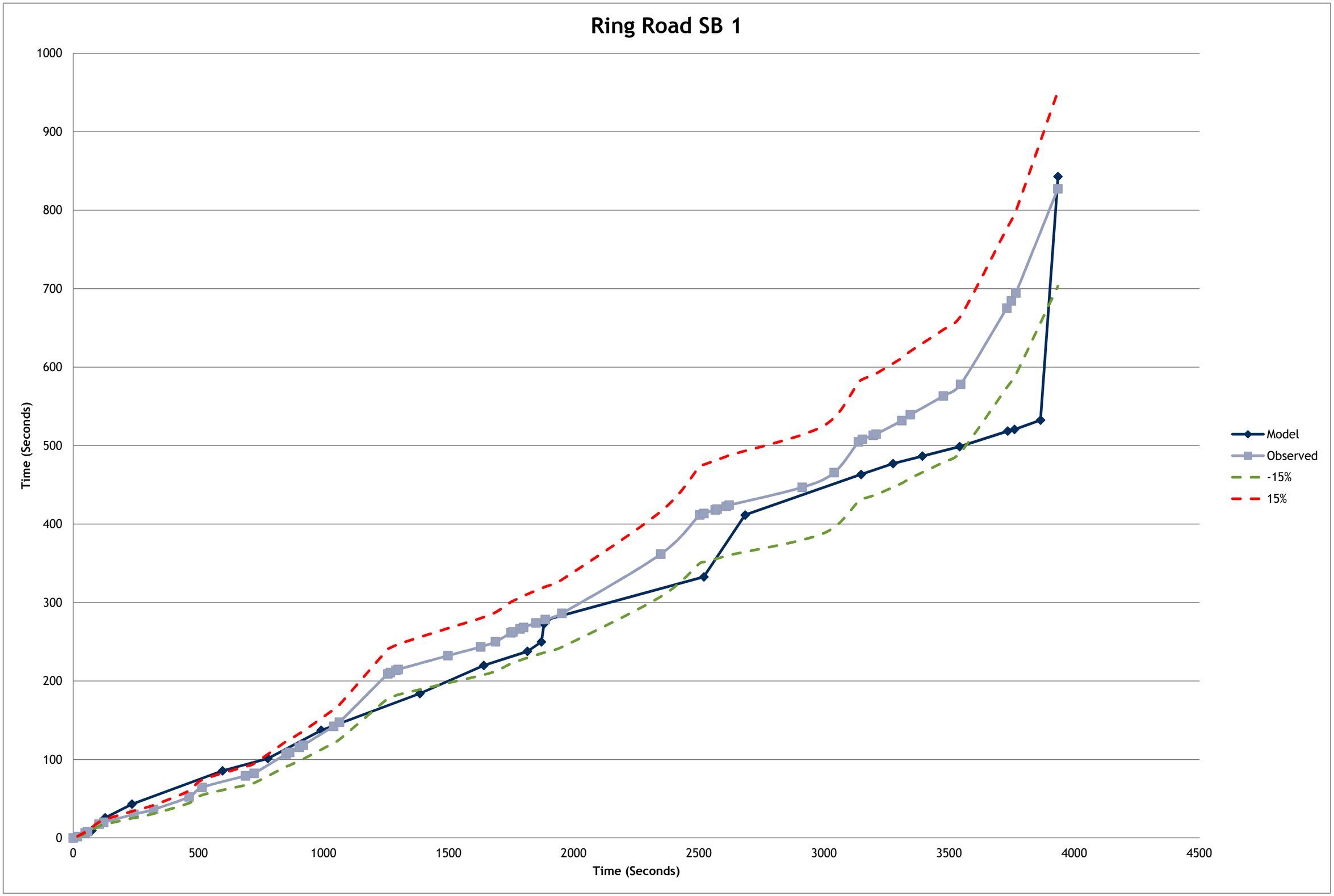


PM Peak Hour (17:00 – 18:00)

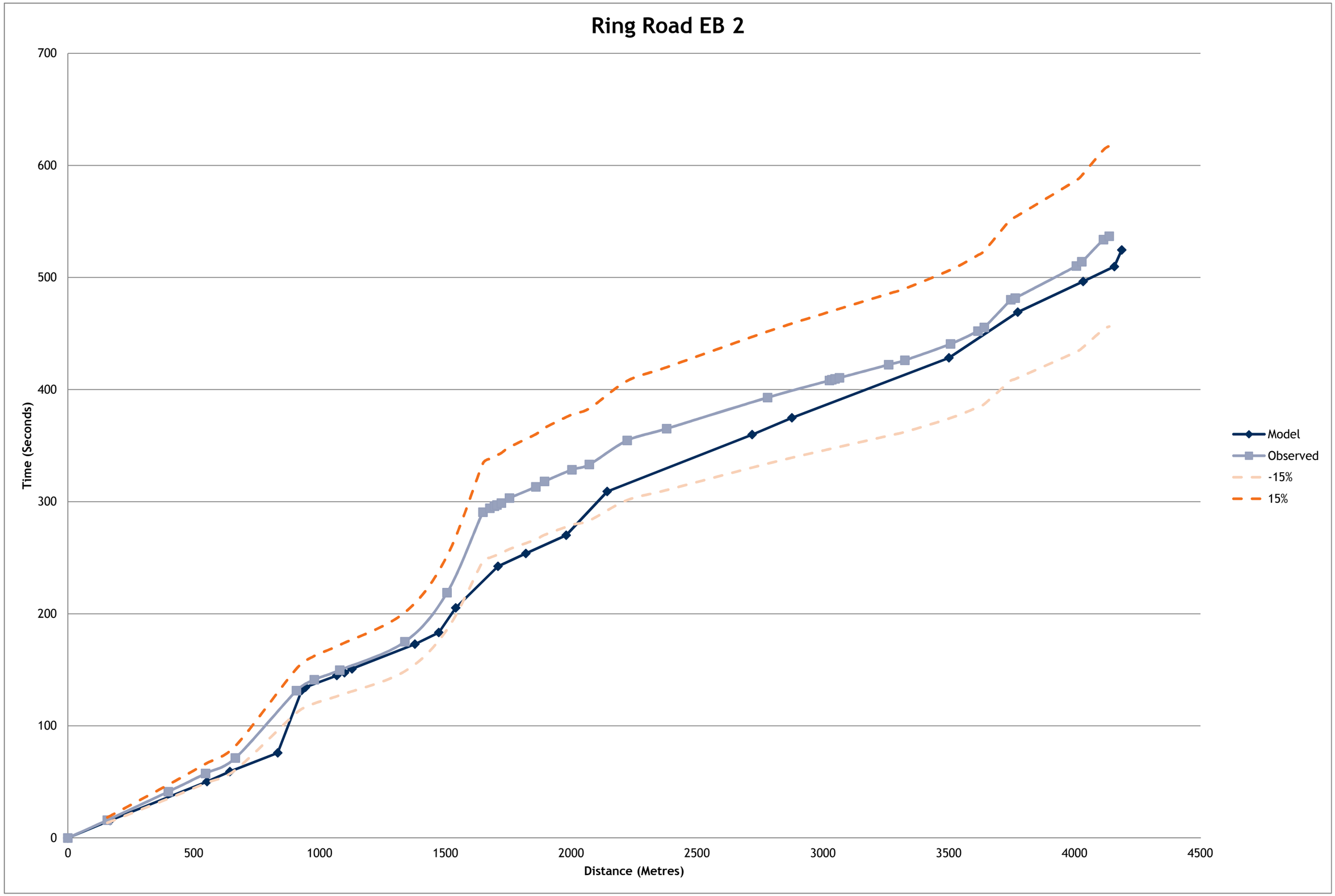
Ring Road NB 1



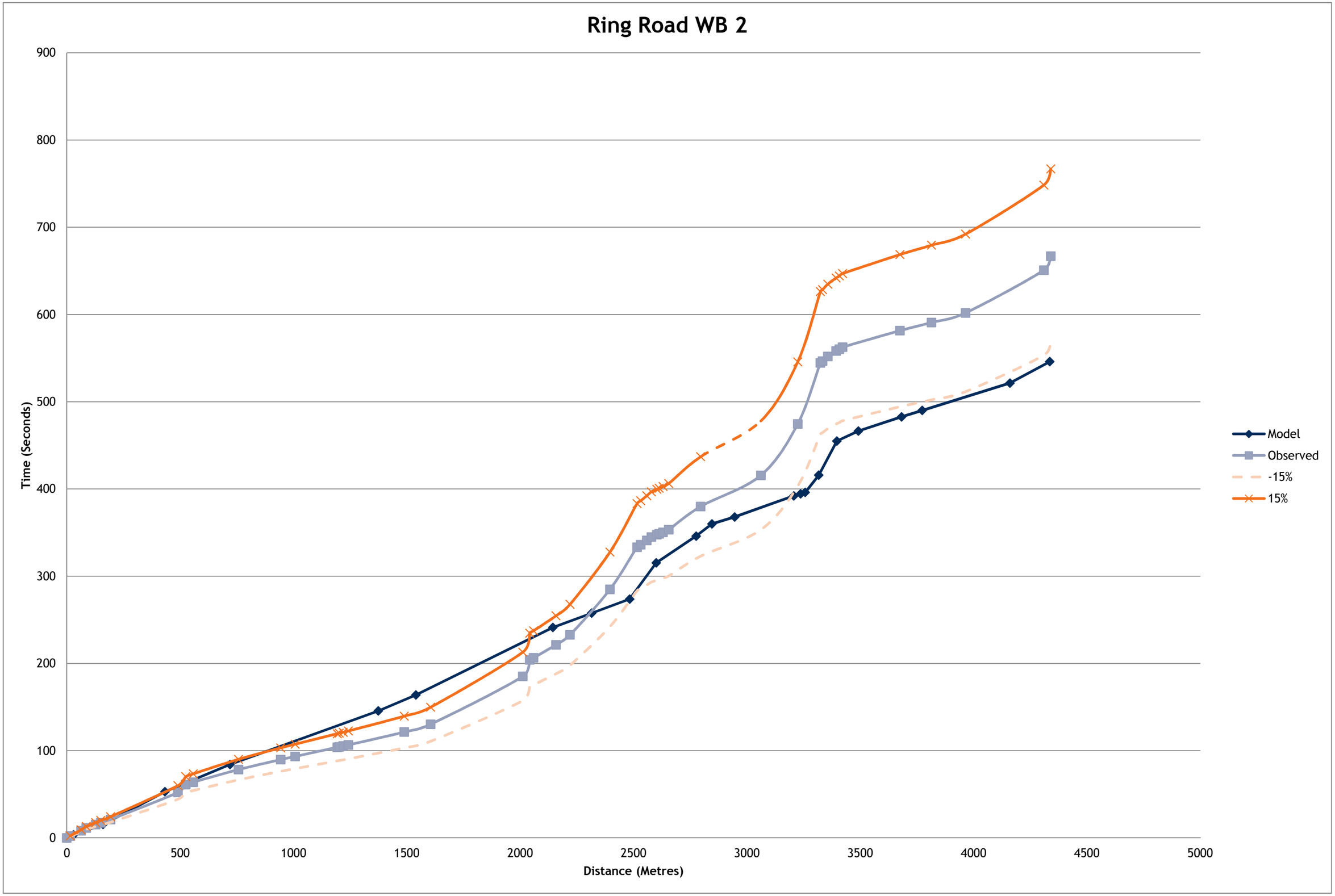
Ring Road SB 1



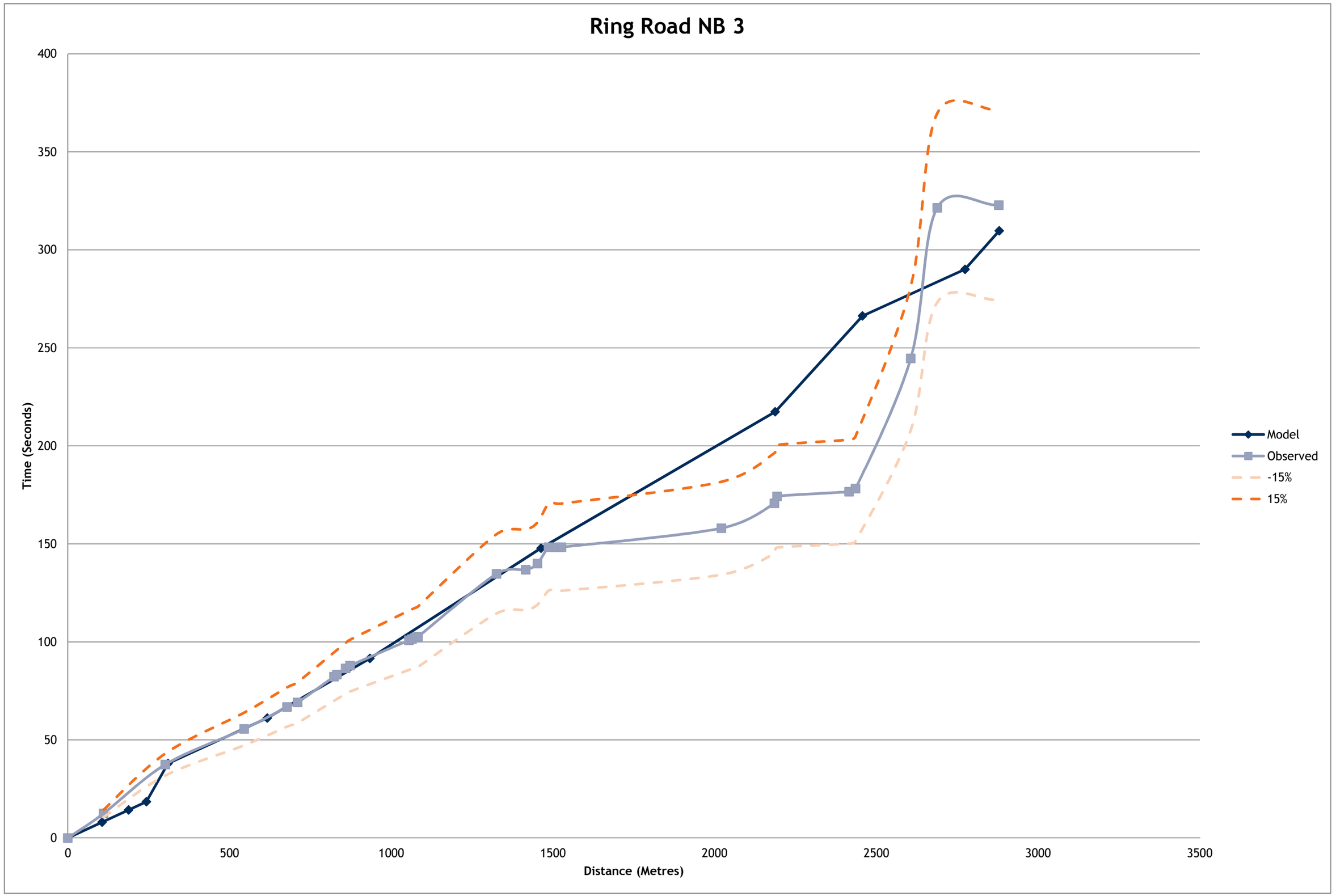
Ring Road EB 2

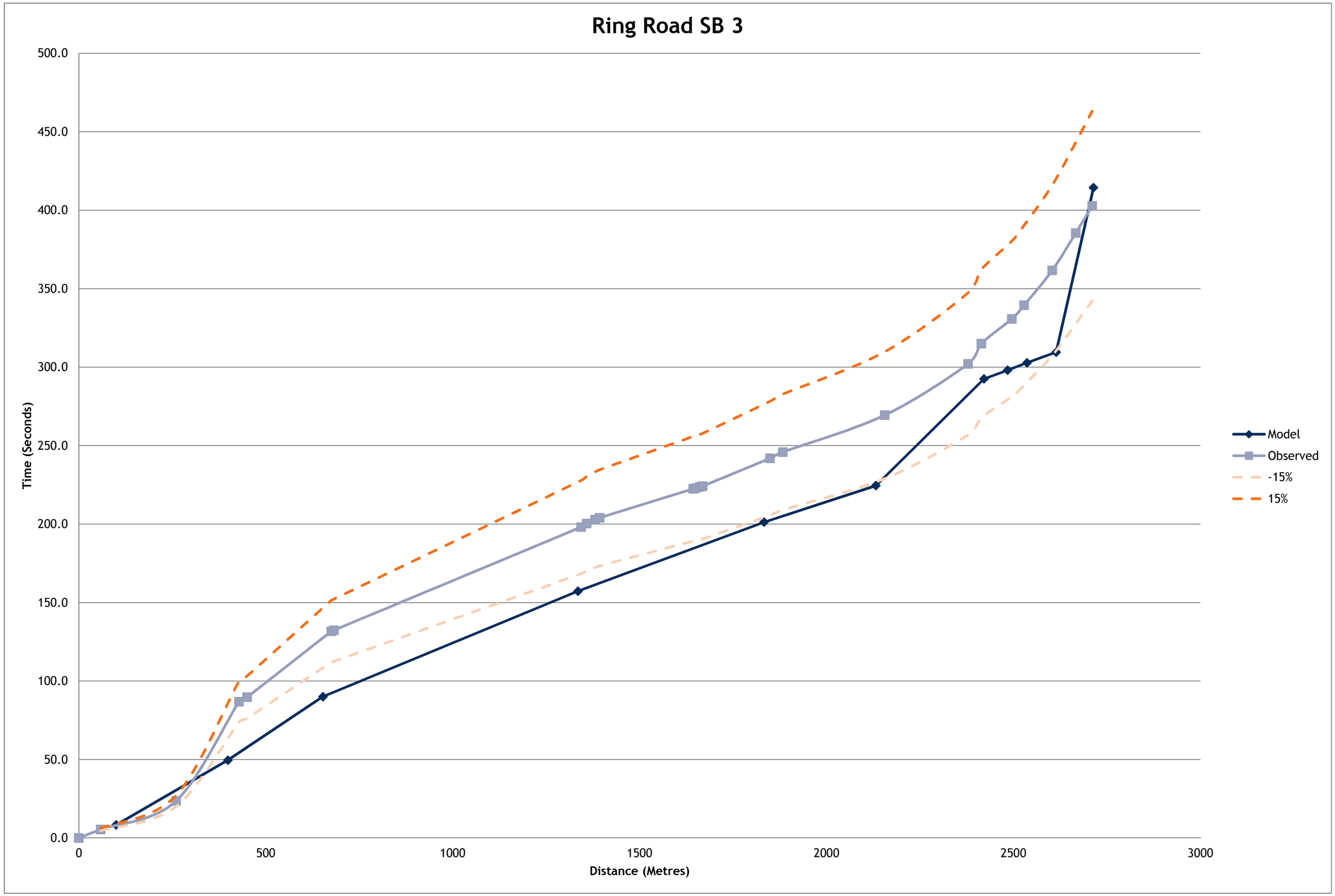


Ring Road WB 2

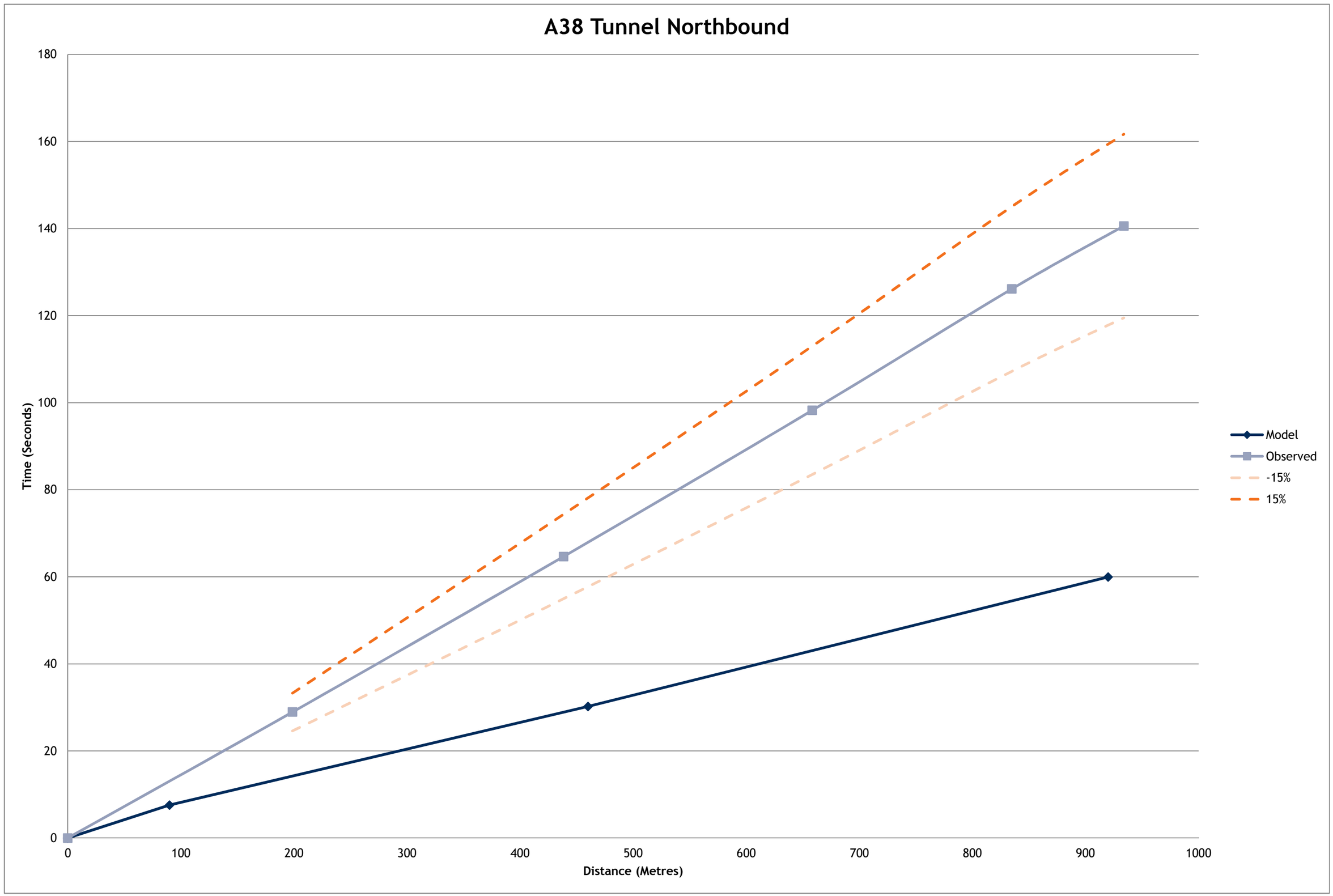


Ring Road NB 3

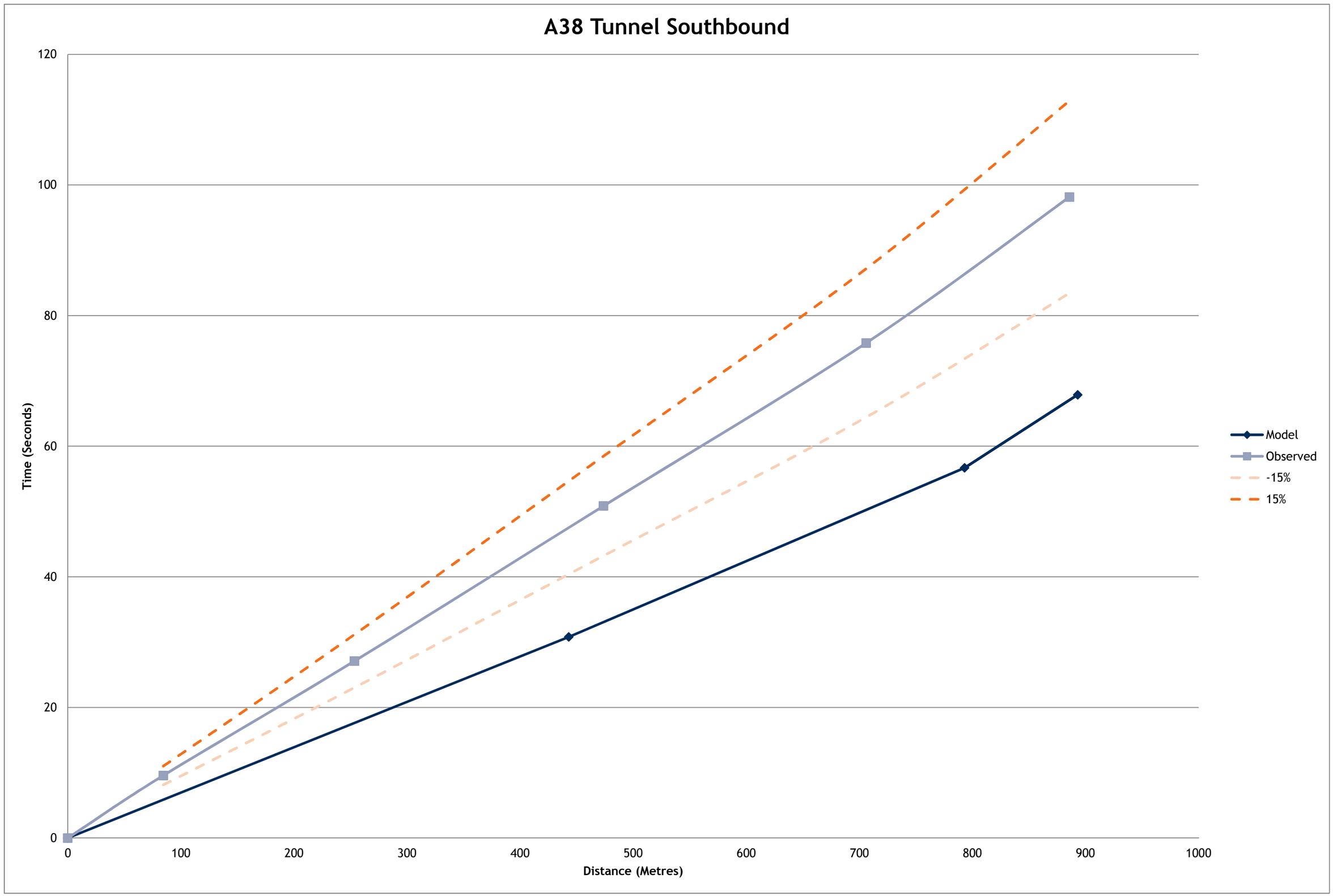



Ring Road SB 3
500.0
450.0
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Time (Seconds)
0
500
1000
1500
2000
2500
3000
Distance (Metres)
Model
Observed
-15%
15%

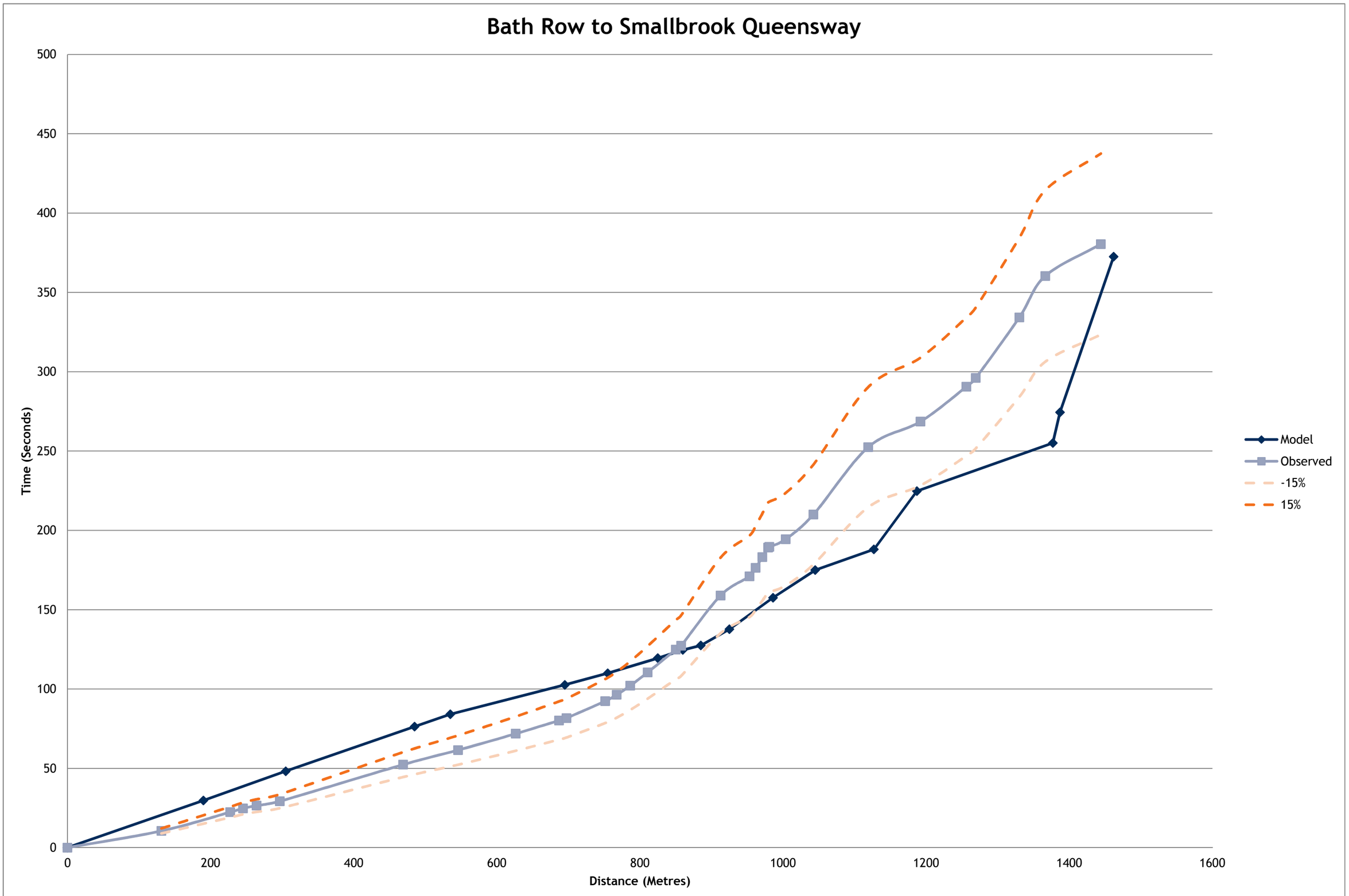
A38 Tunnel Northbound



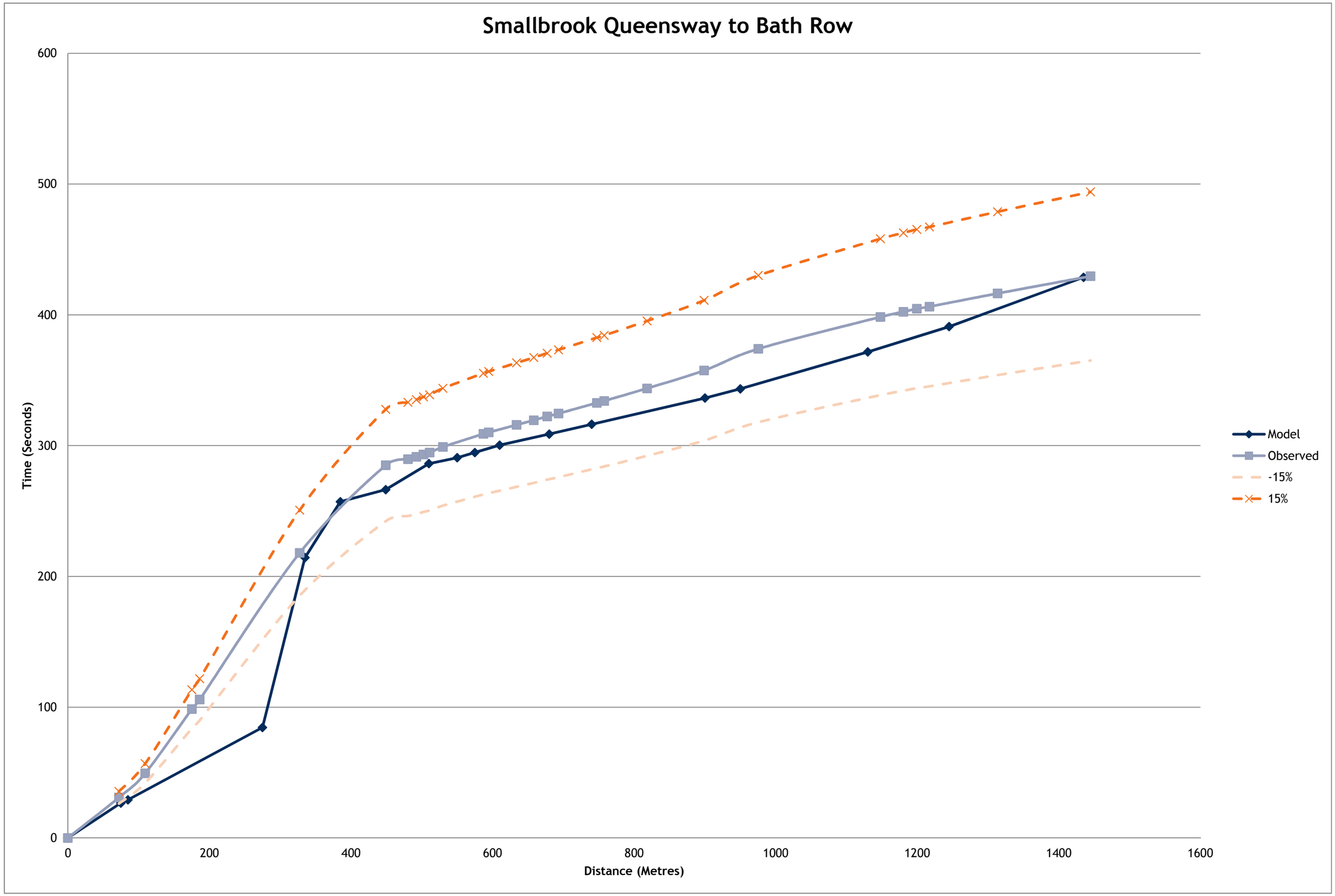
A38 Tunnel Southbound



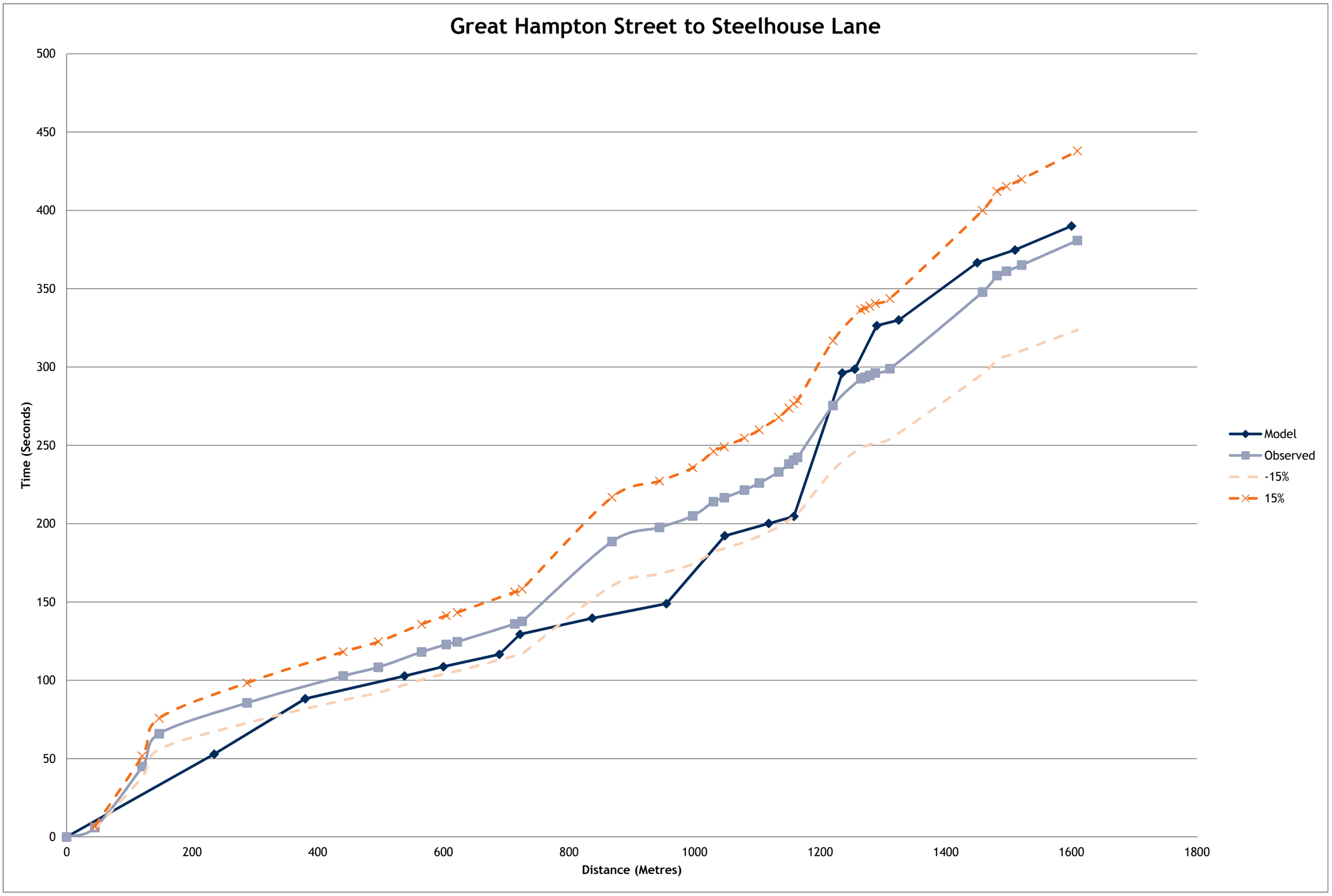
Bath Row to Smallbrook Queensway



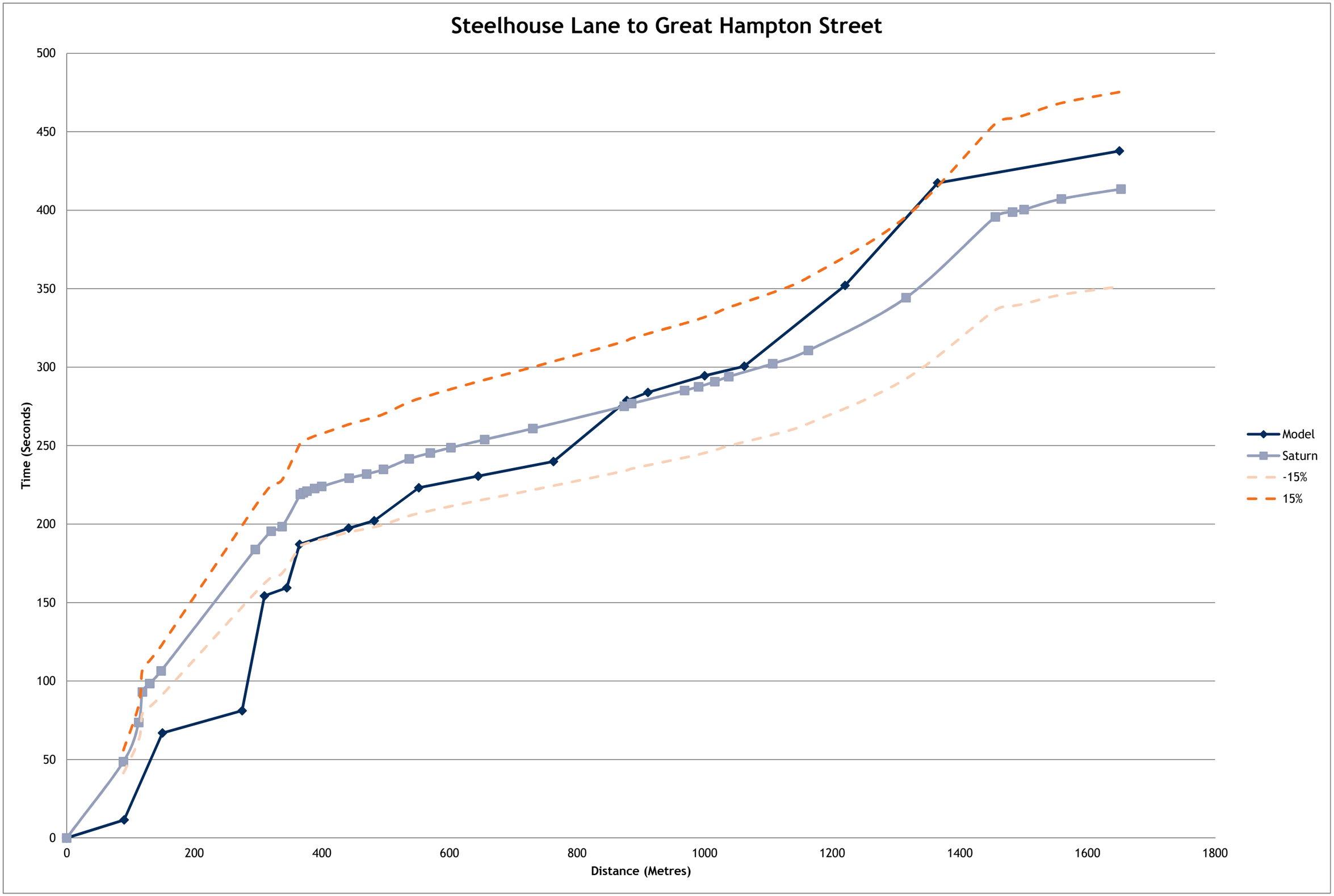
Smallbrook Queensway to Bath Row



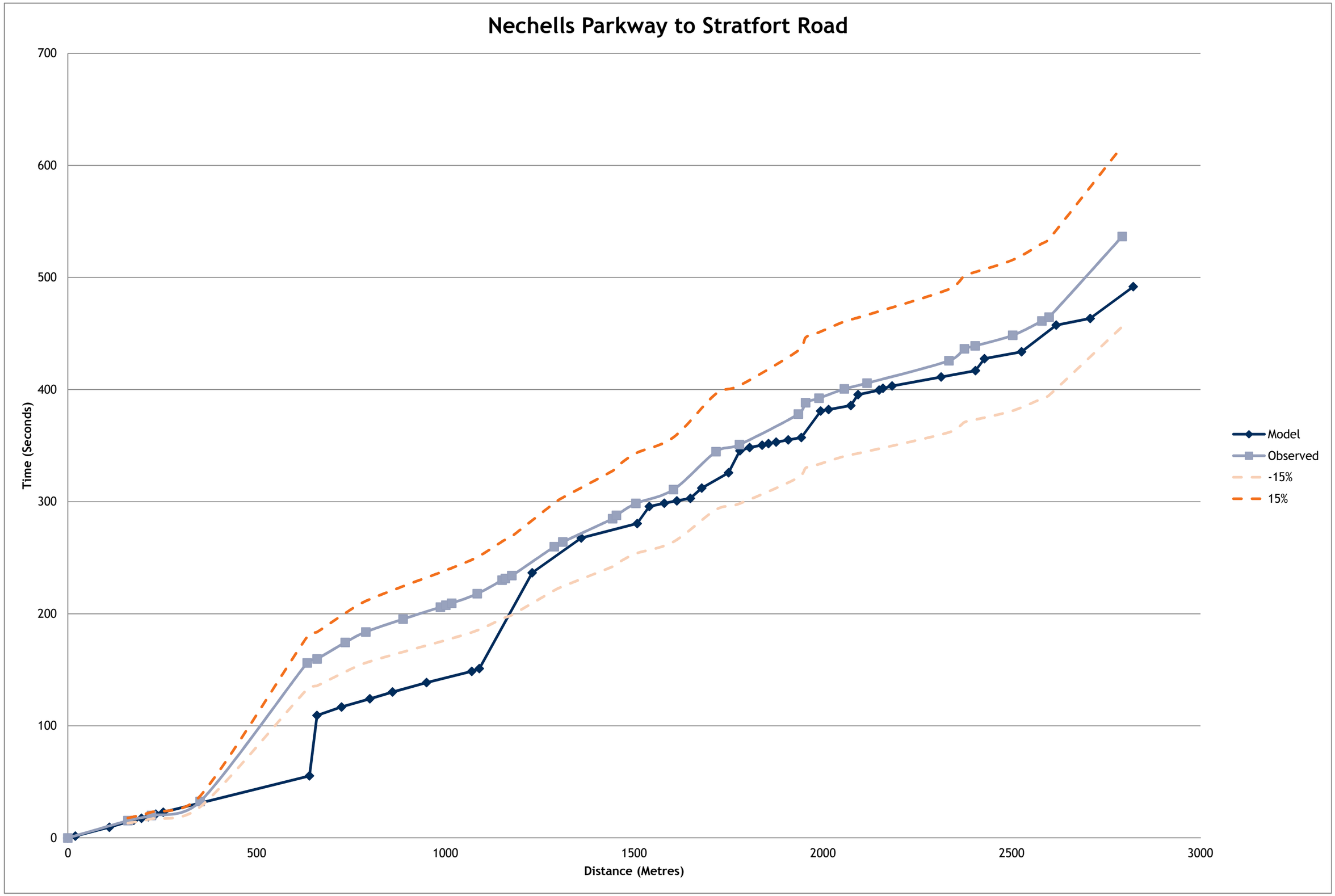
Great Hampton Street to Steelhouse Lane



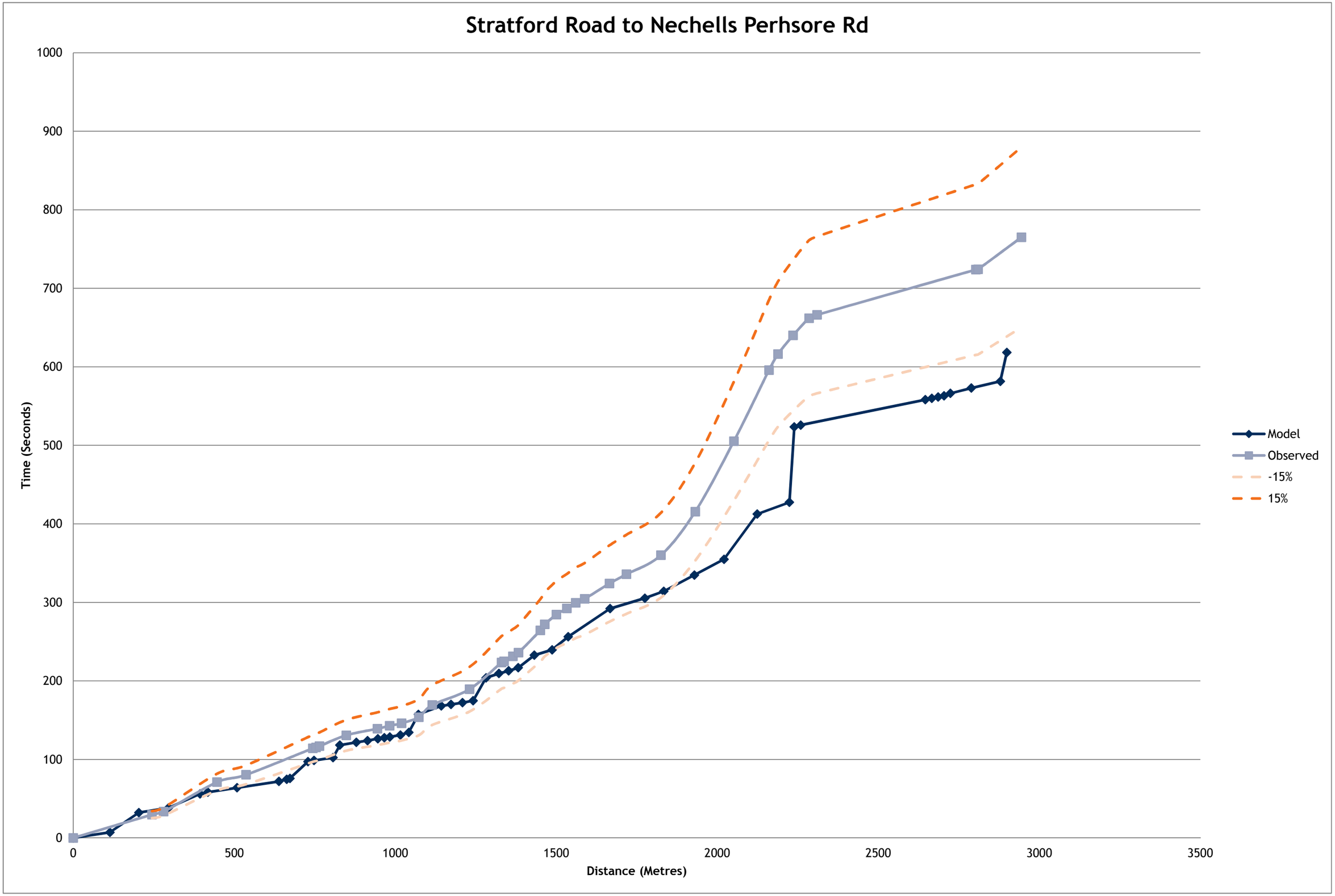
Steelhouse Lane to Great Hampton Street



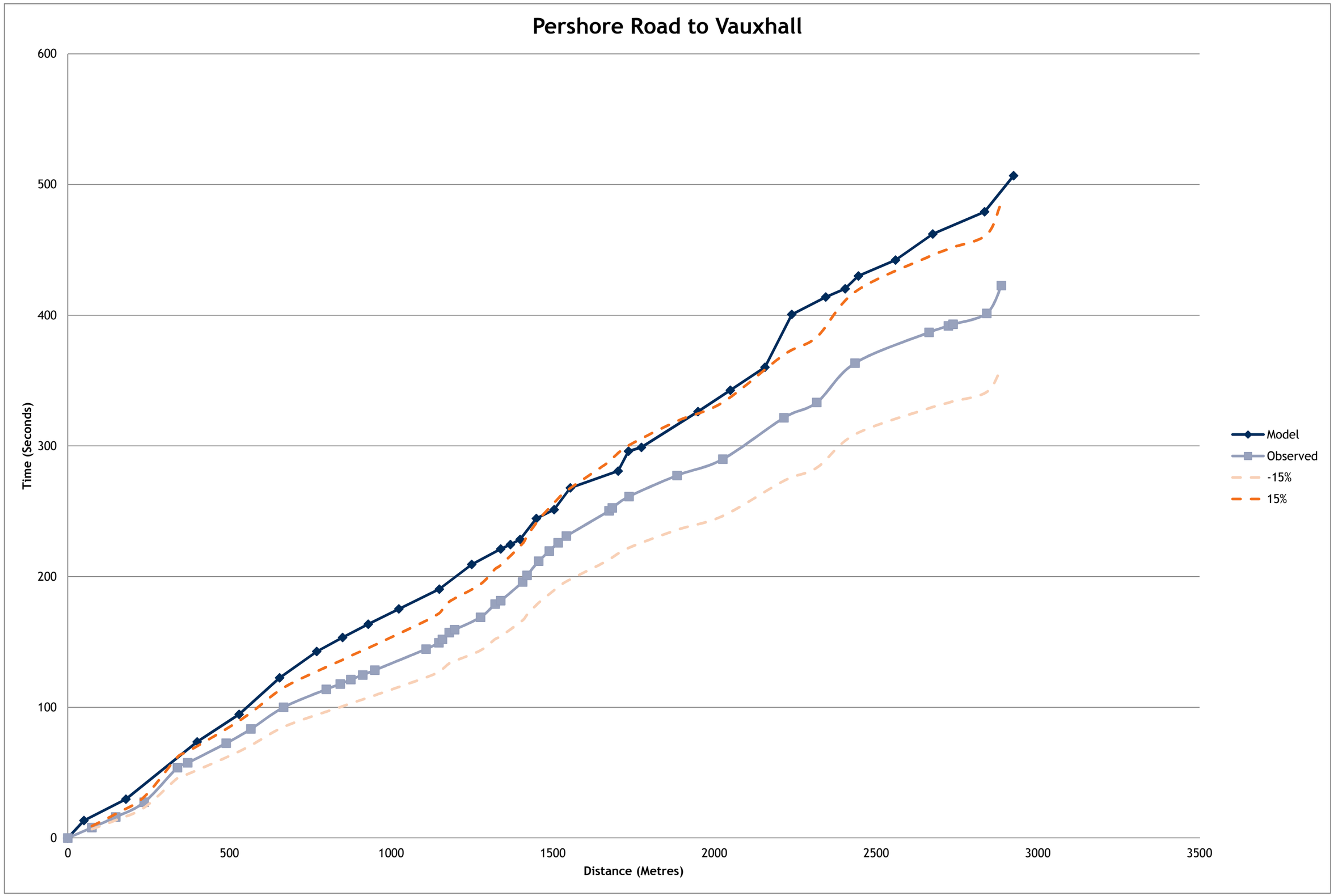
Nechells Parkway to Stratfort Road



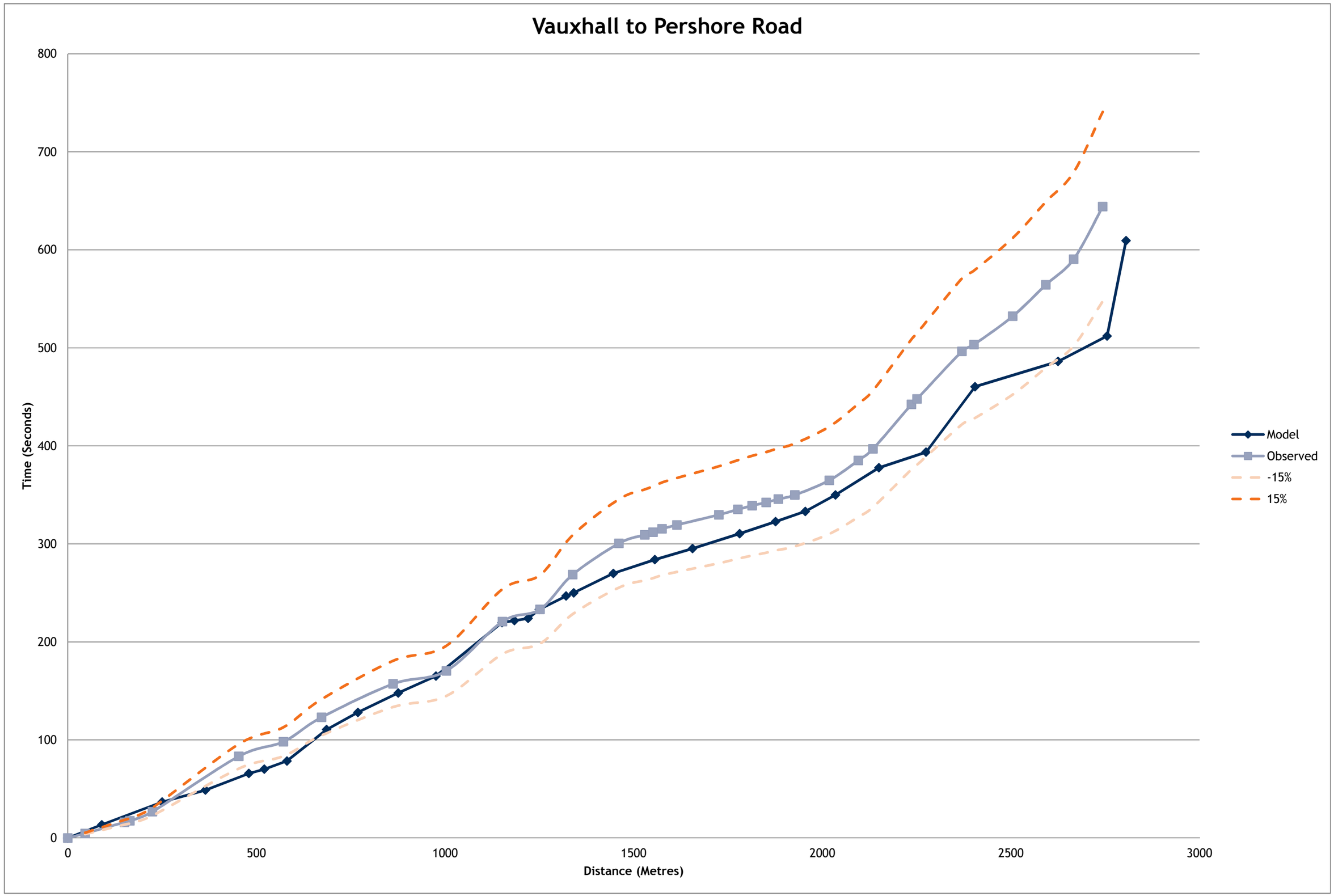
Stratford Road to Nechells Perhsore Rd



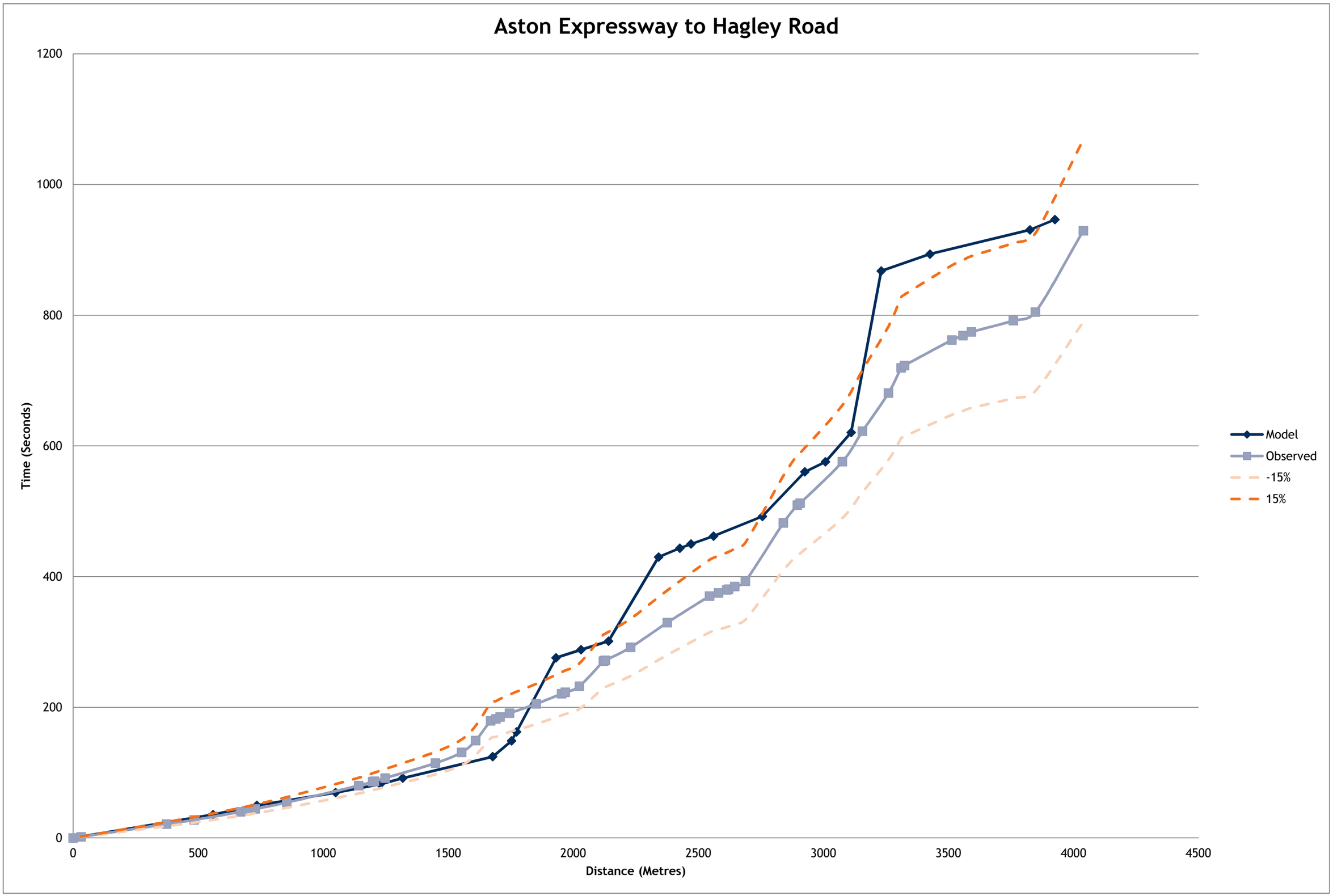
Pershore Road to Vauxhall



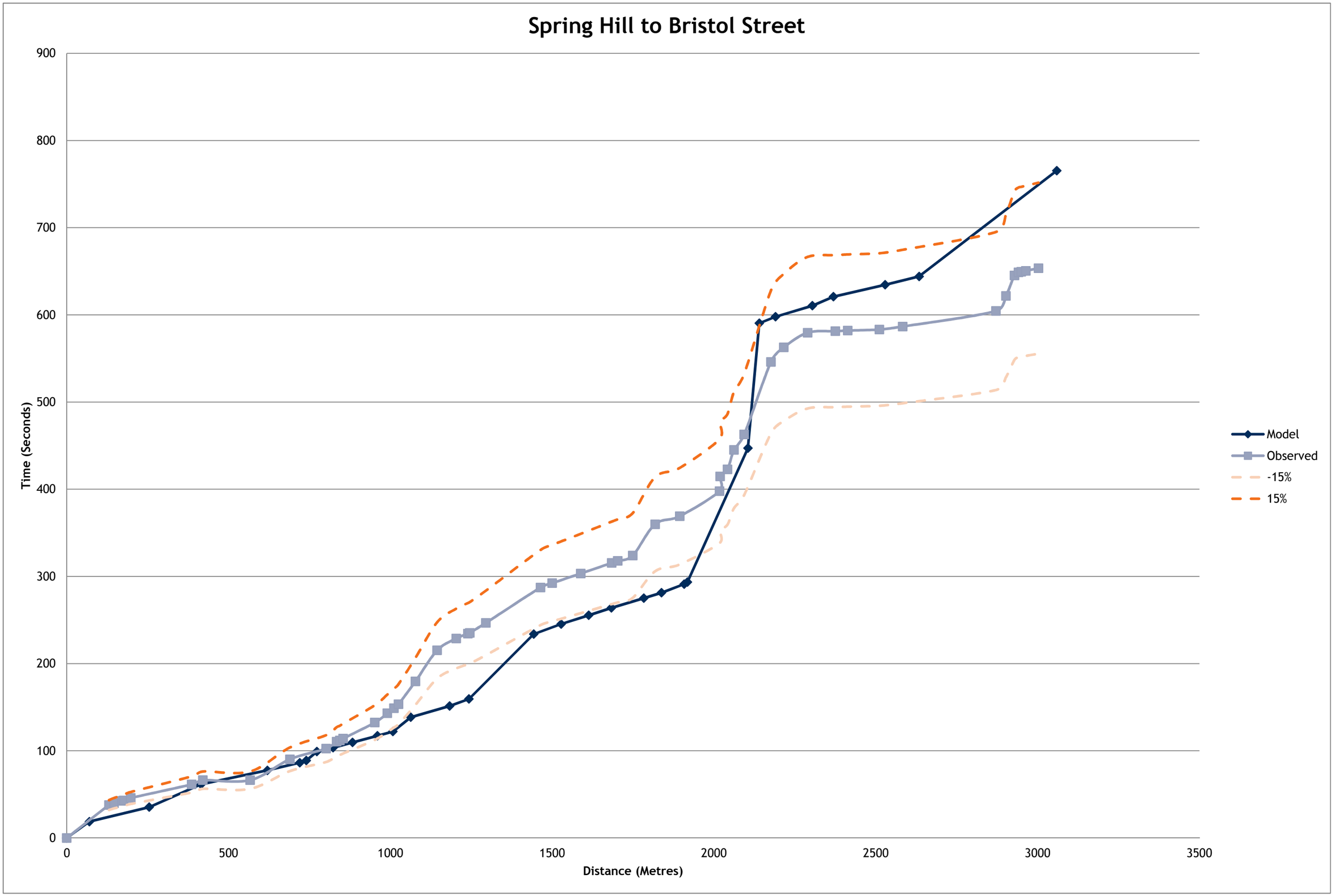
Vauxhall to Pershore Road



Aston Expressway to Hagley Road



Spring Hill to Bristol Street



D Assignment Parameters

Review of Assignment Parameters

Parameter	Old Value	Updated Value	Description
BB109	F	T	Updated Blocking Back
RTP108	F	T	Random Delays
AUTONA	F	T	Calculates optimum NITA
AUTNUC	F	T	NUC set automatically for junctions
MONACO	F	T	Blocked Queue Assumption
NITA	30	20	Max Assignments
NITA_S	30	256	Max post-conversion assignment
KONSTP	0	1	Stopping Gap and Istop
NITS	10	50	Max number of sim iterations
LRTP	0	60	Length of random time delay
NIPS	0	2	Maximum number of signal loops
NOTUK	0	1	Non UK rules
KPHMIN	1	10	Minimum speed
MASL_M	0	25	Minimum assignemt - simualtion loops
NITA_M	3	6	The minimum number of assignment iterations
AFTERS	0.5	1	Delays in later periods factor
STPGAP	1	0.1	% stopping Gap
XFSTOP	0.05	0.015	Wardrop assignment stopping parameter for minimum step length
FISTOP	0.05	0.015	Wardrop assignment stopping parameter monitoring the fractional improvements in the objective function
GAPR	0.9	1.5	Gap Roundabout
PCNEAR	2	1	% change on links
RSTOP	94.5	98	number of links meet PCnear %
UNCRTS	0.2	0.015	Wardrop assignment stopping parameter

CONTROL INFORMATION

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SDG project/proposal number	Client contract/project number
22693502	

Author/originator	Reviewer/approver
Caulfield, Tom	Kohli, Serbjeet

Other contributors	Distribution			
Patel, Rishi	*Client:*	Stuart Law, Tom Willets	*SDG*:	Beatriz Roldao, Chris Whitehouse

Version control/issue number	Date
Final	05/01/2015

Appendix F. Observed and Future Year Traffic Flows

F.1 Key

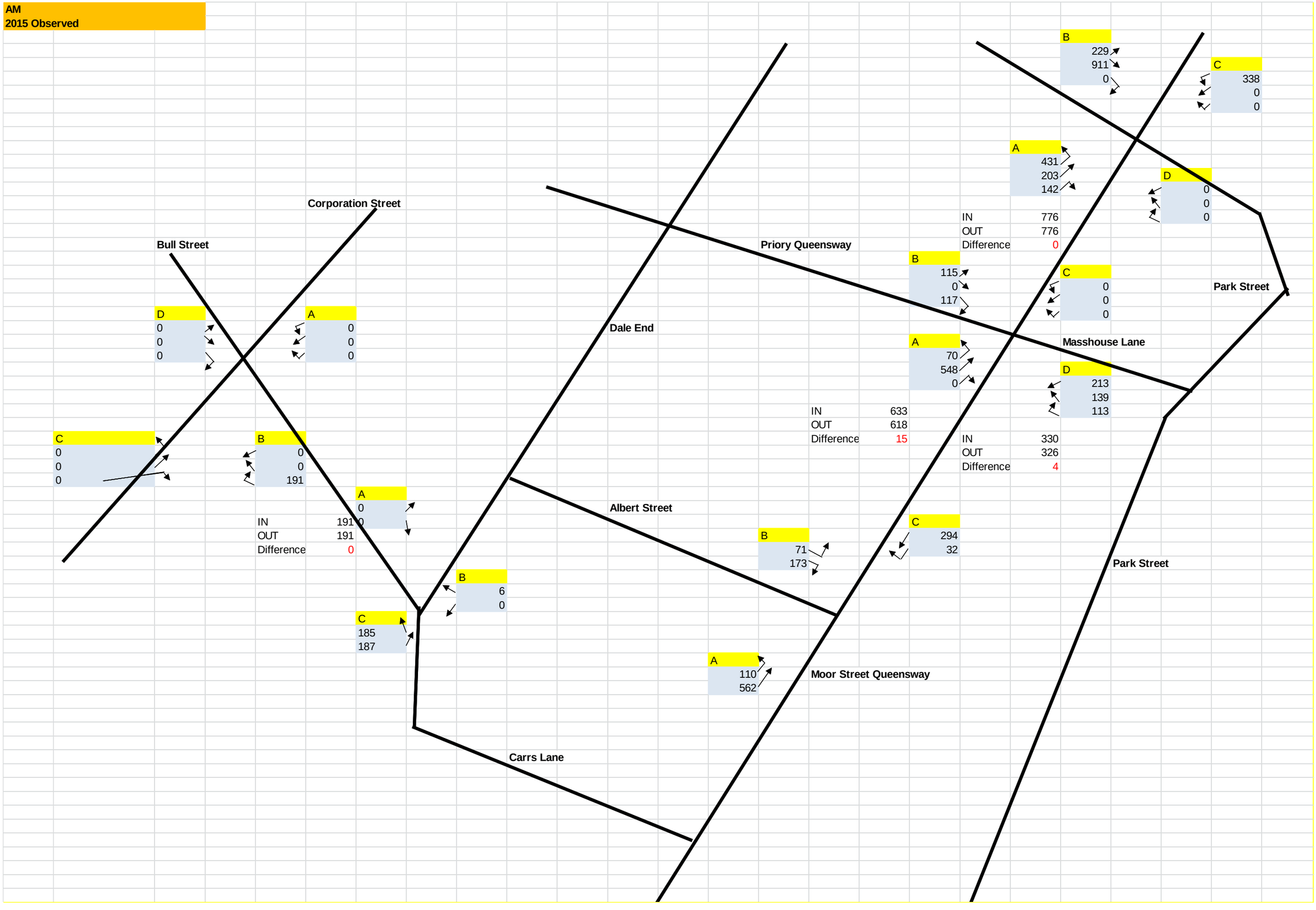
Key (1)	
Road	
Junction	
Junction Arm	A
Traffic Flow (PCU's)	123
Movement of Traffic	→

Key (2)	
Road	
Junction Arm	A
Traffic Flow (PCU's)	25
Movement of Traffic	→
Difference Between Junctions	0
Traffic in to Junction	156
Traffic out of Junction	156

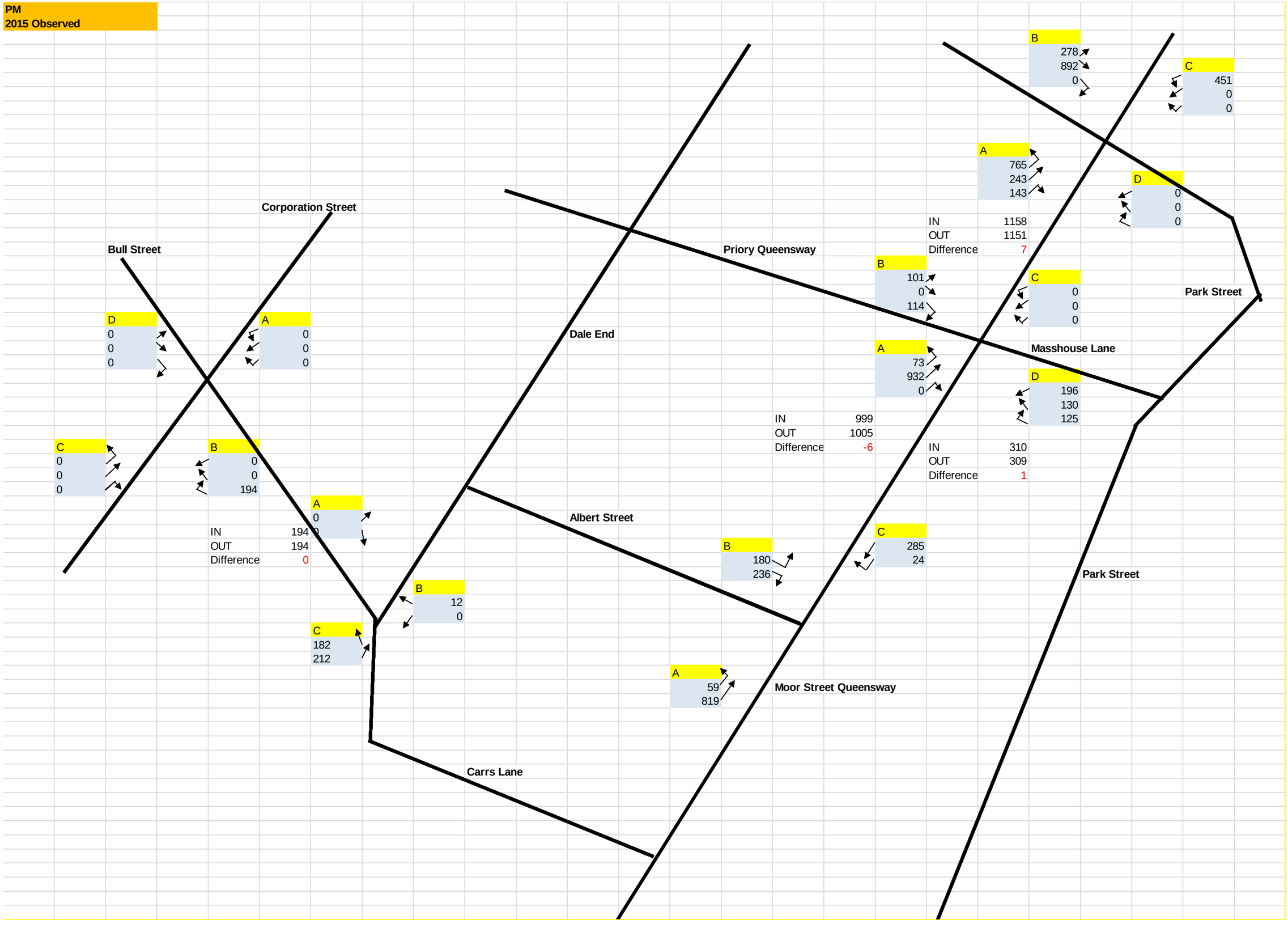
F.2 2015 Observed Traffic Flows

F.2.1 Section 1 – Moor Street Queensway (including off-line junctions 1 and 2)

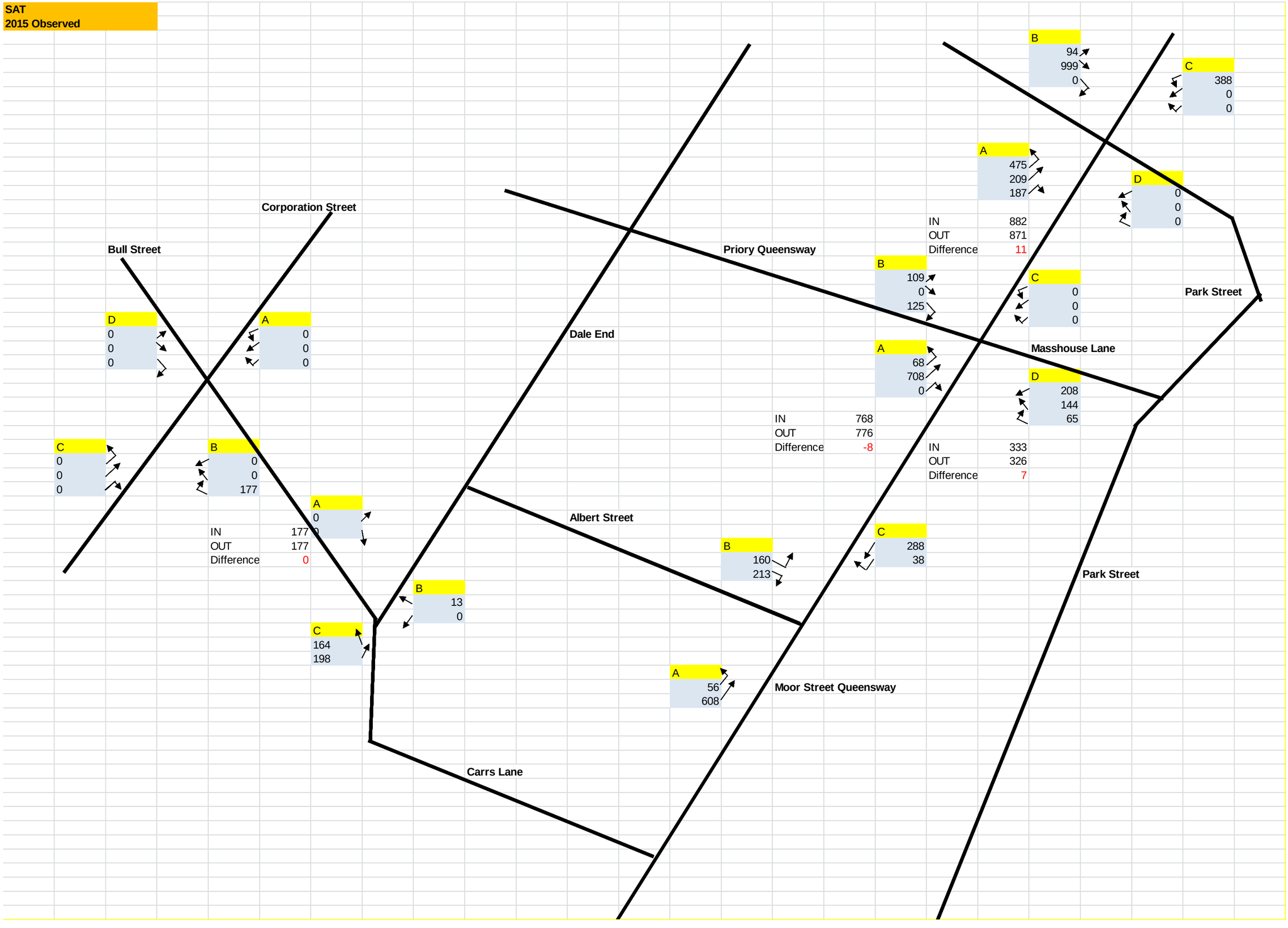
AM
2015 Observed



PM
2015 Observed

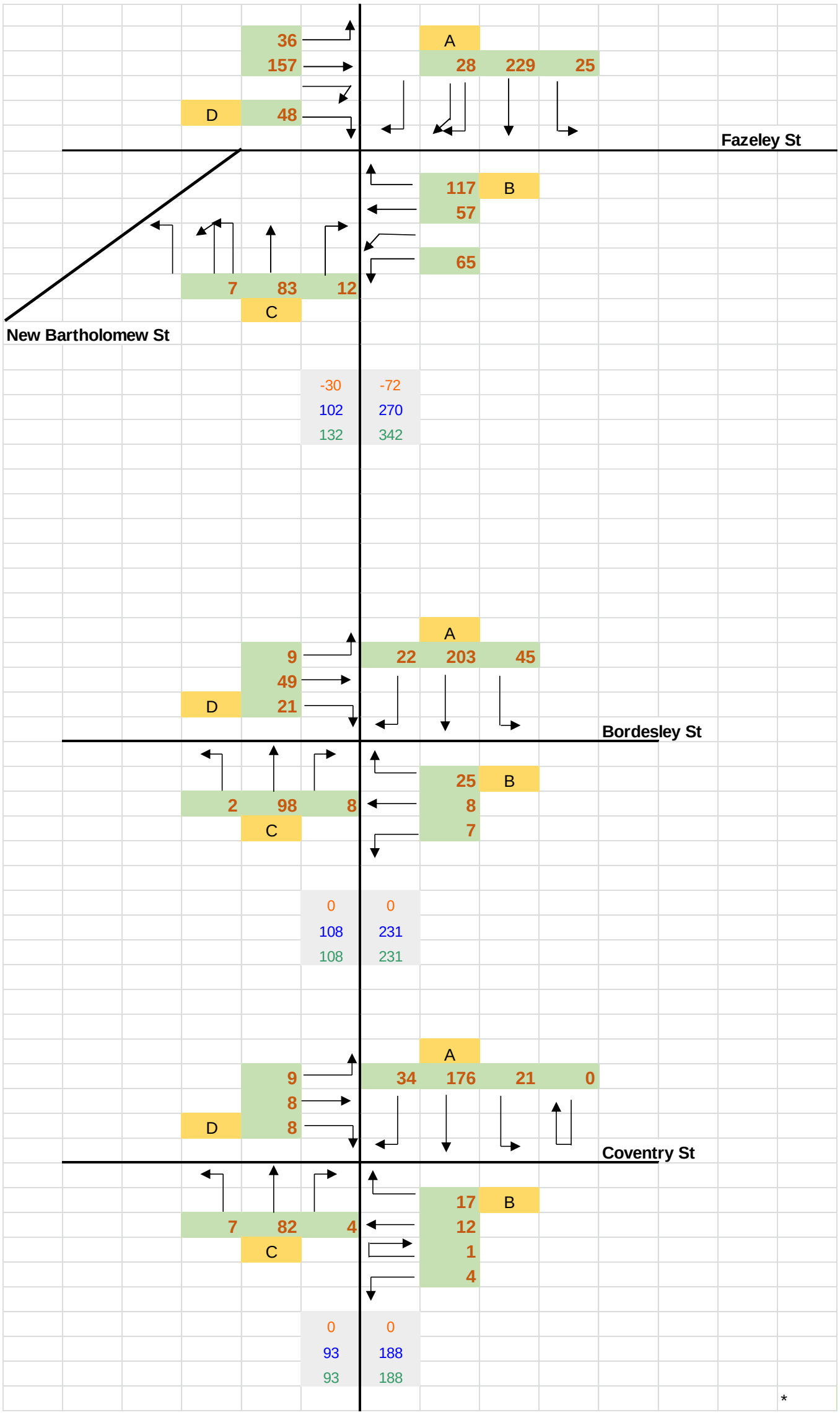


SAT
2015 Observed

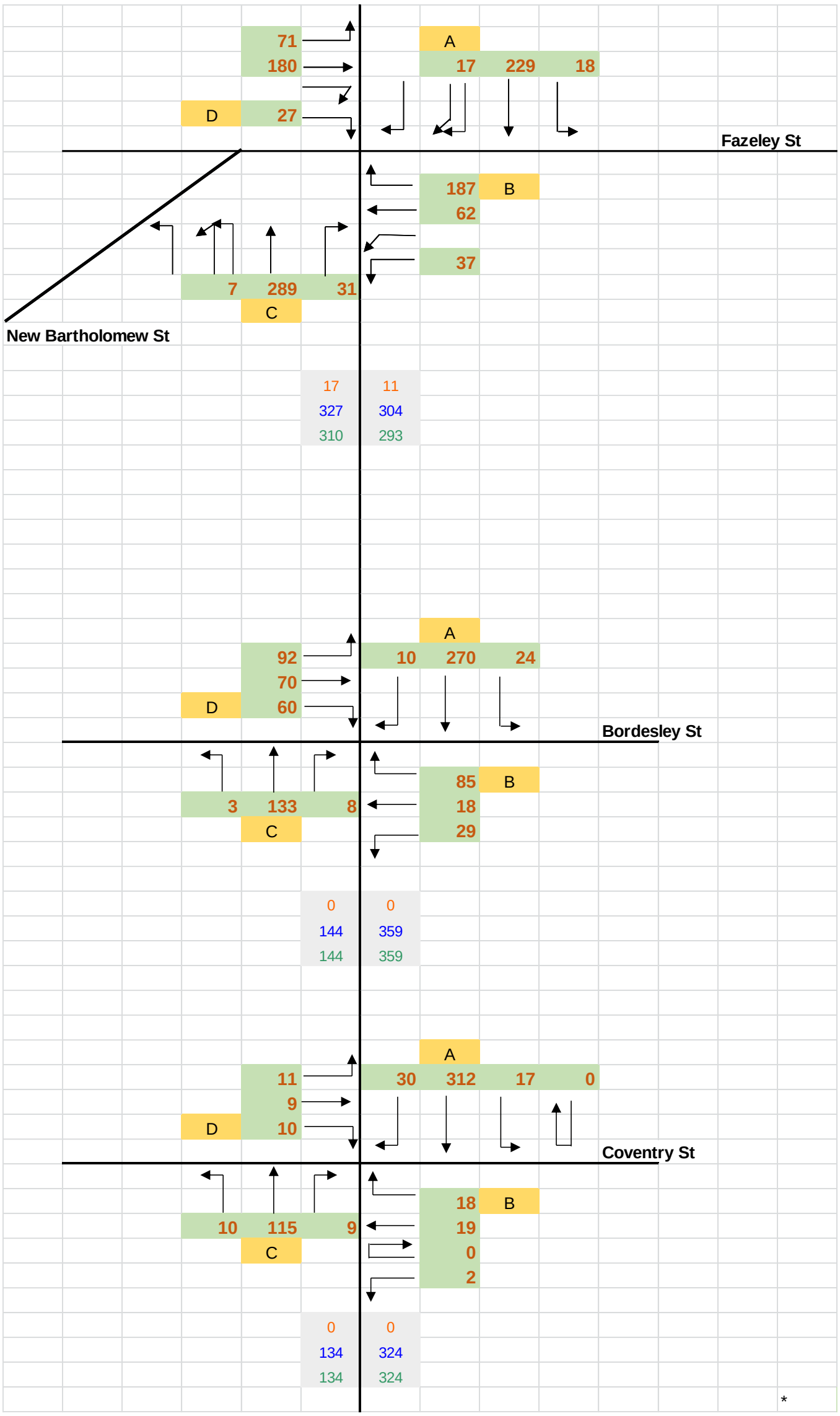


F.2.2 Section 2 – New Canal Street and Meriden Street

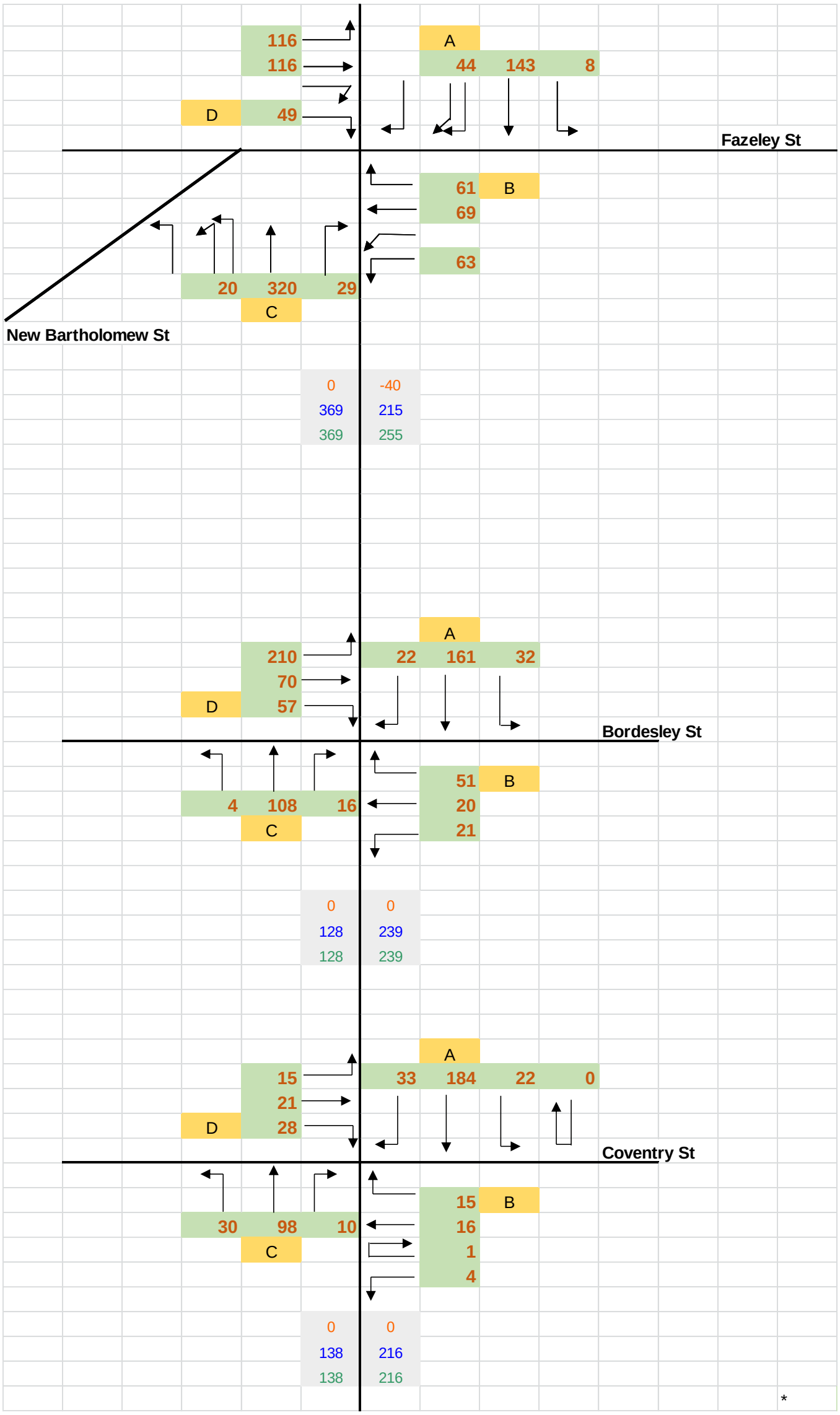
AM 2015


36
157
A
28
229
25
D
48
Fazeley St
117
B
57
65
7
83
12
C
New Bartholomew St
-30
-72
102
270
132
342
A
9
22
203
45
49
D
21
Bordesley St
25
B
2
98
8
8
C
7
0
0
108
231
108
231
A
9
34
176
21
0
8
D
8
Coventry St
17
B
7
82
4
12
C
1
4
0
0
93
188
93
188
*

PM 2015

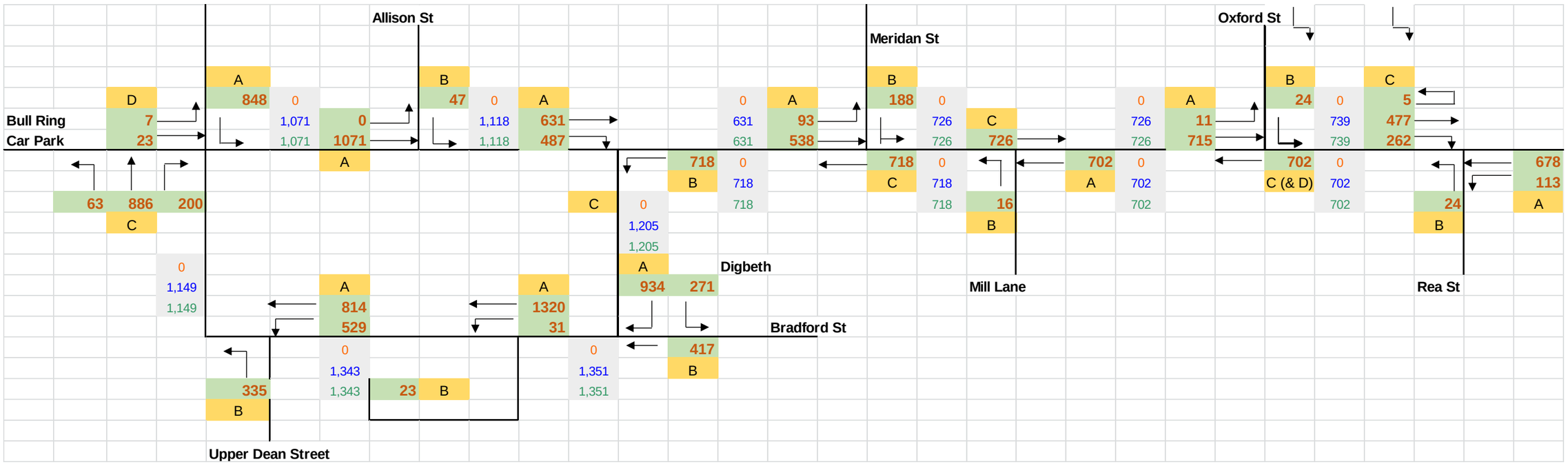

71
180
A
17
229
18
D
27
Fazeley St
187
B
62
37
7
289
31
C
New Bartholomew St
17
11
327
304
310
293
A
92
10
270
24
70
D
60
Bordesley St
85
B
3
133
8
18
C
29
0
0
144
359
144
359
A
11
30
312
17
0
9
D
10
Coventry St
18
B
10
115
9
19
C
0
2
0
0
134
324
134
324
*

SAT 2015

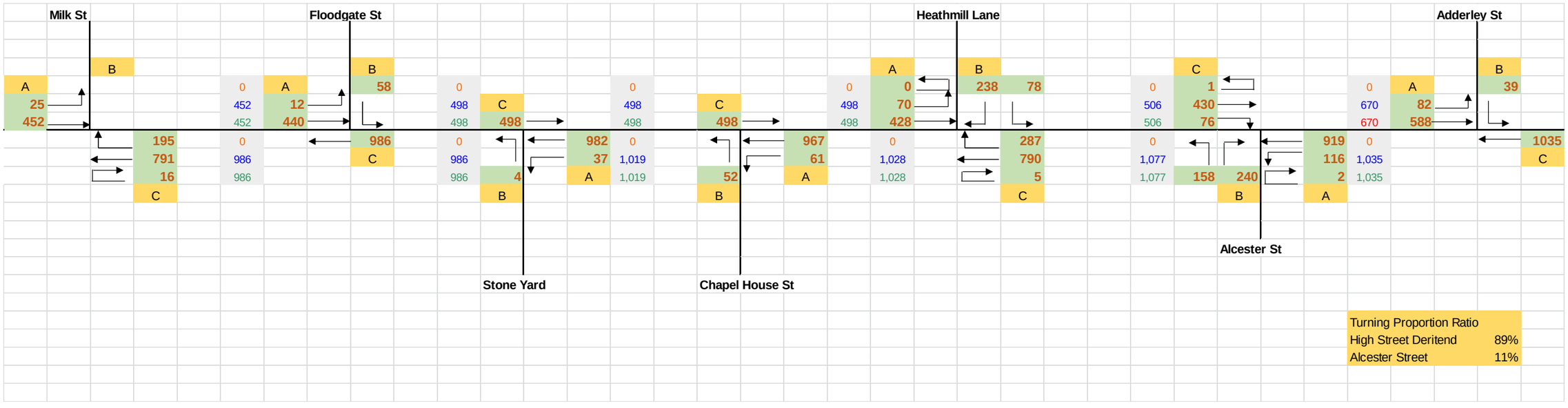

116
116
A
44
143
8
D
49
Fazeley St
61
B
69
63
20
320
29
C
New Bartholomew St
0
-40
369
215
369
255
A
210
22
161
32
70
D
57
Bordesley St
51
B
4
108
16
20
C
21
0
0
128
239
128
239
A
15
33
184
22
0
21
D
28
Coventry St
15
B
30
98
10
16
C
1
4
0
0
138
216
138
216
*

F.2.3 Section 3 – Moat Lane Gyratory, Digbeth (B4100) and High Street Deritend

AM 2015 (Moat Lane Gyratory and Digbeth)

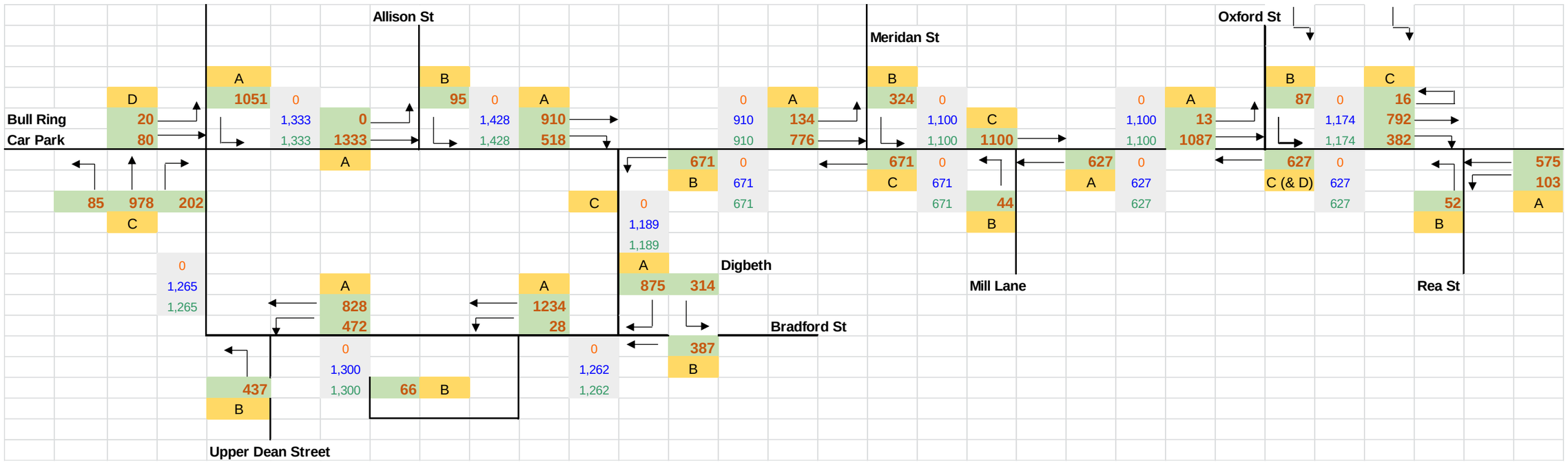


AM 2015 (High Street Deritend)

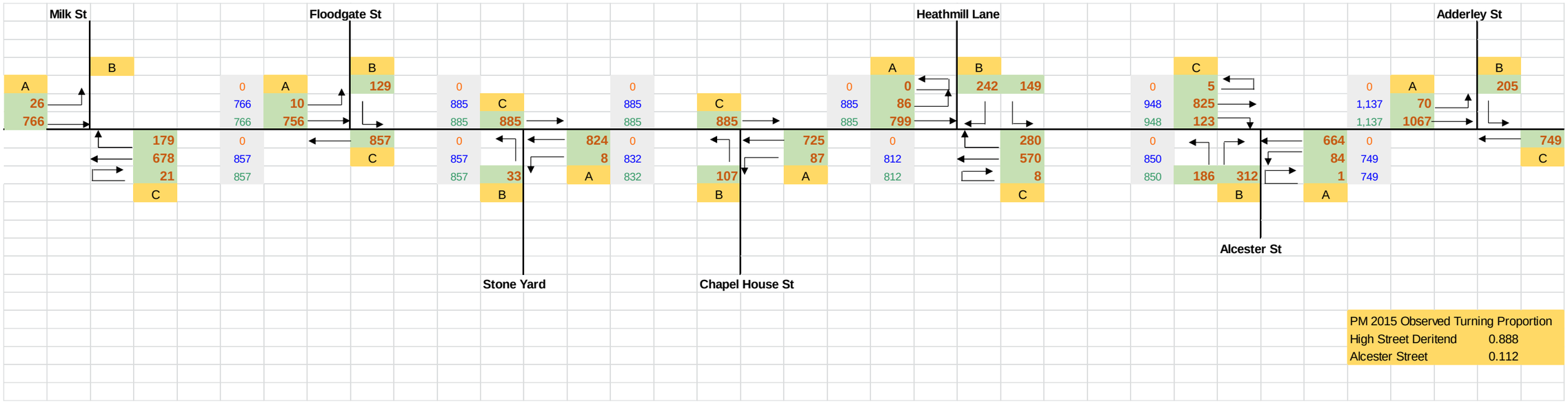


Turning Proportion Ratio	
High Street Deritend	89%
Alcester Street	11%

PM 2015 (Moat Lane Gyratory and Digbeth)

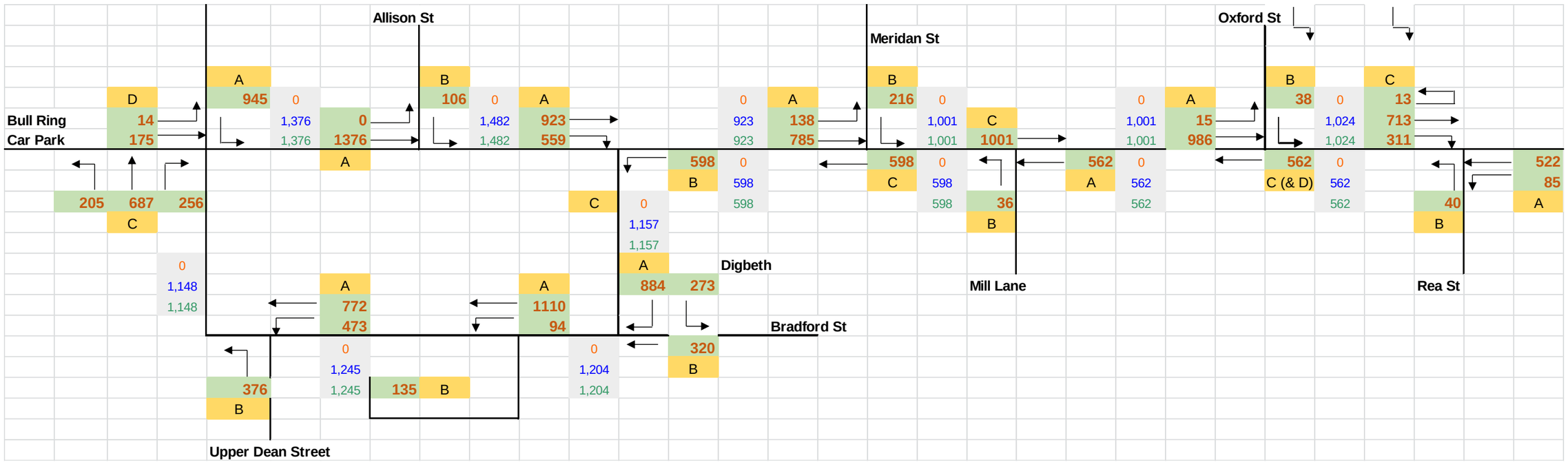


PM 2015 (High Street Deritend)

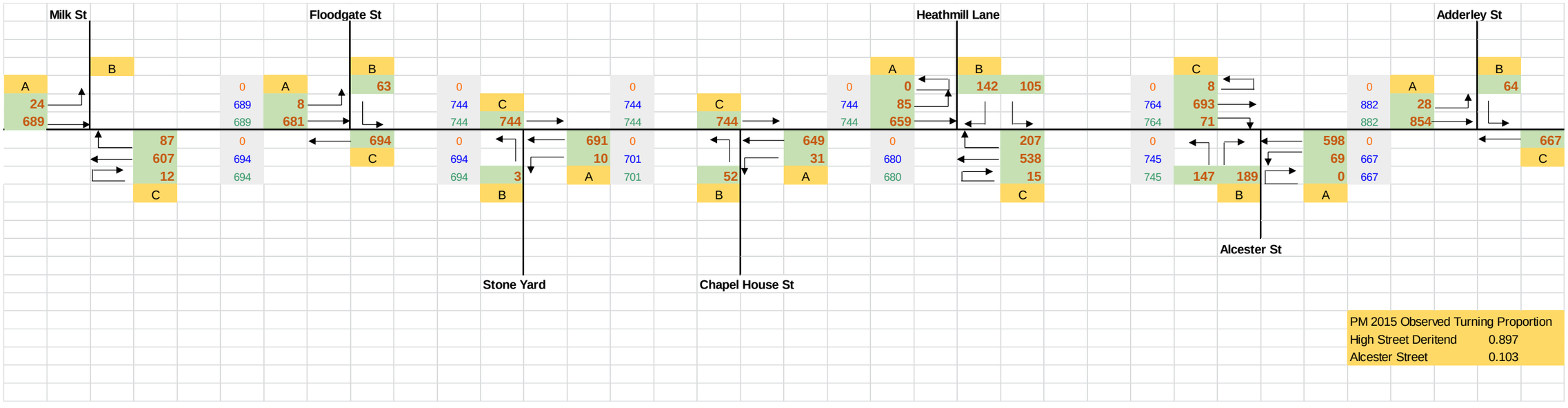


PM 2015 Observed Turning Proportion	
High Street Deritend	0.888
Alcester Street	0.112

SAT 2015 (Moat Lane Gyratory and Digbeth)



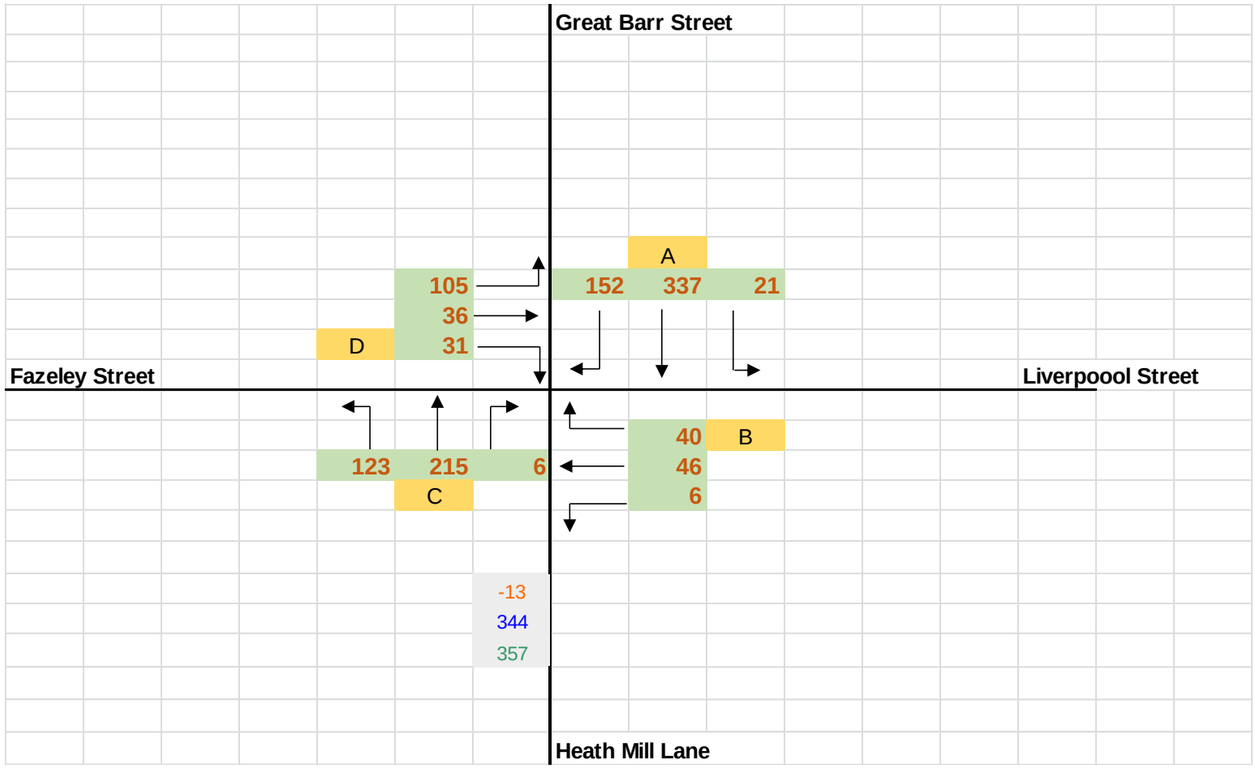
SAT 2015 (High Street Deritend)



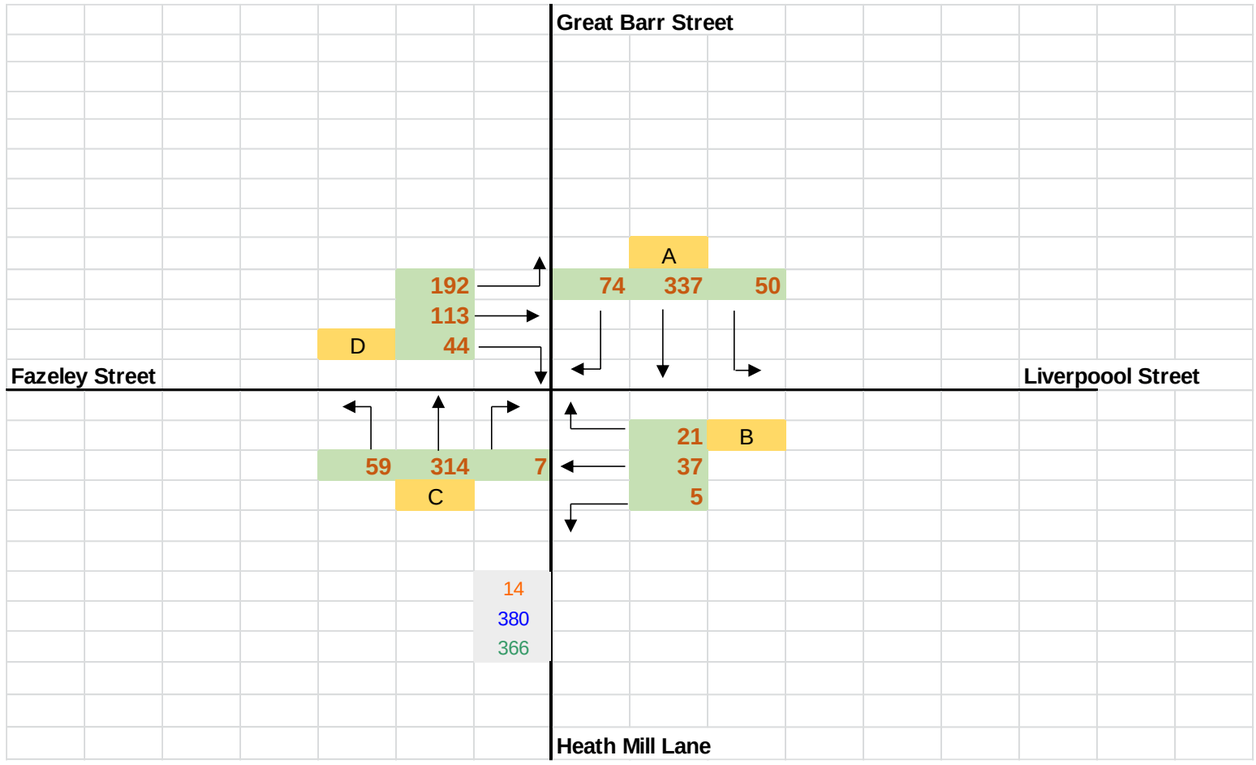
PM 2015 Observed Turning Proportion	
High Street Deritend	0.897
Alcester Street	0.103

F.2.4 Off-line Junction 4 – Heath Mill Lane / Liverpool Street

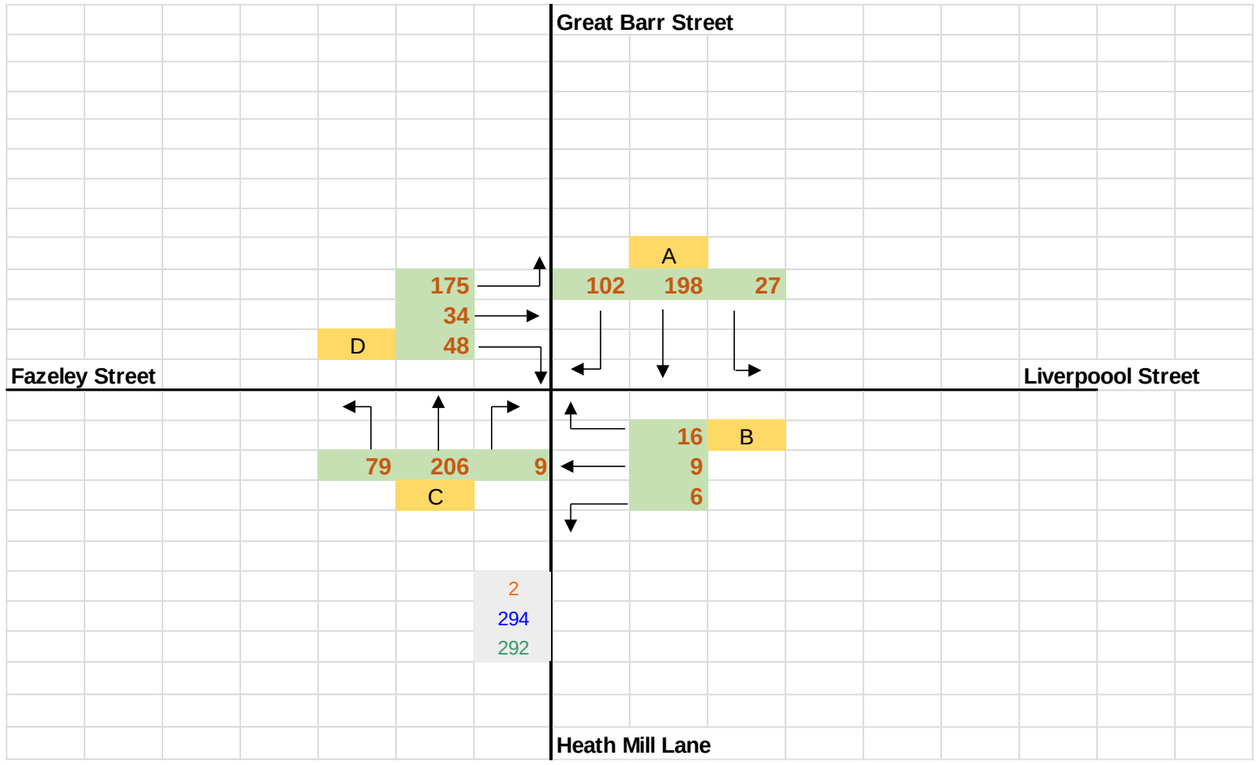
AM 2015 (Heath Mill Lane / Liverpool Street)



PM 2015 (Heath Mill Lane / Liverpool Street)



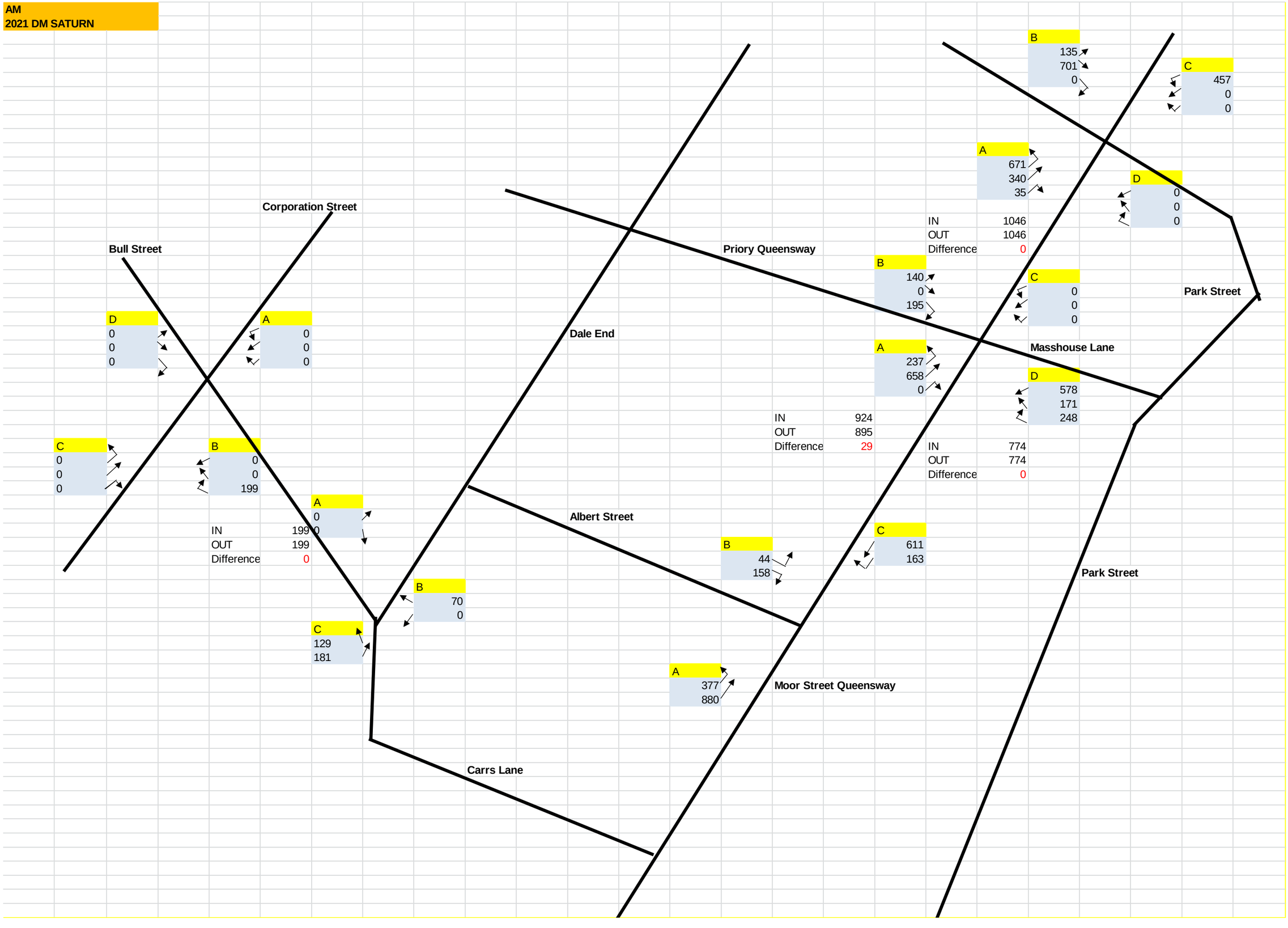
SAT 2015 (Heath Mill Lane / Liverpool Street)



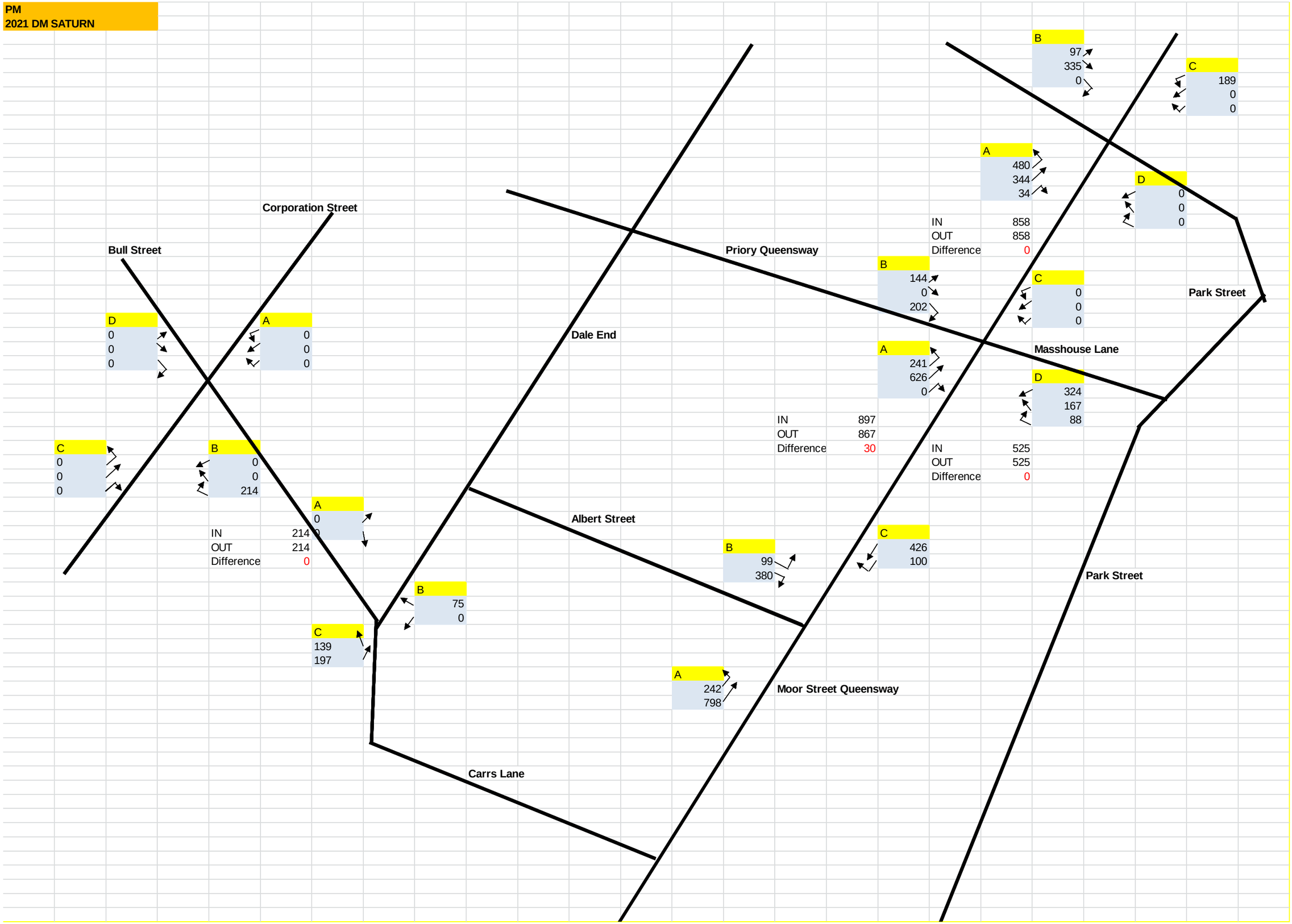
F.3 Do Minimum Future Year Traffic Flows

F.3.1 Section 1 – Moor Street Queensway (including off-line junctions 1 and 2)

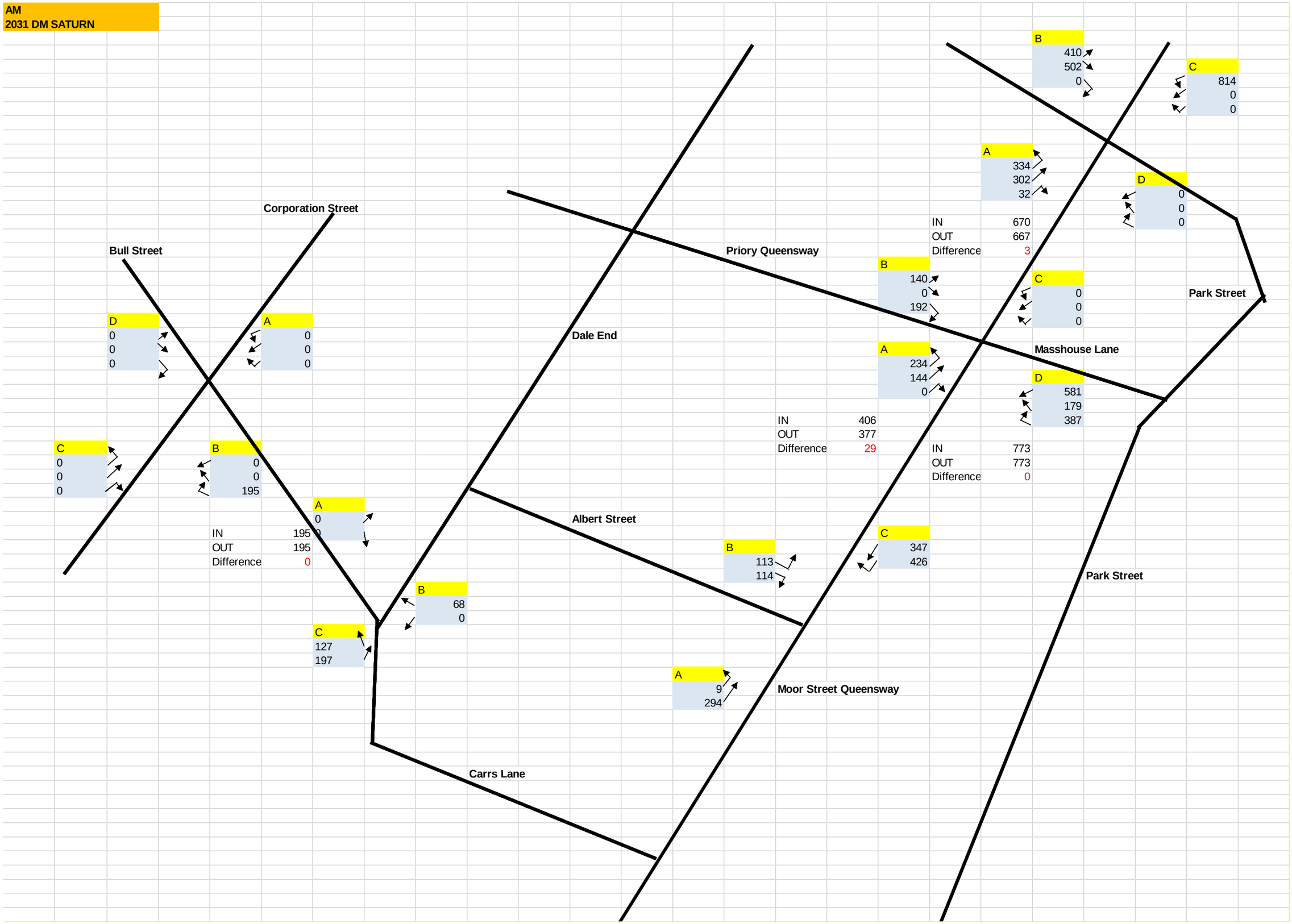
AM
2021 DM SATURN



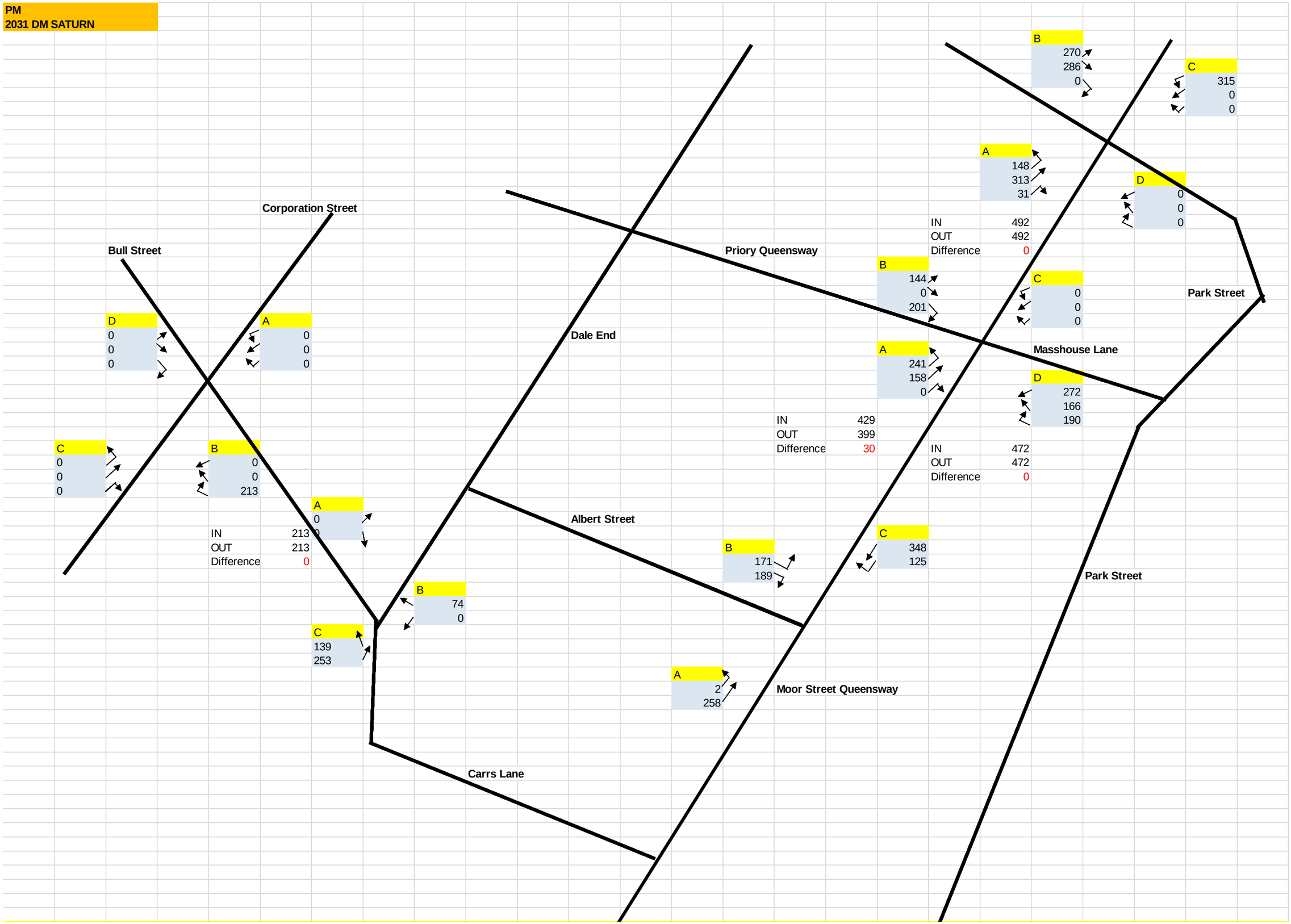
PM
2021 DM SATURN



AM
2031 DM SATURN

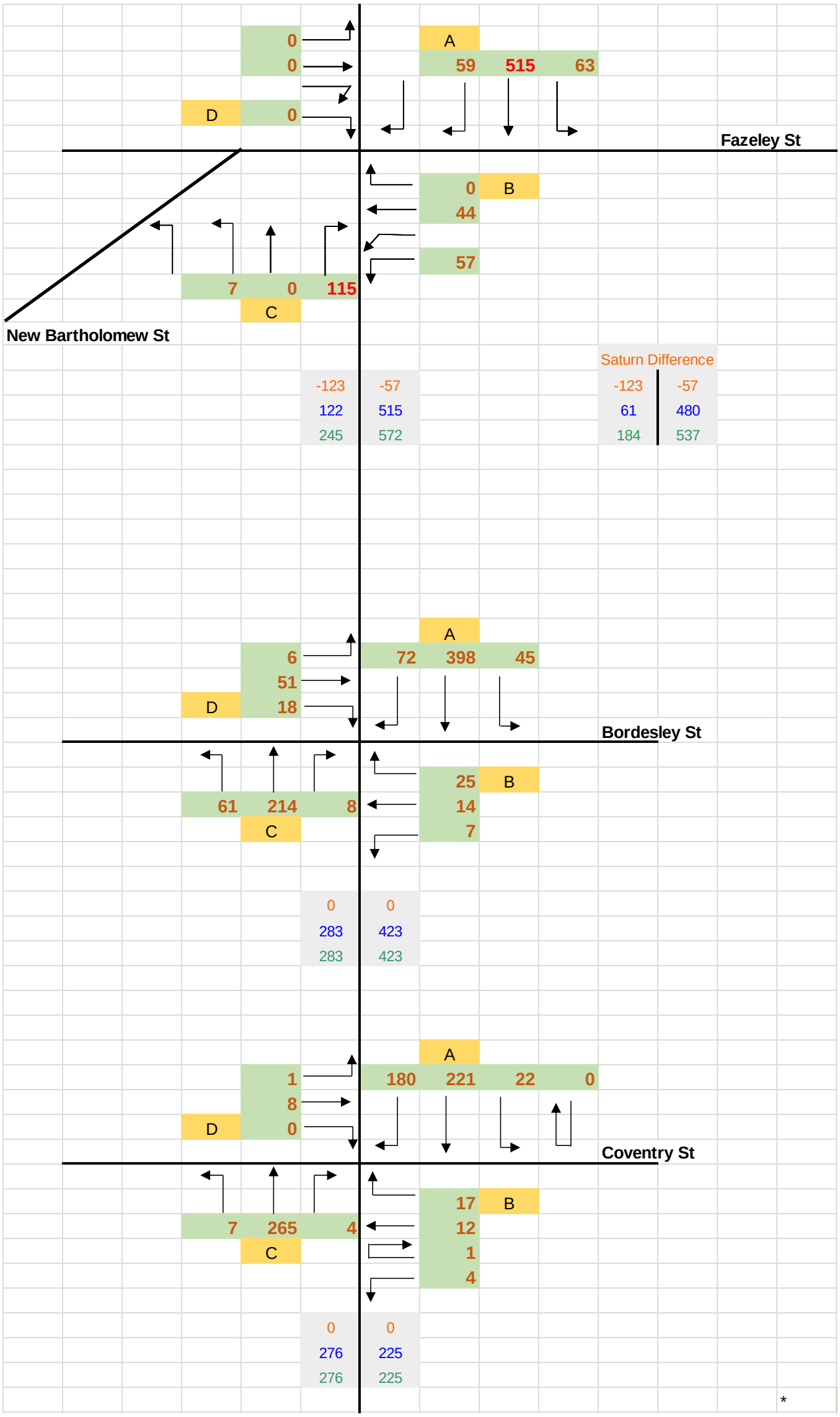


PM
2031 DM SATURN



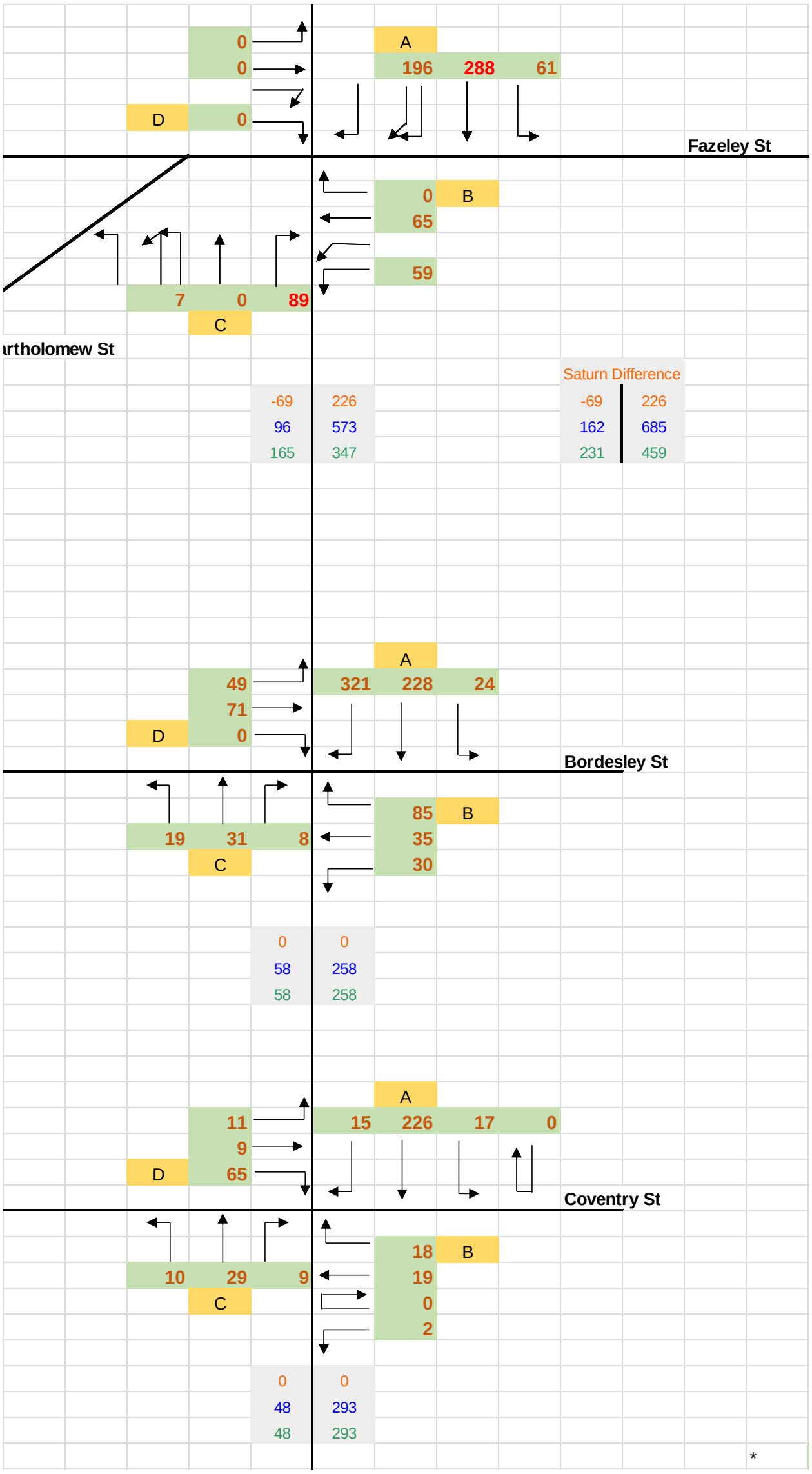
F.3.2 Section 2 – New Canal Street and Meriden Street

AM 2021 DM


0
0
A
59
515
63
D
0
Fazeley St
0
B
44
57
7
0
115
C
New Bartholomew St
-123
-57
122
515
245
572
Saturn Difference
-123
-57
61
480
184
537
A
6
72
398
45
51
D
18
Bordesley St
25
B
61
214
8
14
C
7
0
0
283
423
283
423
A
1
180
221
22
0
8
D
0
Coventry St
17
B
7
265
4
12
C
1
4
0
0
276
225
276
225

*

PM 2021 DM



Saturn Difference	
-69	226
162	685
231	459

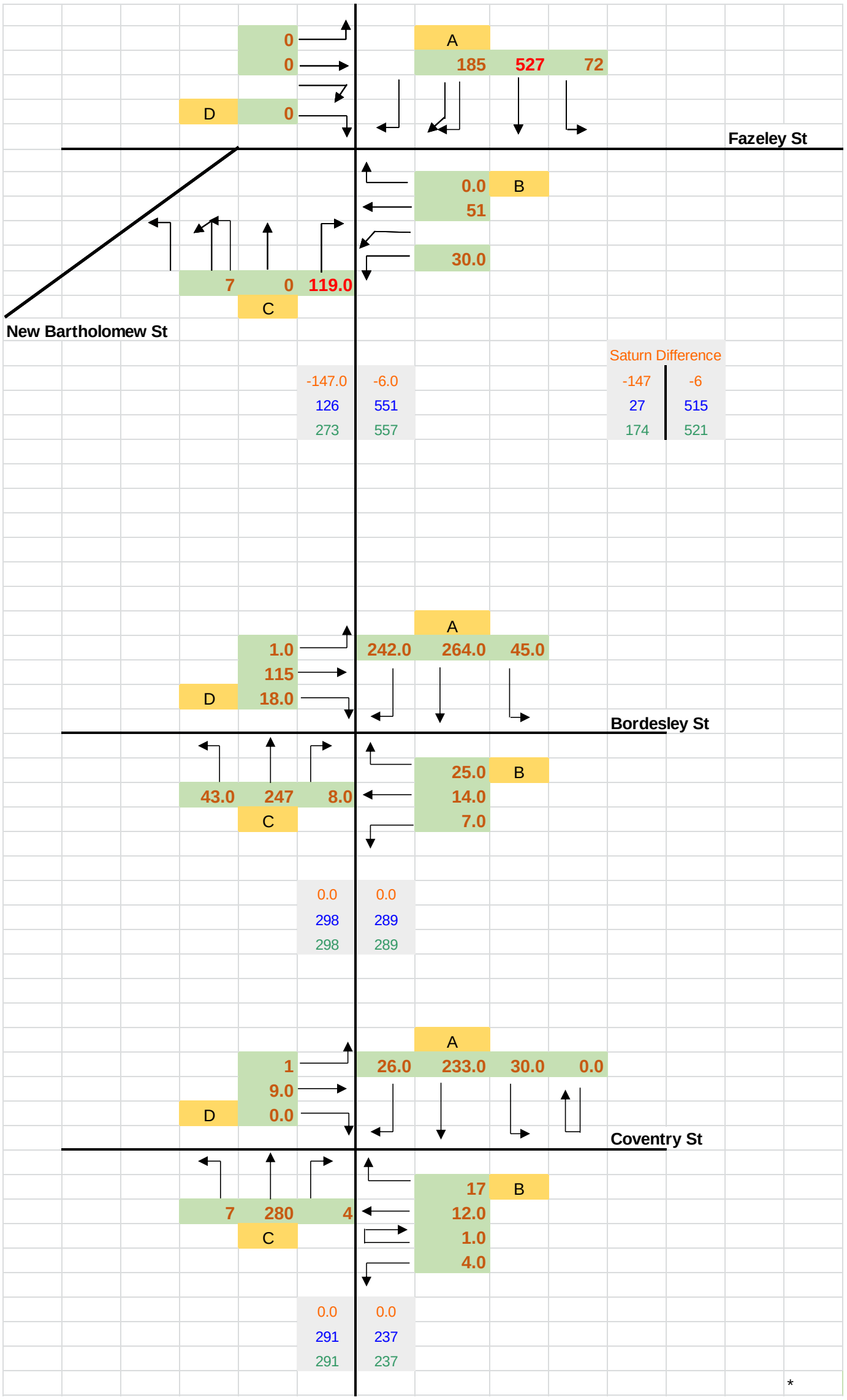
-69	226
96	573
165	347

0	0
58	258
58	258

0	0
48	293
48	293

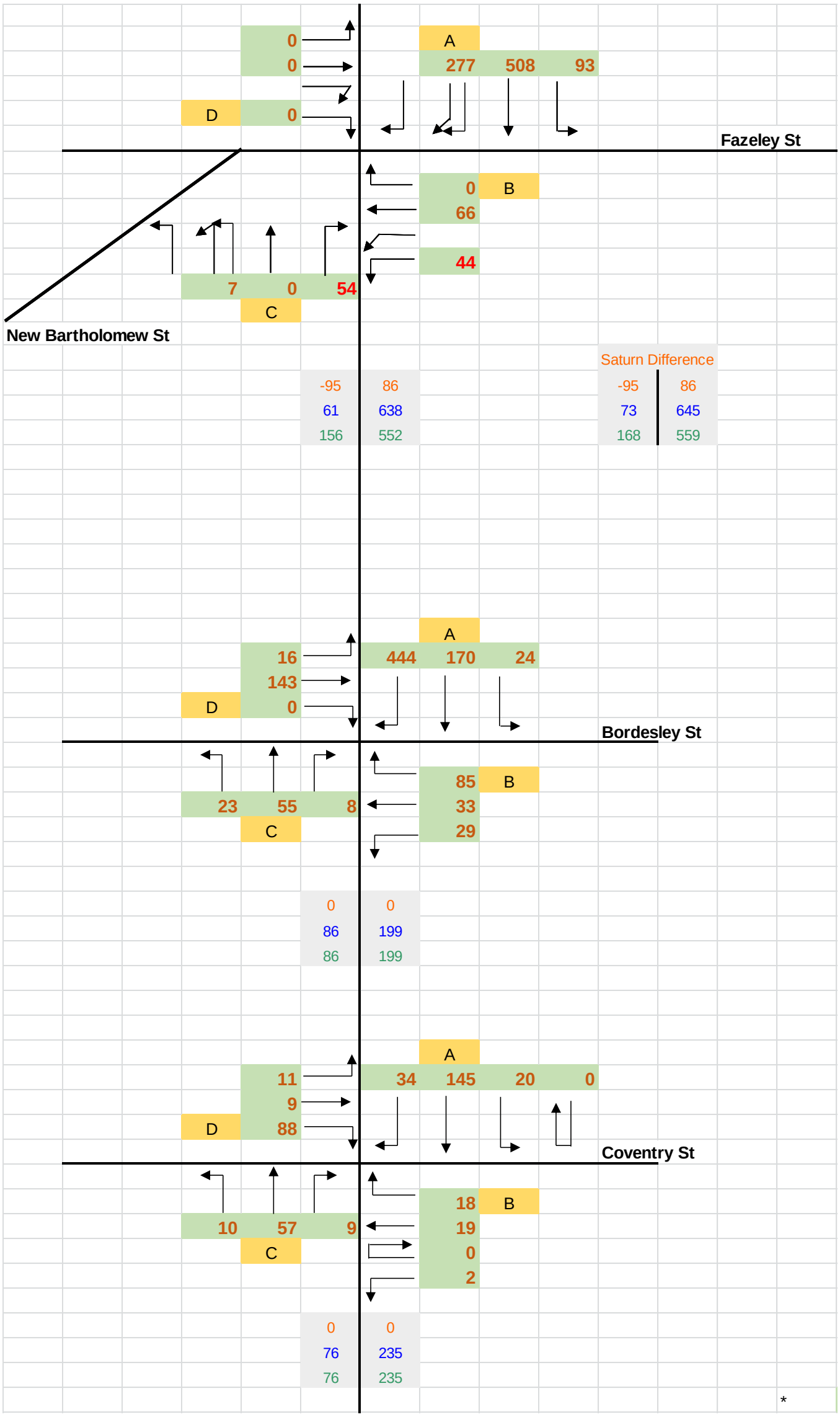
*

AM 2031 DM


0
0
A
185
527
72
D
0
Fazeley St
0.0
B
51
30.0
7
0
119.0
C
New Bartholomew St
Saturn Difference
-147
-6
27
515
174
521
-147.0
-6.0
126
551
273
557
A
1.0
242.0
264.0
45.0
115
D
18.0
Bordesley St
25.0
B
43.0
247
8.0
14.0
C
7.0
0.0
0.0
298
289
298
289
A
1
26.0
233.0
30.0
0.0
9.0
D
0.0
Coventry St
17
B
7
280
4
12.0
C
1.0
4.0
0.0
0.0
291
237
291
237

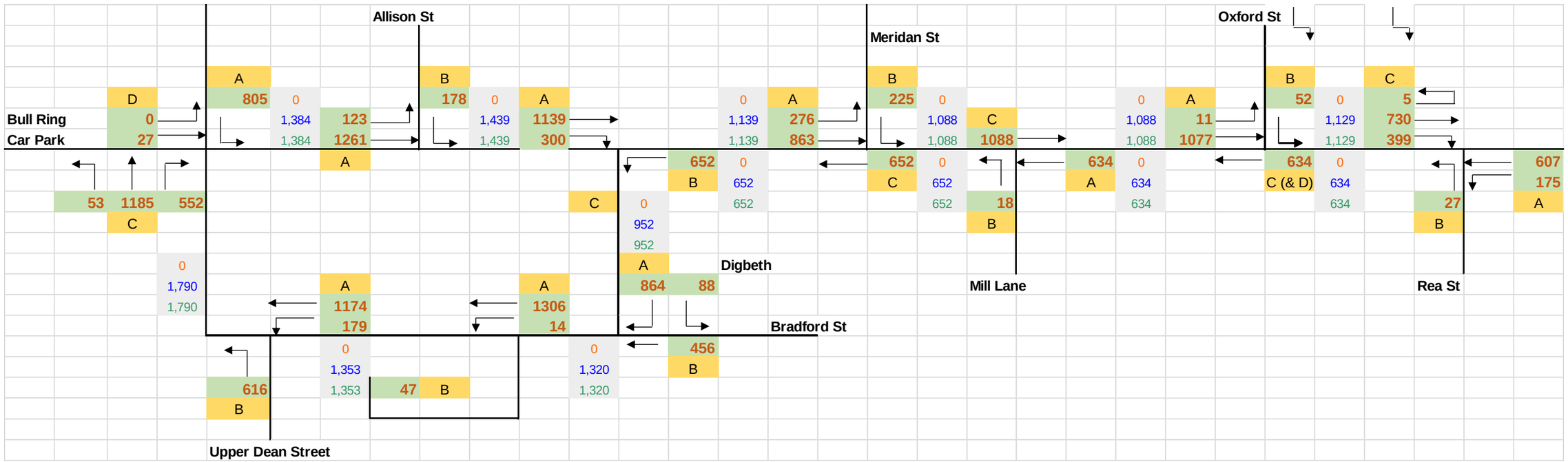
*

PM 2031 DM

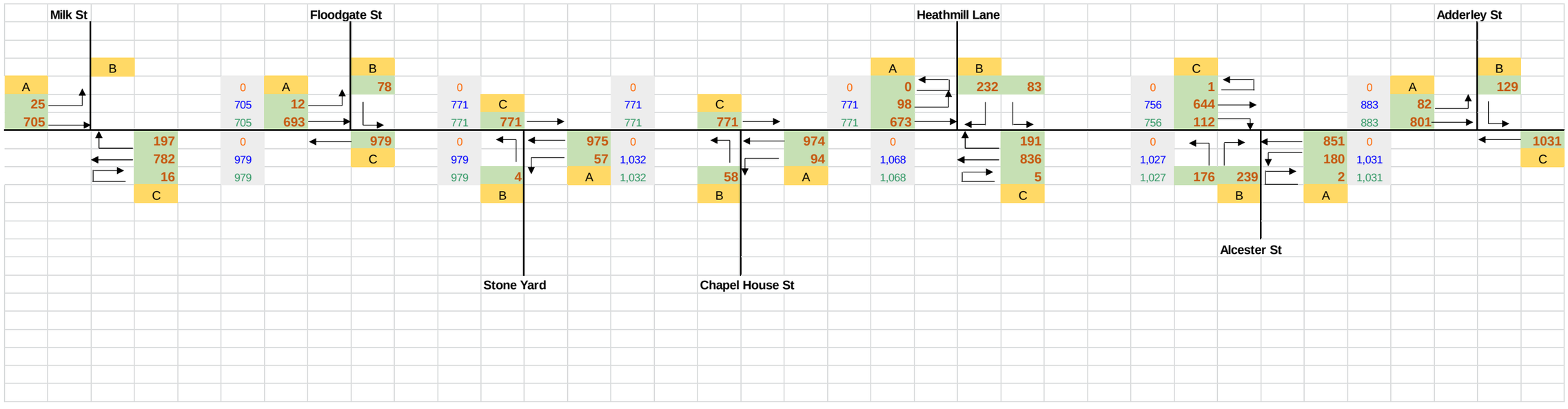

0
0
A
277
508
93
D
0
Fazeley St
0
B
66
44
7
0
54
C
New Bartholomew St
Saturn Difference
-95
86
-95
86
61
638
73
645
156
552
168
559
A
16
444
170
24
143
D
0
Bordesley St
85
B
23
55
8
33
C
29
0
0
86
199
86
199
A
11
34
145
20
0
9
D
88
Coventry St
18
B
10
57
9
19
C
0
2
0
0
76
235
76
235
*

F.3.3 Section 3 – Moat Lane Gyratory, Digbeth (B4100) and High Street Deritend

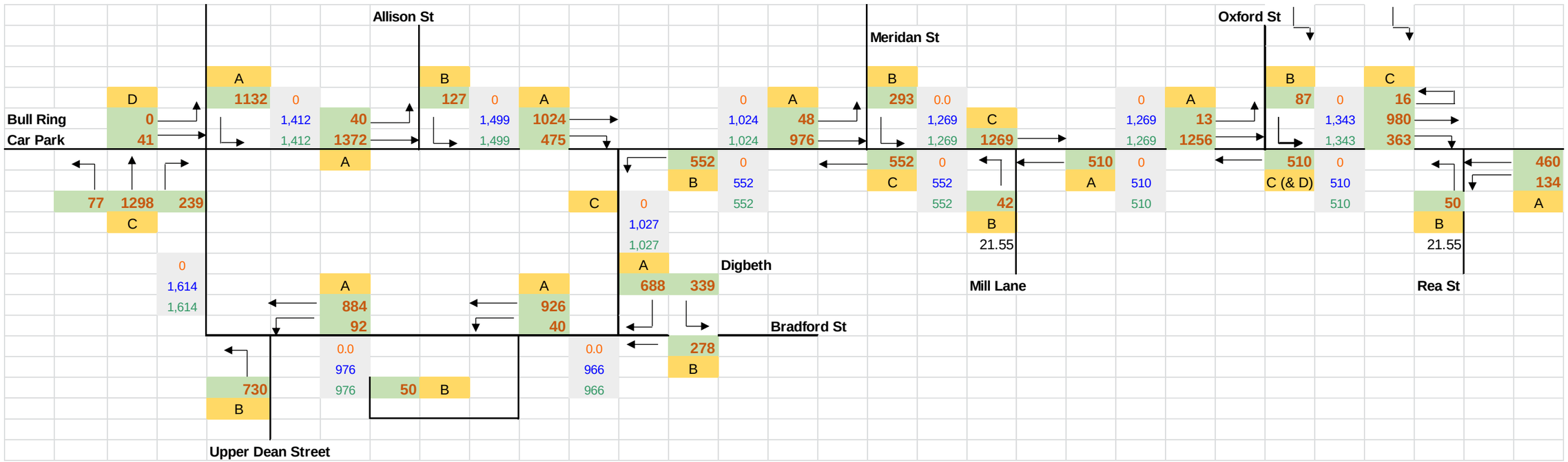
AM 2021 DM (Moat Lane Gyratory and Digbeth)



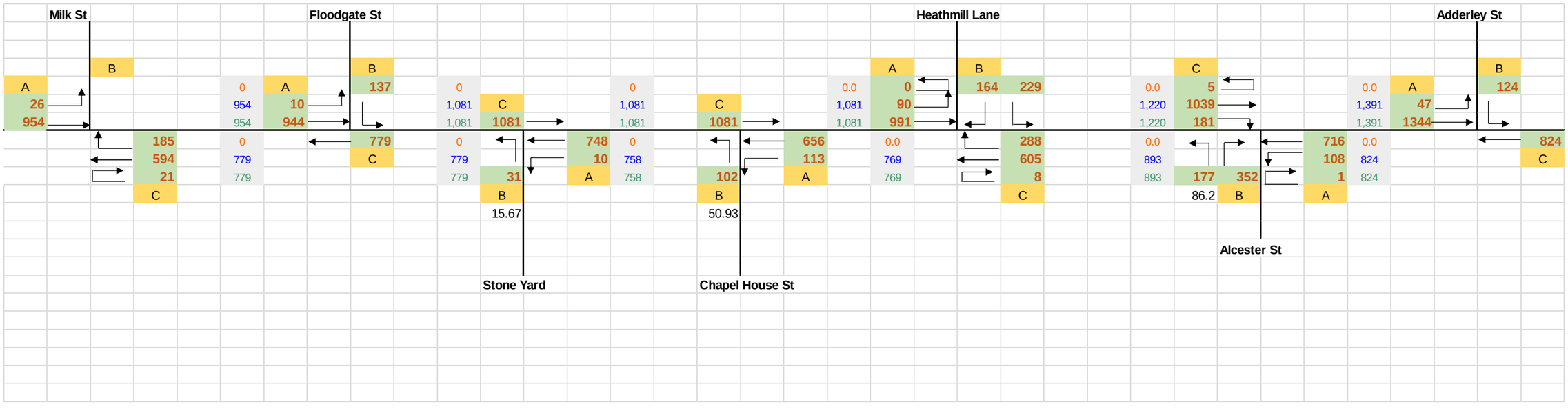
AM 2021 DM (High Street Deritend)



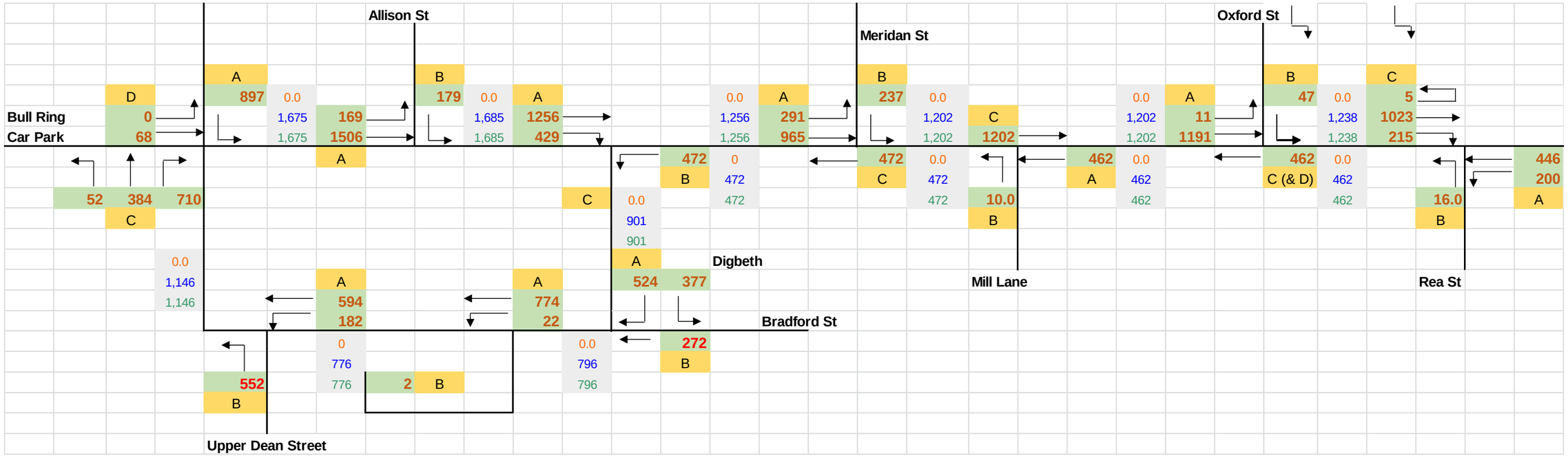
PM 2021 DM (Moat Lane Gyratory and Digbeth)



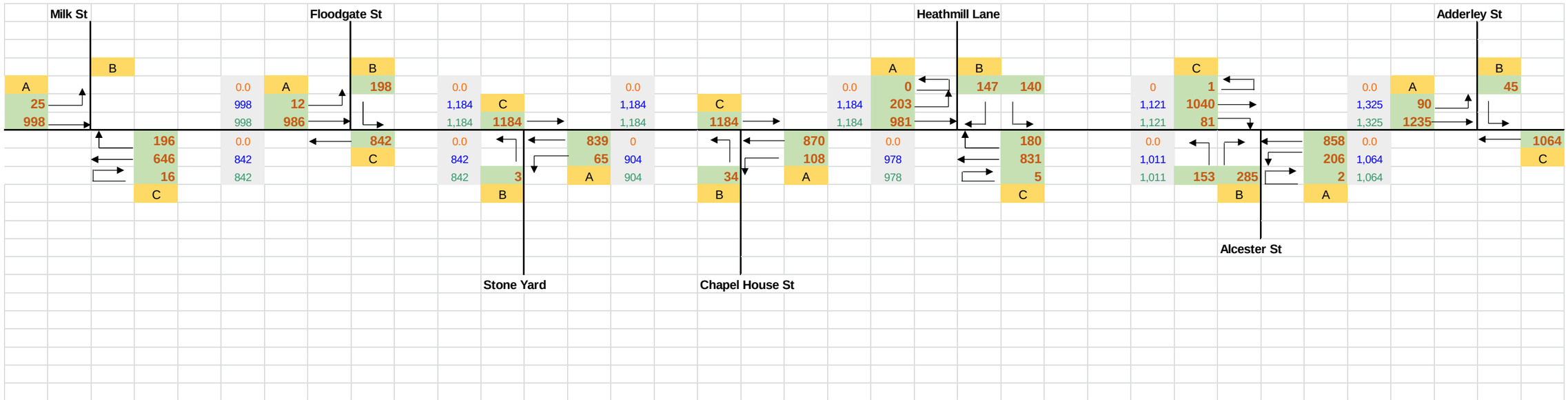
PM 2021 DM (High Street Deritend)



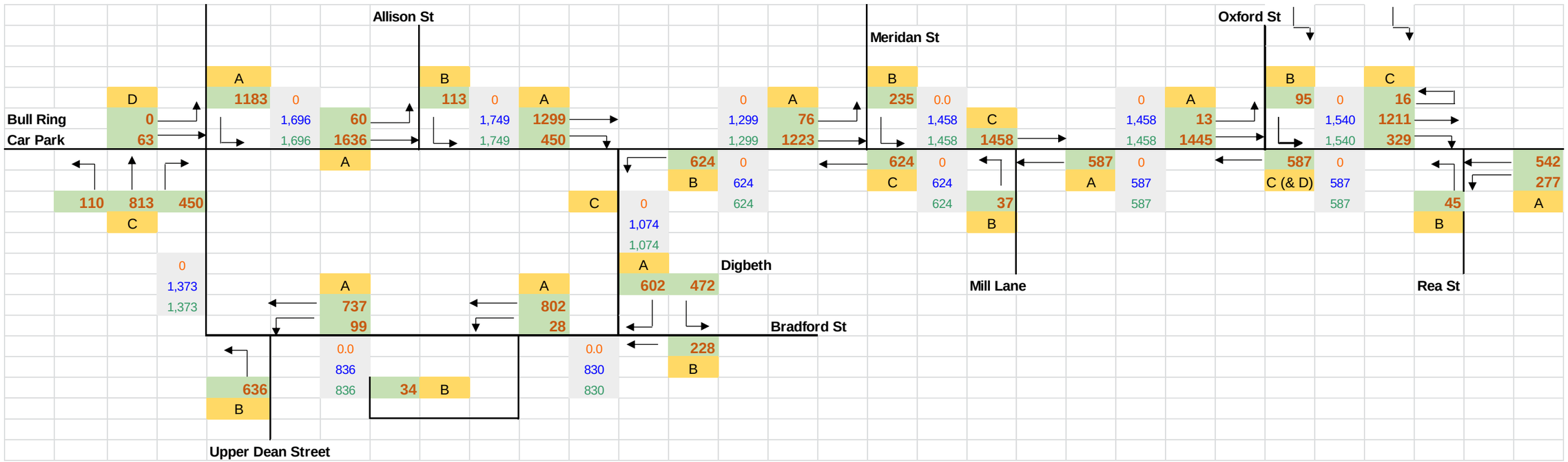
AM 2031 DM (Moat Lane Gyratory and Digbeth)



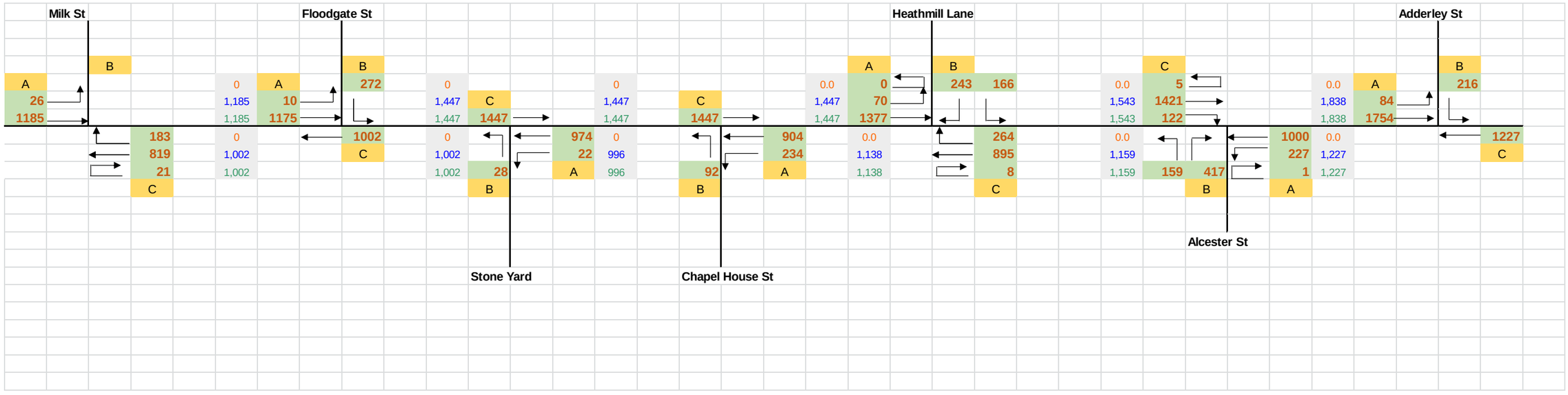
AM 2031 DM (High Street Deritend)



PM 2031 DM (Moat Lane Gyratory and Digbeth)

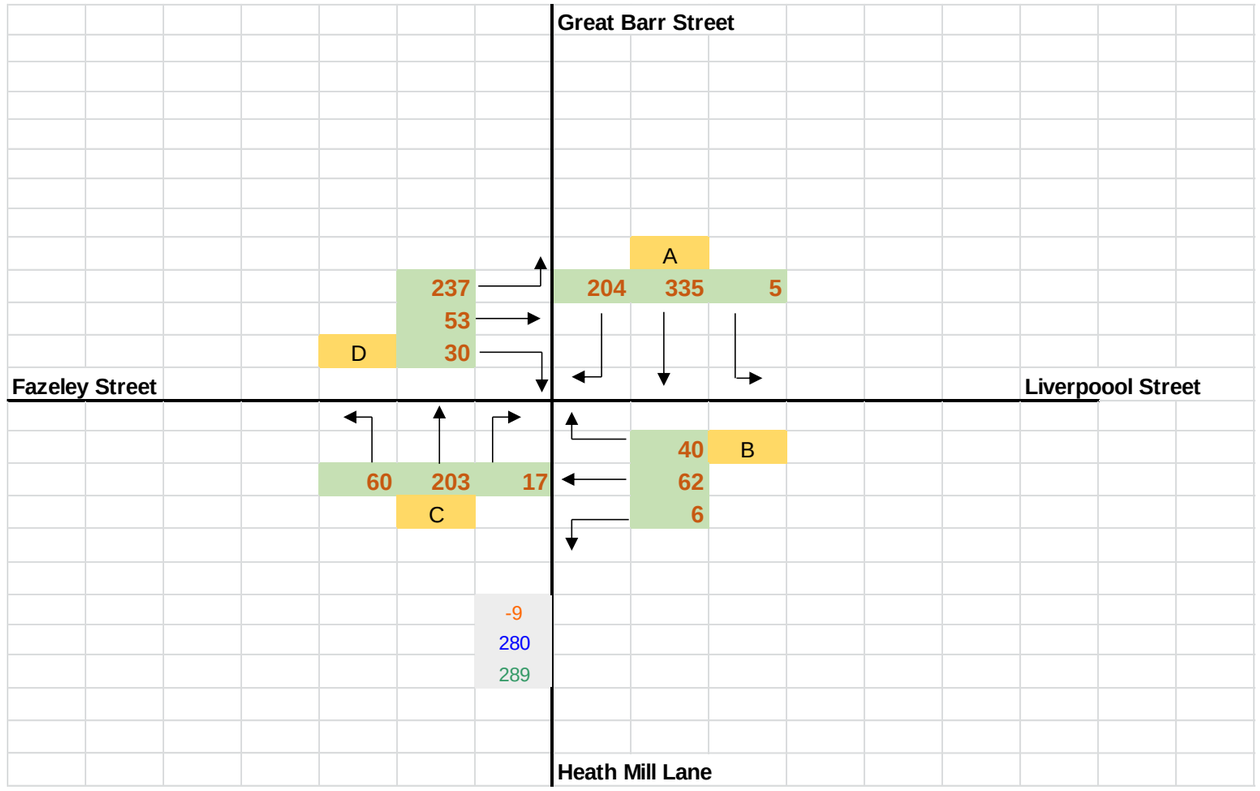


PM 2031 DM (High Street Deritend)

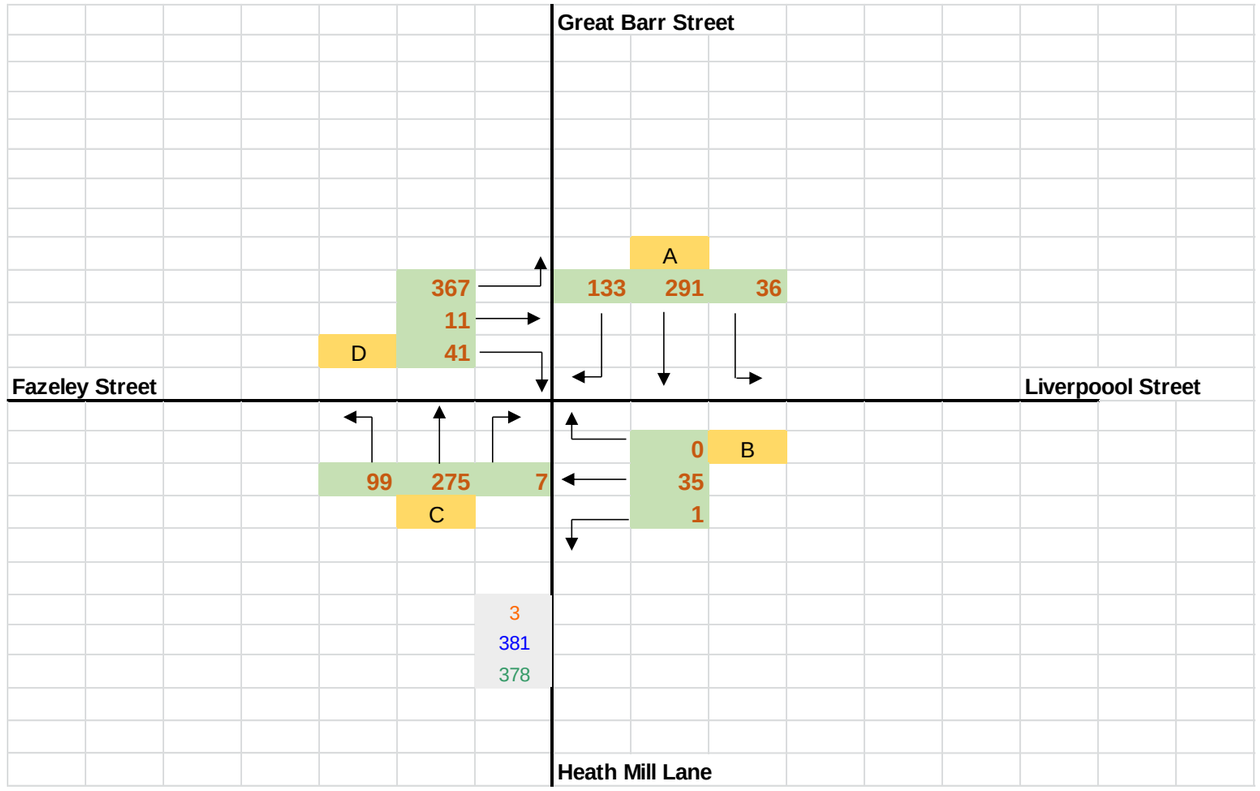


F.3.4 Off-line Junction 4 – Heath Mill Lane / Liverpool Street

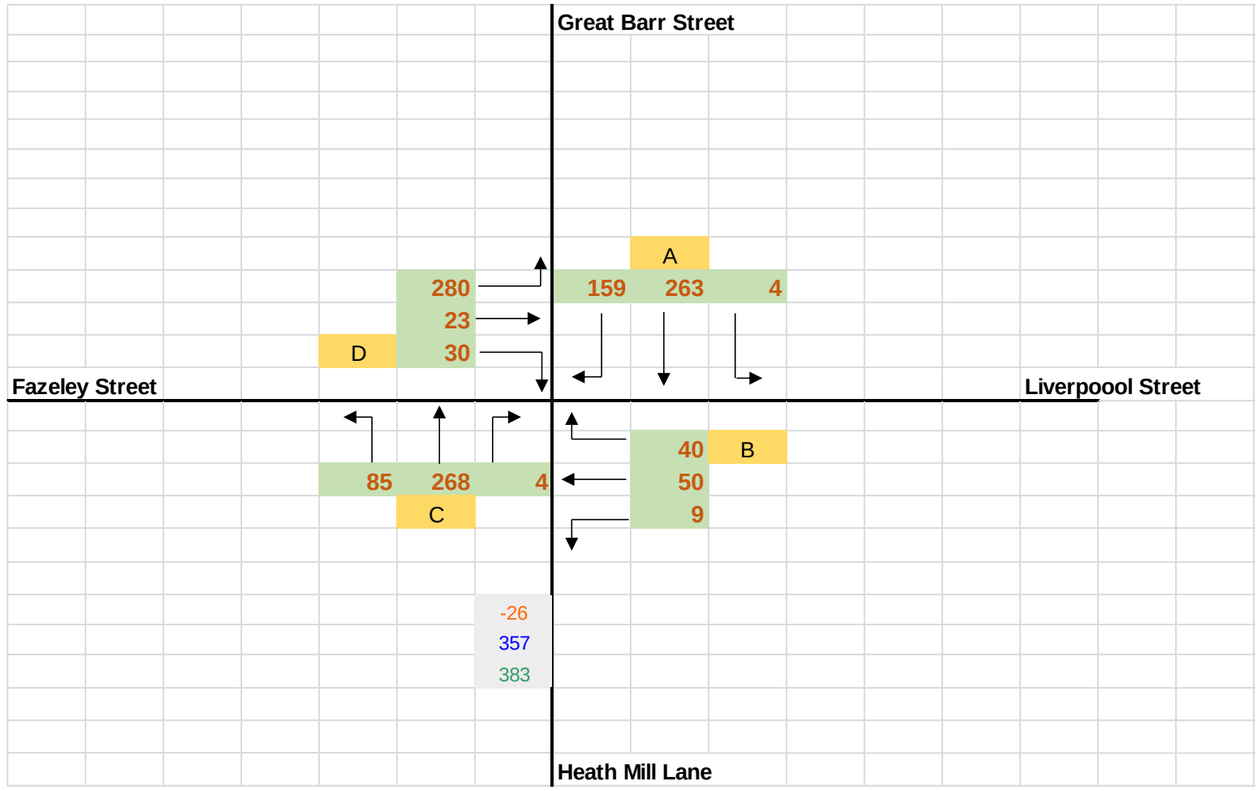
AM 2021 DM (Heath Mill Lane / Liverpool Street)



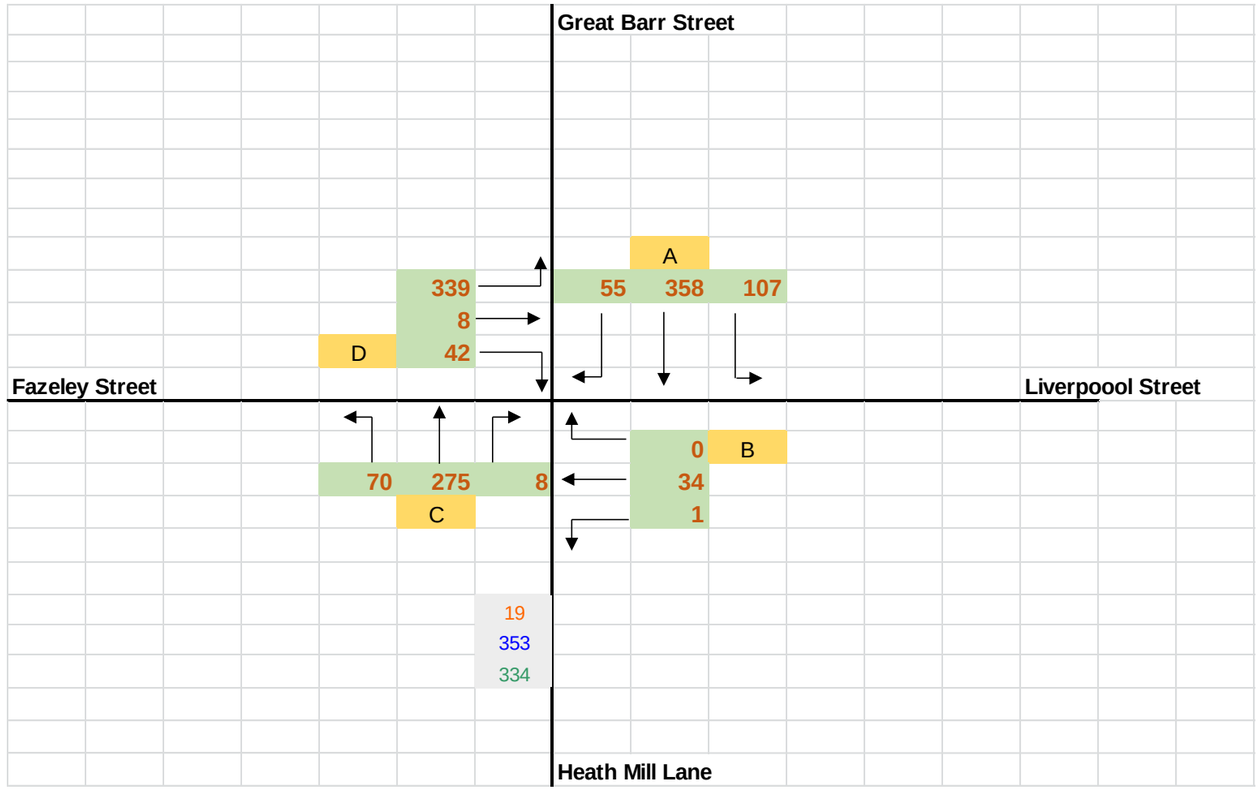
PM 2021 DM (Heath Mill Lane / Liverpool Street)



AM 2031 DM (Heath Mill Lane / Liverpool Street)



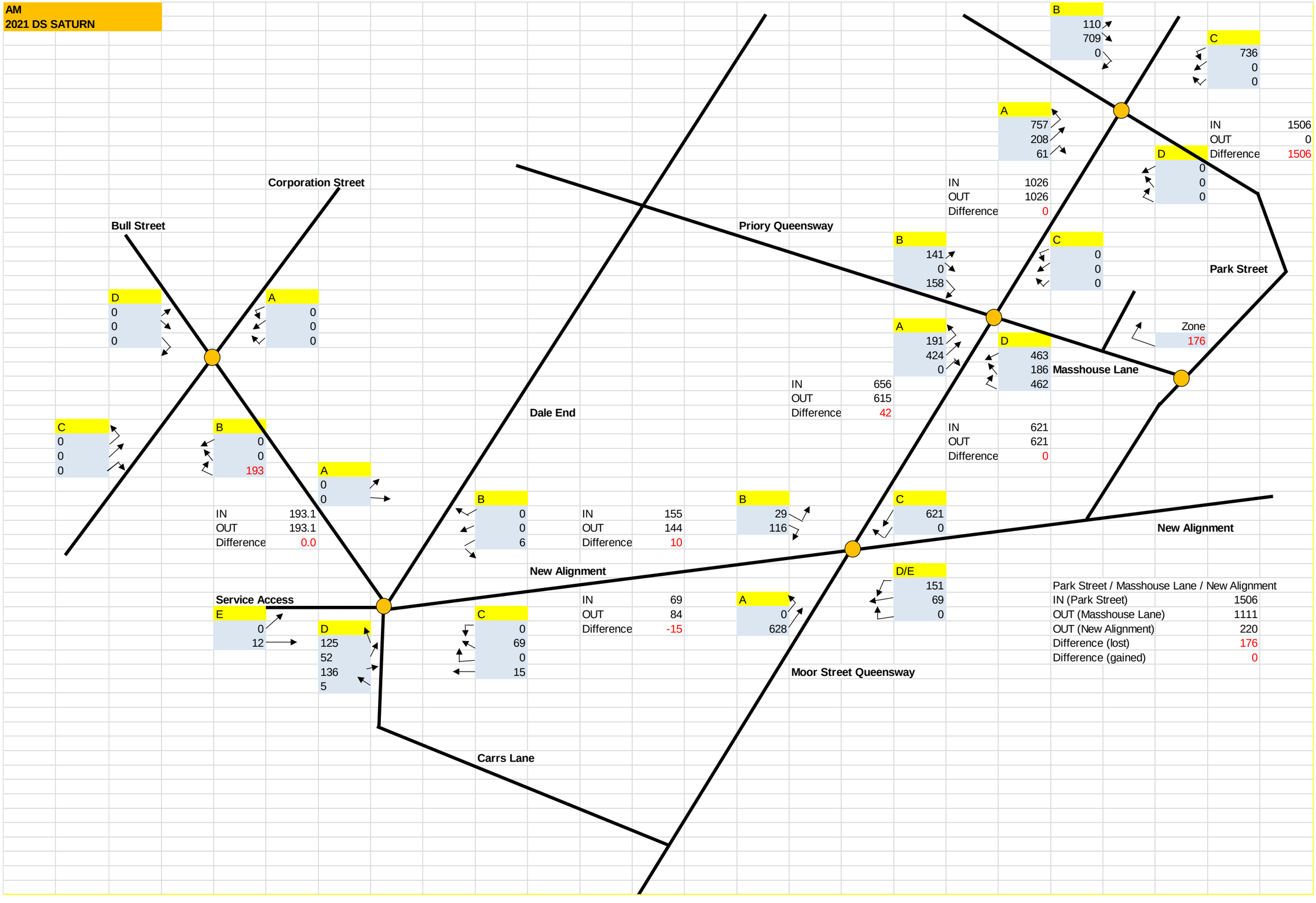
PM 2031 DM (Heath Mill Lane / Liverpool Street)



F.4 Do Something Future Year Traffic Flows

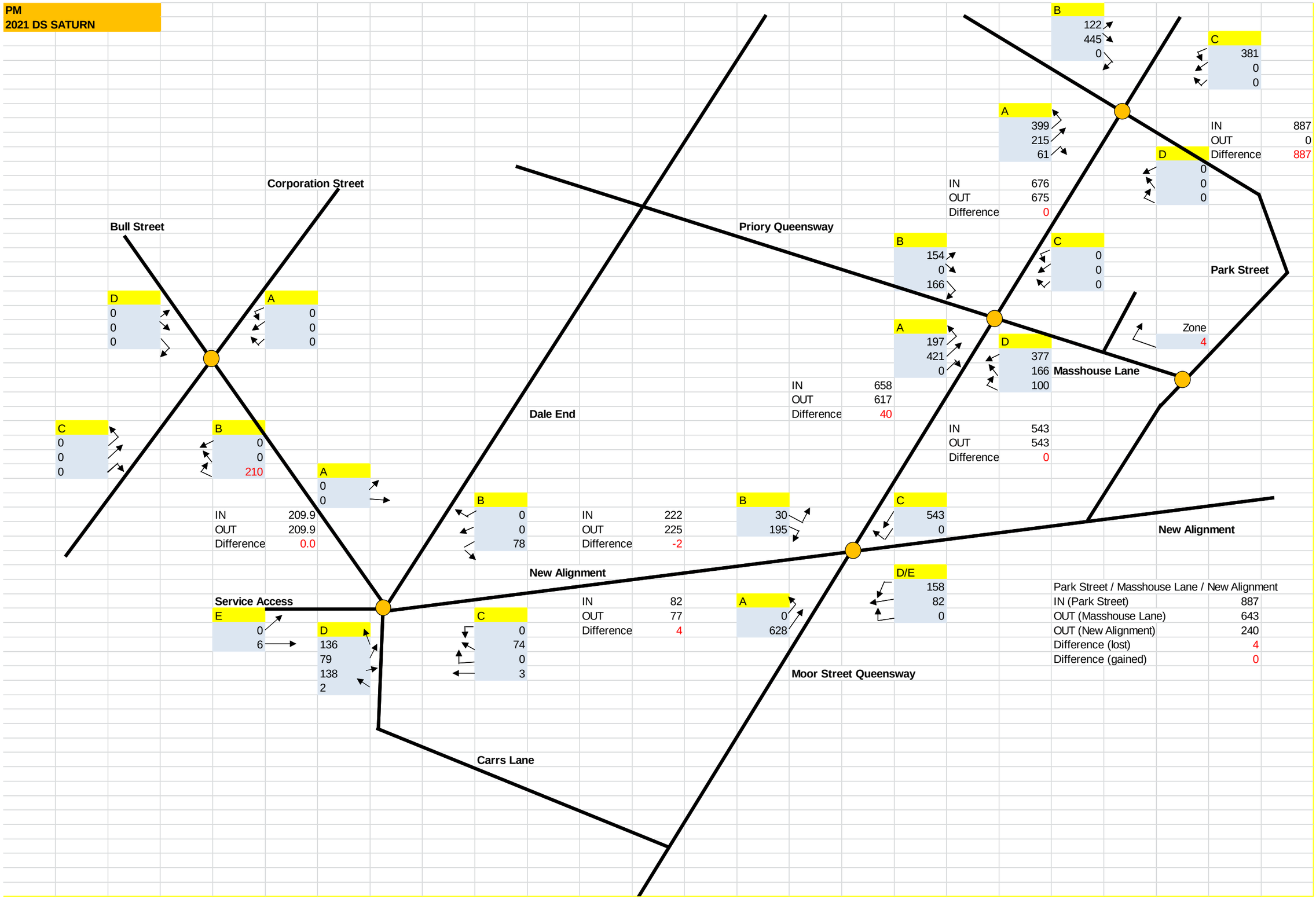
F.4.1 Section 1 – Moor Street Queensway (including off-line junctions 1 and 2)

AM
2021 DS SATURN



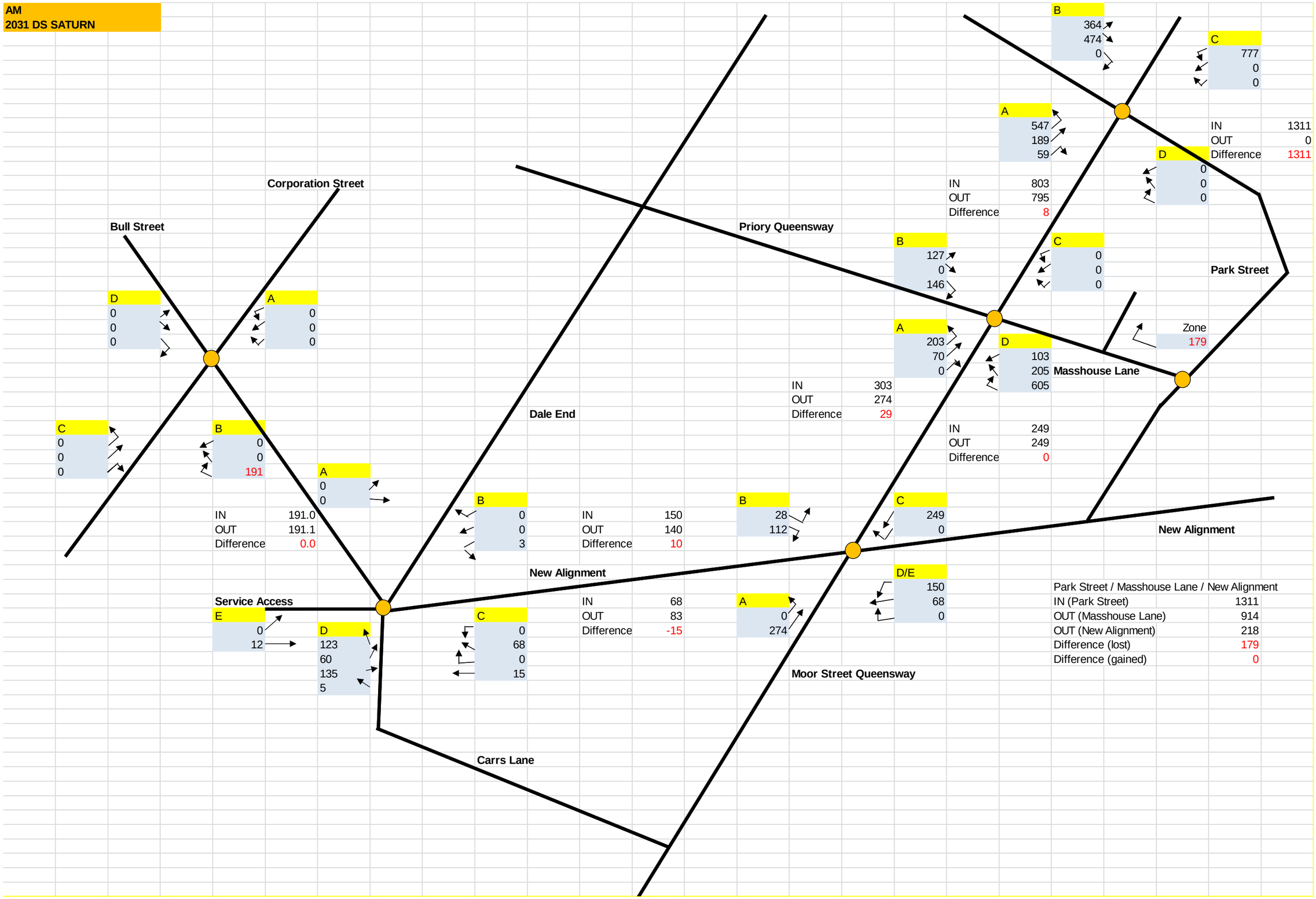
Park Street / Masshouse Lane / New Alignment	
IN (Park Street)	1506
OUT (Masshouse Lane)	1111
OUT (New Alignment)	220
Difference (lost)	176
Difference (gained)	0

PM
2021 DS SATURN



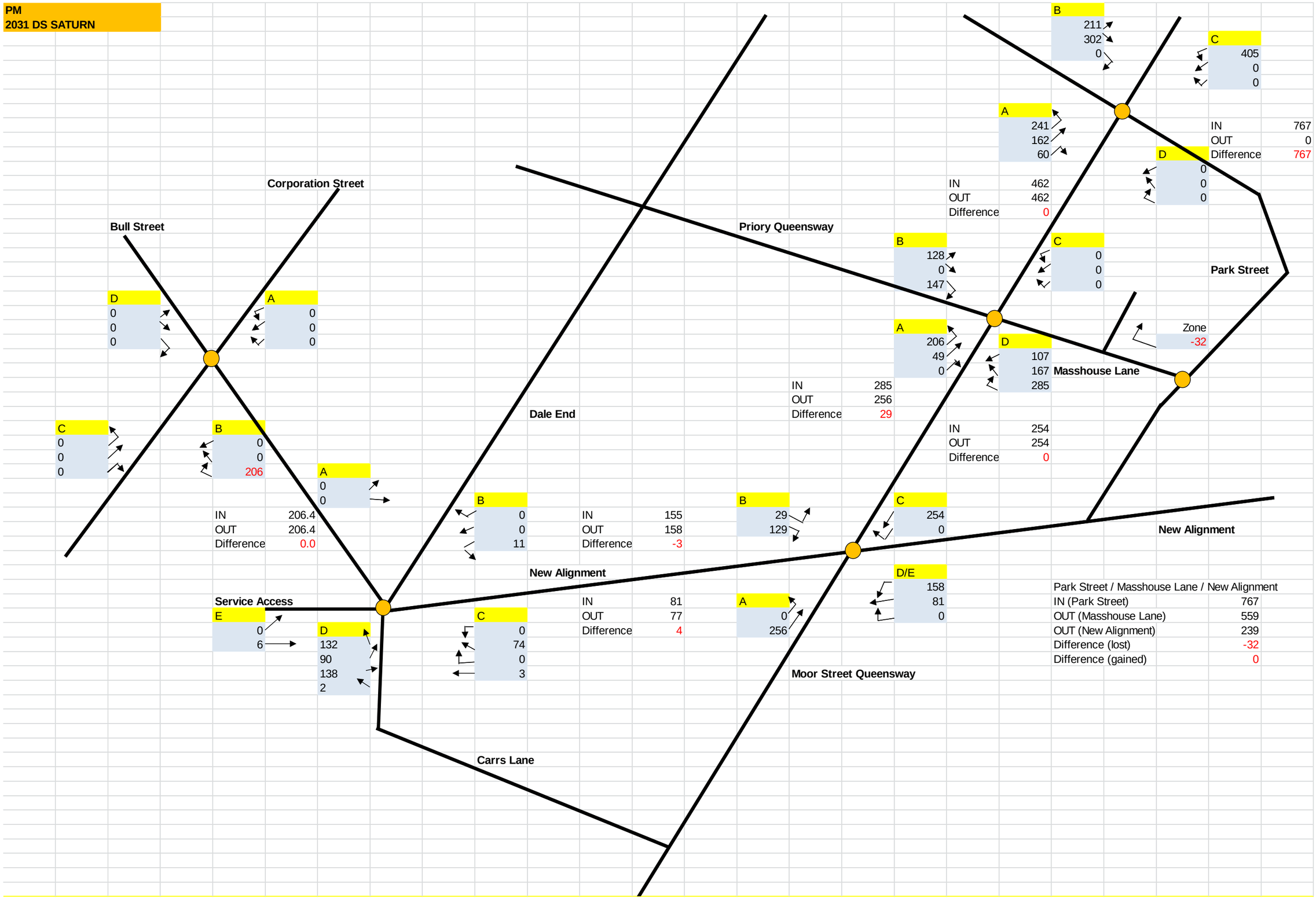
Park Street / Masshouse Lane / New Alignment	
IN (Park Street)	887
OUT (Masshouse Lane)	643
OUT (New Alignment)	240
Difference (lost)	4
Difference (gained)	0

AM
2031 DS SATURN



Park Street / Masshouse Lane / New Alignment	
IN (Park Street)	1311
OUT (Masshouse Lane)	914
OUT (New Alignment)	218
Difference (lost)	179
Difference (gained)	0

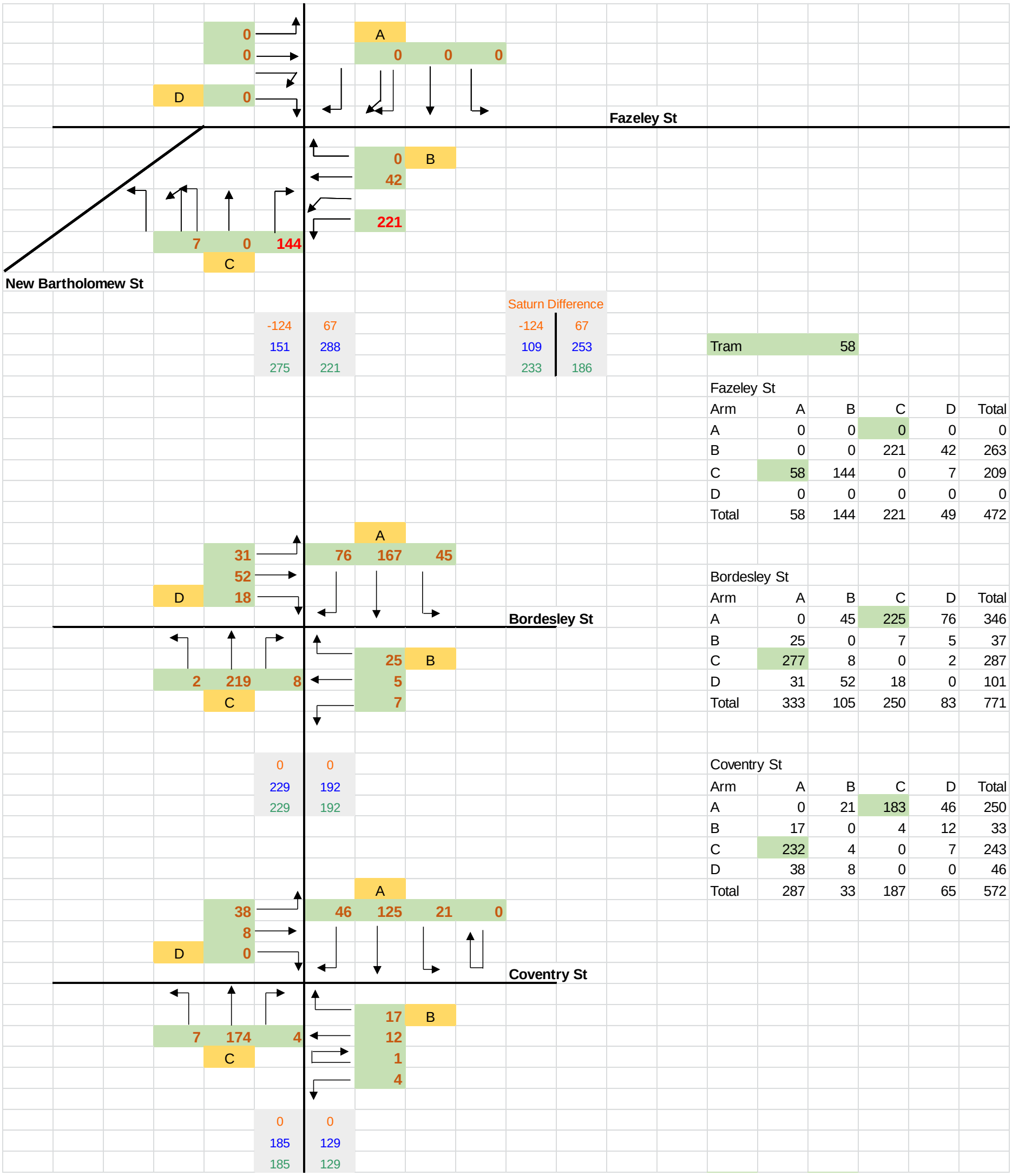
PM
2031 DS SATURN



Park Street / Masshouse Lane / New Alignment	
IN (Park Street)	767
OUT (Masshouse Lane)	559
OUT (New Alignment)	239
Difference (lost)	-32
Difference (gained)	0

F.4.2 Section 2 – New Canal Street and Meriden Street

AM 2021 DS



Tram 58

Fazeley St

Arm	A	B	C	D	Total
A	0	0	0	0	0
B	0	0	221	42	263
C	58	144	0	7	209
D	0	0	0	0	0
Total	58	144	221	49	472

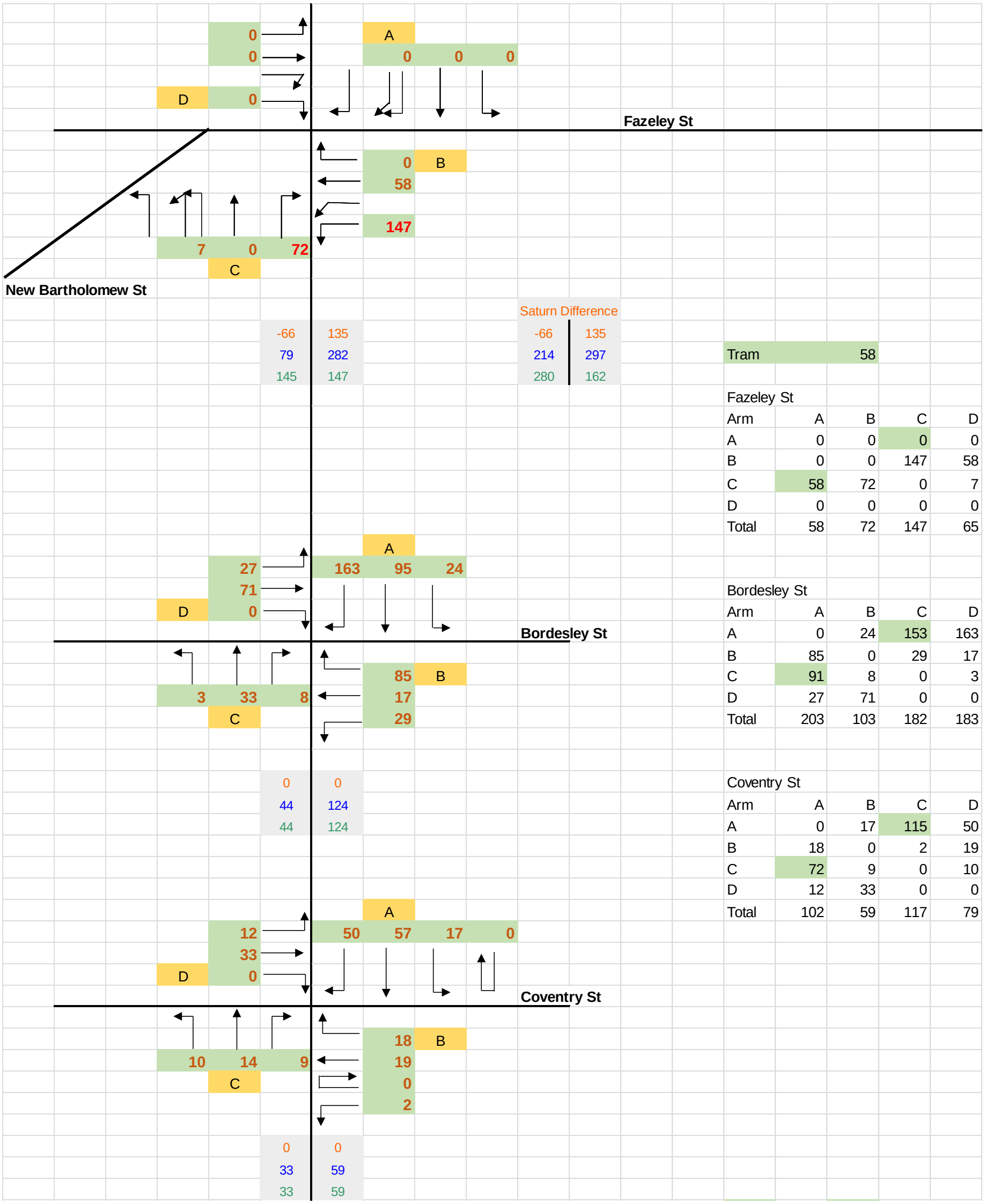
Bordesley St

Arm	A	B	C	D	Total
A	0	45	225	76	346
B	25	0	7	5	37
C	277	8	0	2	287
D	31	52	18	0	101
Total	333	105	250	83	771

Coventry St

Arm	A	B	C	D	Total
A	0	21	183	46	250
B	17	0	4	12	33
C	232	4	0	7	243
D	38	8	0	0	46
Total	287	33	187	65	572

PM 2021 DS



Tram 58

Fazeley St

Arm	A	B	C	D
A	0	0	0	0
B	0	0	147	58
C	58	72	0	7
D	0	0	0	0
Total	58	72	147	65

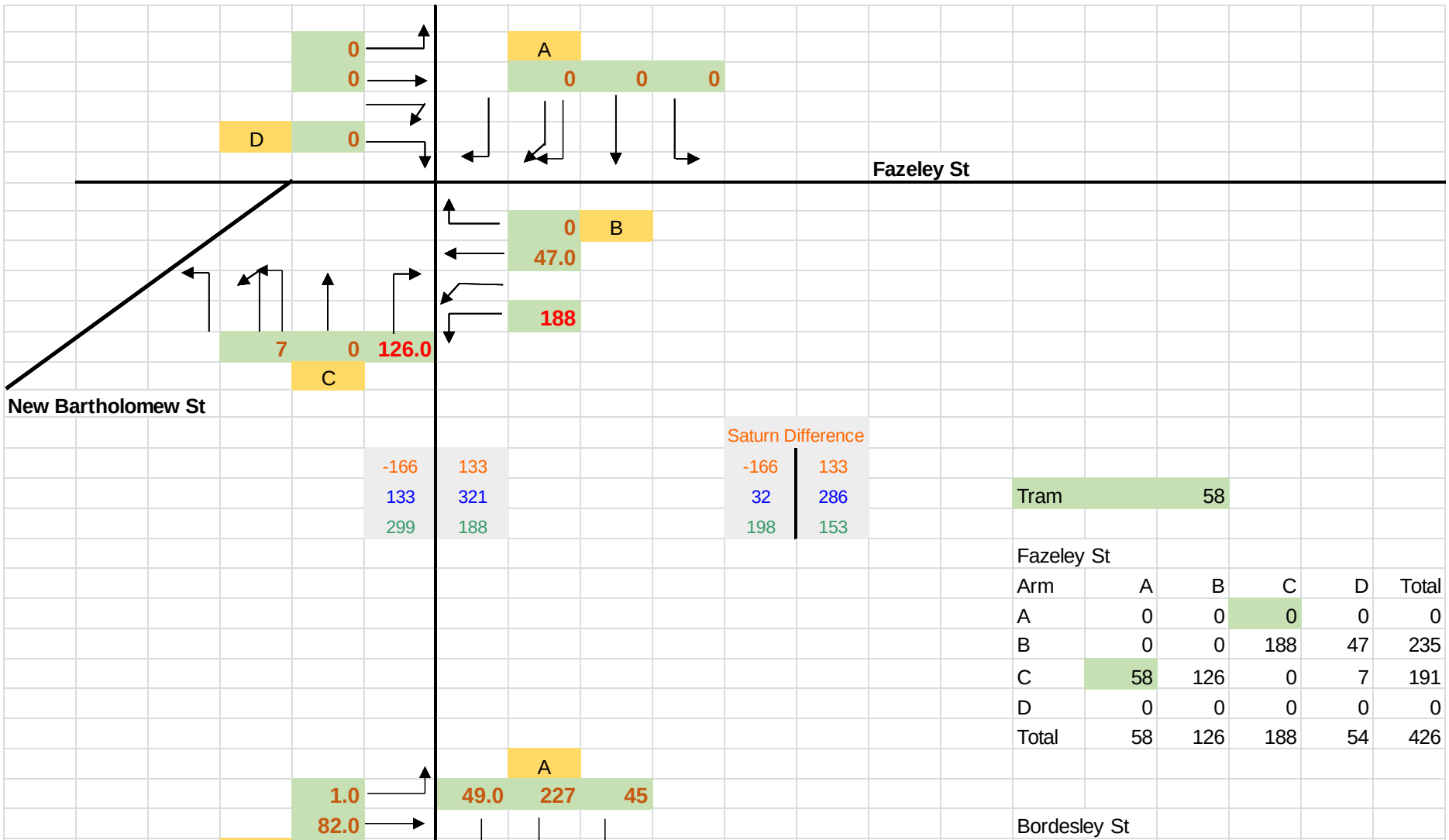
Bordesley St

Arm	A	B	C	D
A	0	24	153	163
B	85	0	29	17
C	91	8	0	3
D	27	71	0	0
Total	203	103	182	183

Coventry St

Arm	A	B	C	D
A	0	17	115	50
B	18	0	2	19
C	72	9	0	10
D	12	33	0	0
Total	102	59	117	79

AM 2031 DS



Tram 58

Fazeley St

Arm	A	B	C	D	Total
A	0	0	0	0	0
B	0	0	188	47	235
C	58	126	0	7	191
D	0	0	0	0	0
Total	58	126	188	54	426

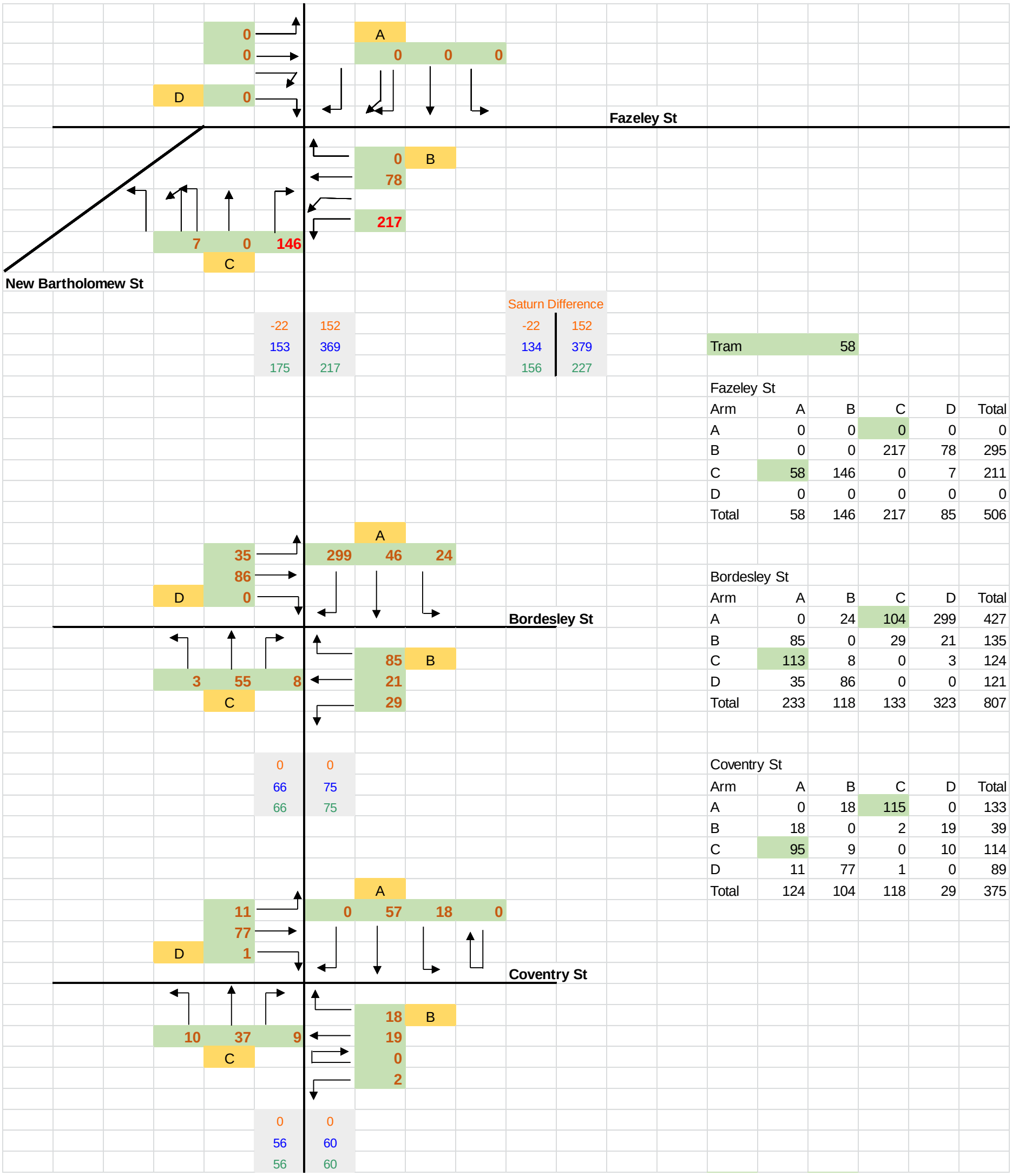
Bordesley St

Arm	A	B	C	D	Total
A	0	45	285	49	379
B	25	0	7	15	47
C	331	8	0	2	341
D	1	82	18	0	101
Total	357	135	310	66	868

Coventry St

Arm	A	B	C	D	Total
A	0	22	218	70	310
B	17	0	4	12	33
C	231	4	0	7	242
D	93	21	0	0	114
Total	341	47	222	89	699

PM 2031 DS



Tram 58

Fazeley St

Arm	A	B	C	D	Total
A	0	0	0	0	0
B	0	0	217	78	295
C	58	146	0	7	211
D	0	0	0	0	0
Total	58	146	217	85	506

Bordesley St

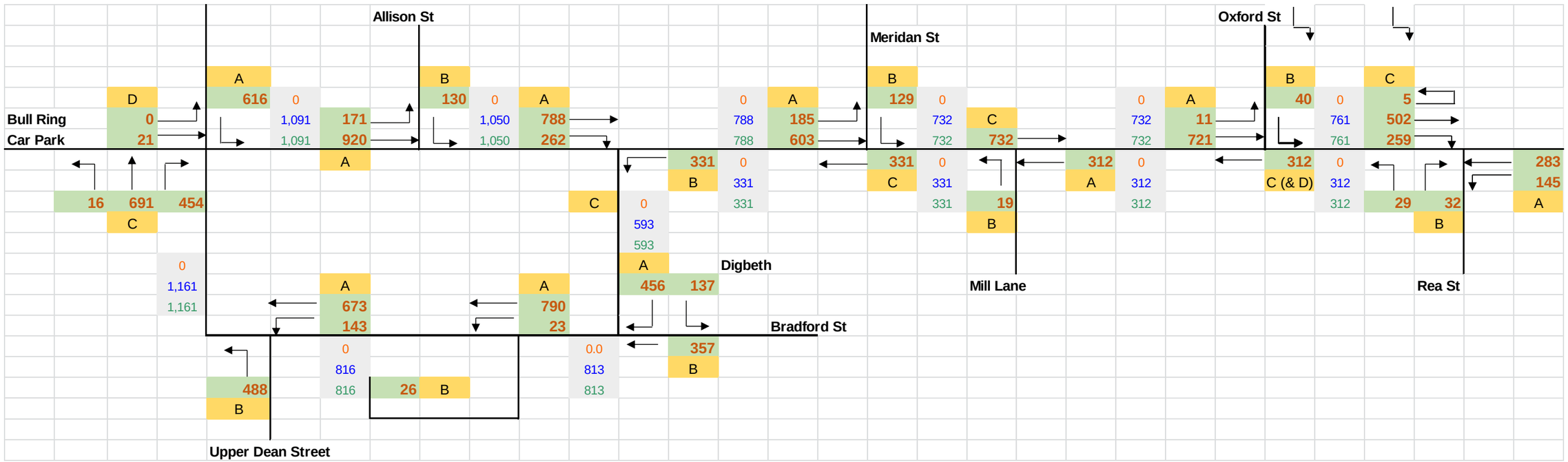
Arm	A	B	C	D	Total
A	0	24	104	299	427
B	85	0	29	21	135
C	113	8	0	3	124
D	35	86	0	0	121
Total	233	118	133	323	807

Coventry St

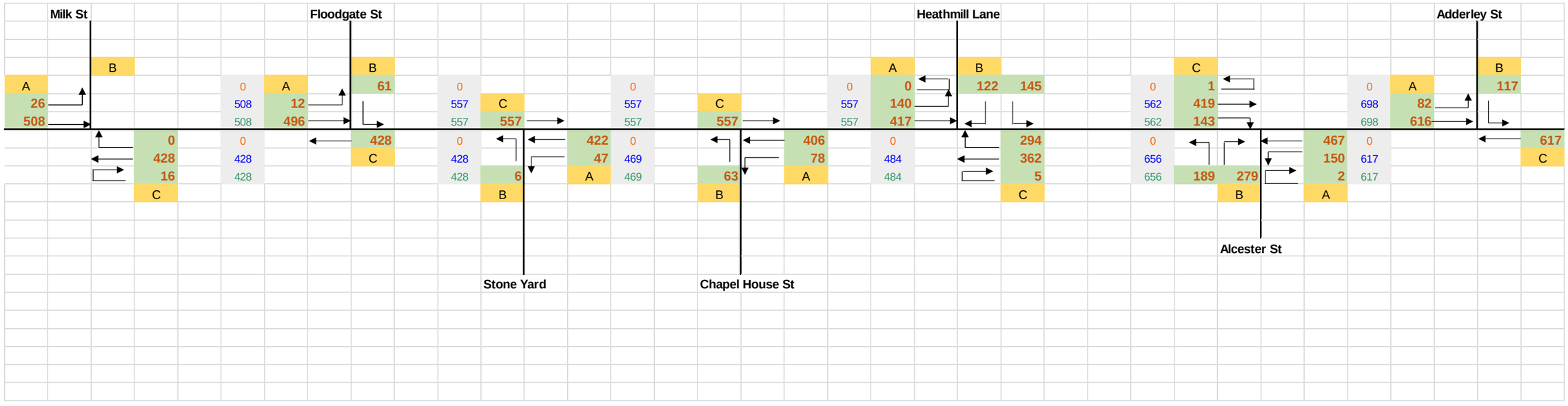
Arm	A	B	C	D	Total
A	0	18	115	0	133
B	18	0	2	19	39
C	95	9	0	10	114
D	11	77	1	0	89
Total	124	104	118	29	375

F.4.3 Section 3 – Moat Lane Gyratory, Digbeth (B4100) and High Street Deritend

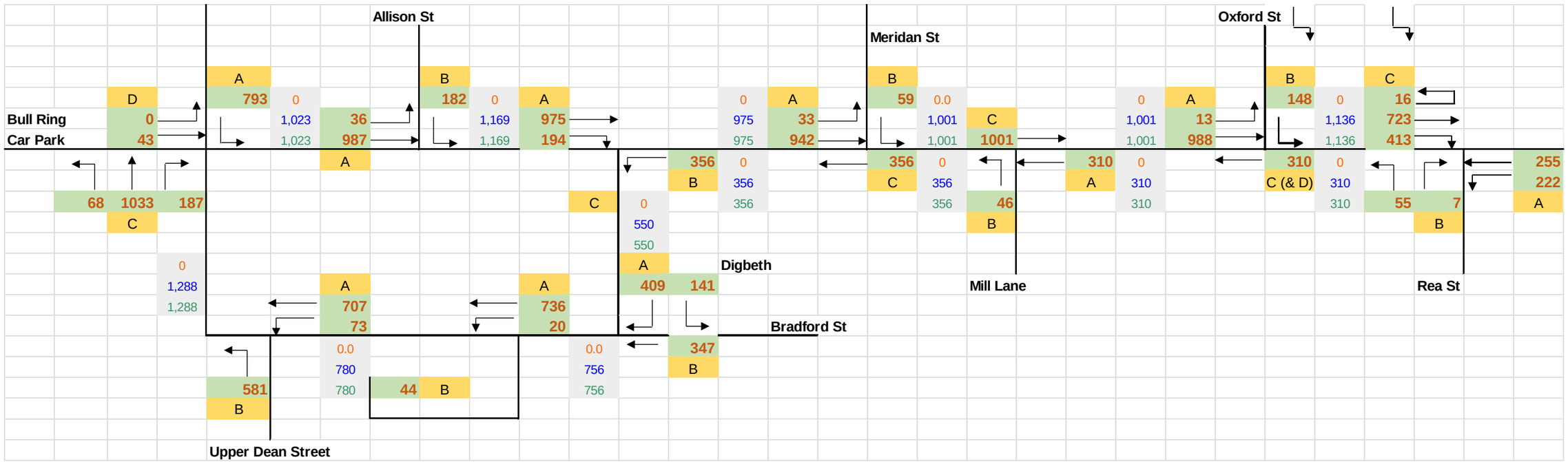
AM 2021 DS (Moat Lane Gyratory and Digbeth)



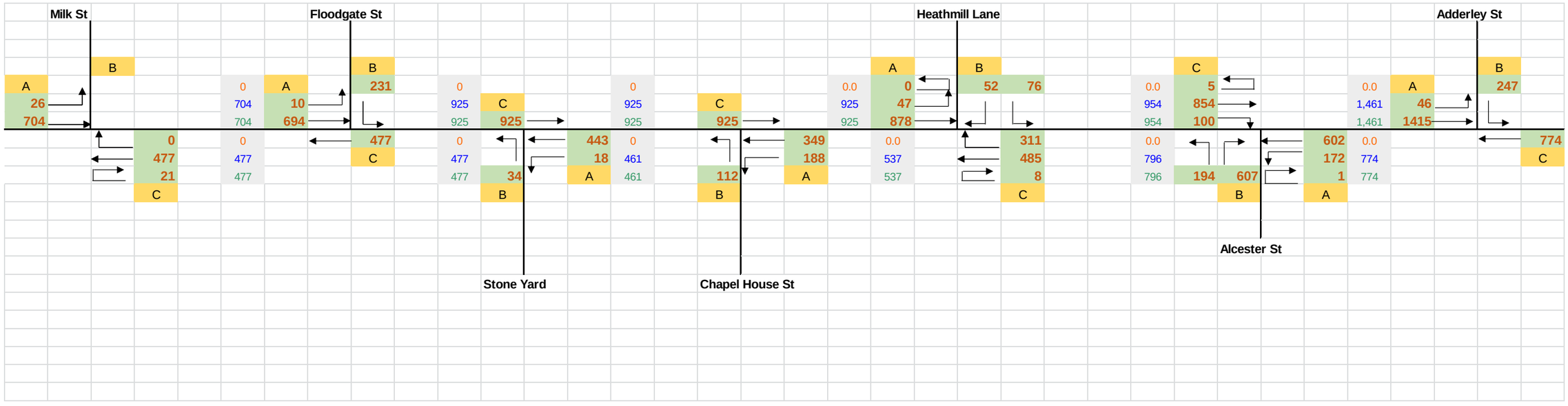
AM 2021 DS (High Street Deritend)



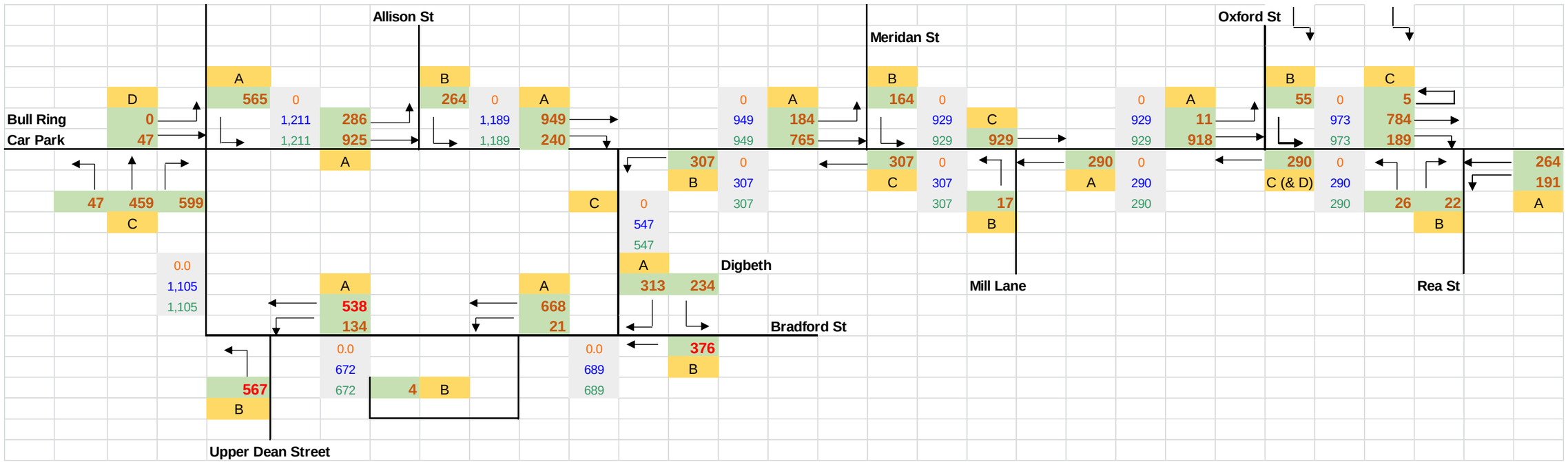
PM 2021 DS (Moat Lane Gyratory and Digbeth)



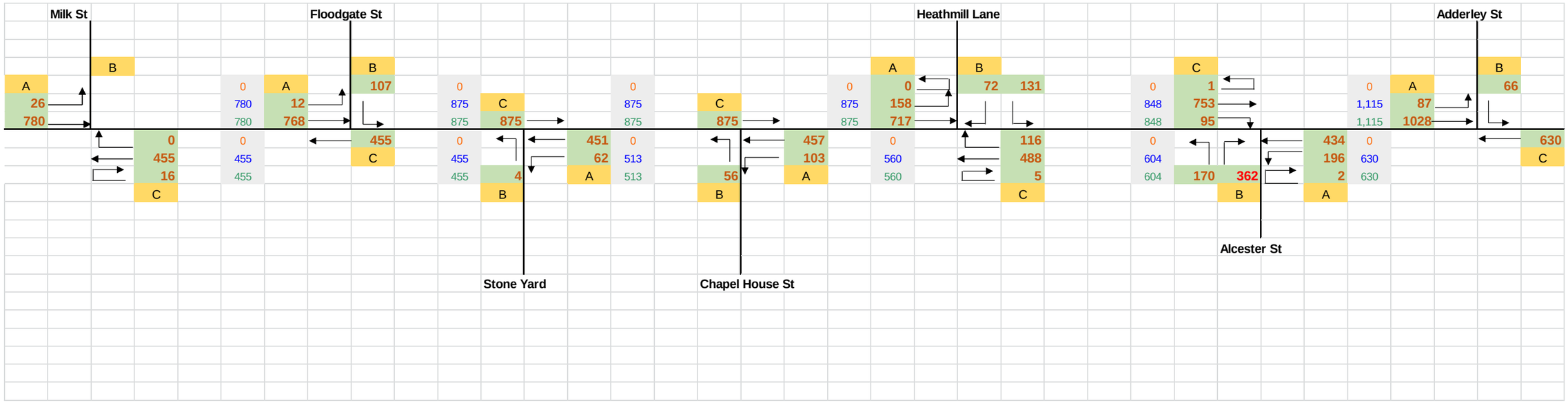
PM 2021 DS (High Street Deritend)



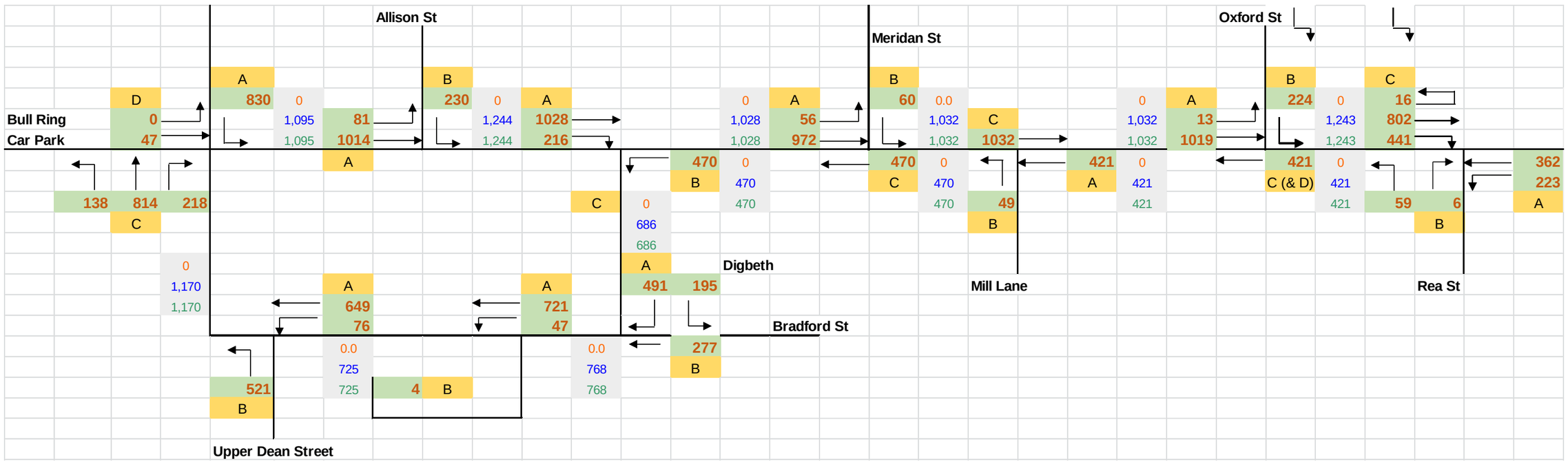
AM 2031 DS (Moat Lane Gyratory and Digbeth)



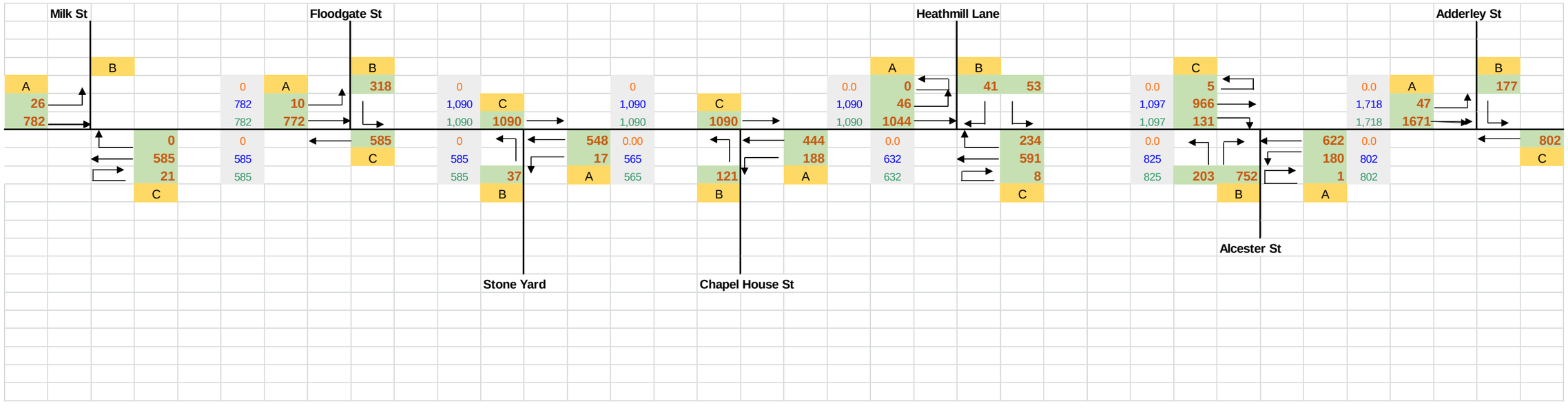
AM 2031 DS (High Street Deritend)



PM 2031 DS (Moat Lane Gyratory and Digbeth)

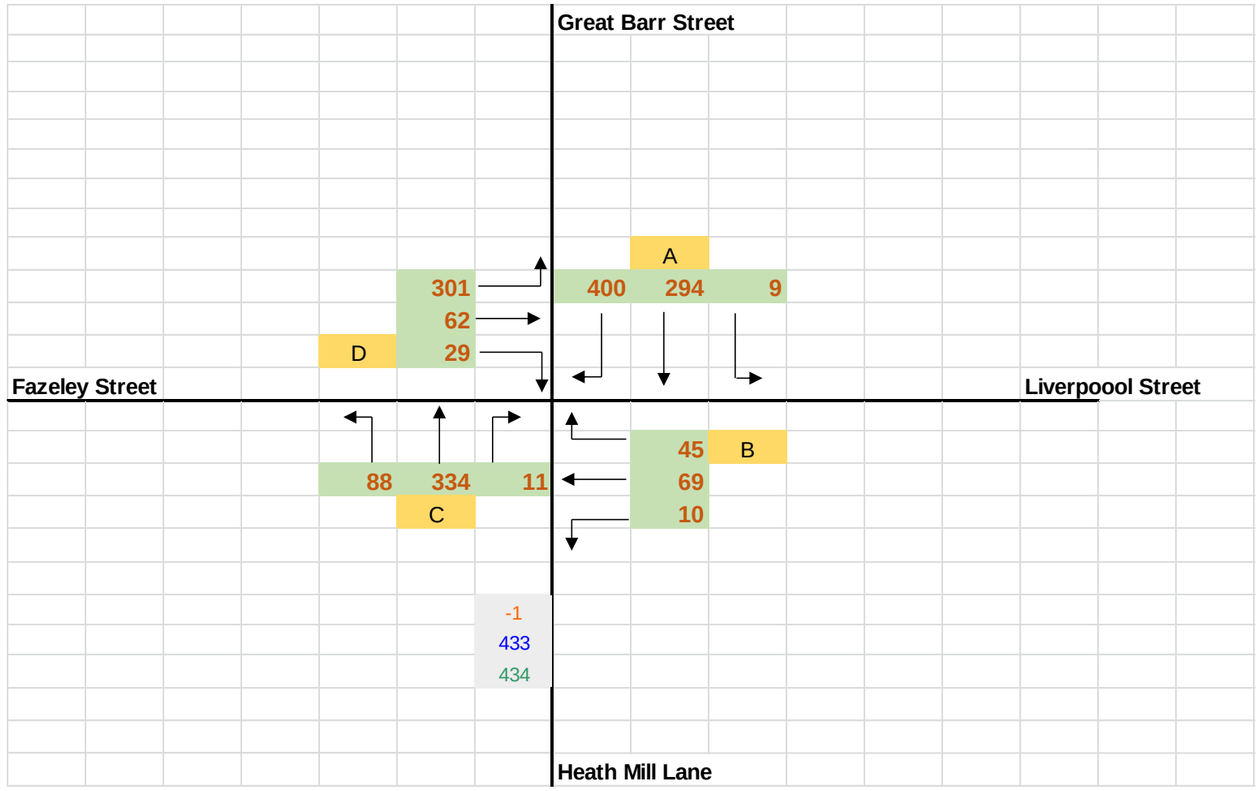


PM 2031 DS (High Street Deritend)

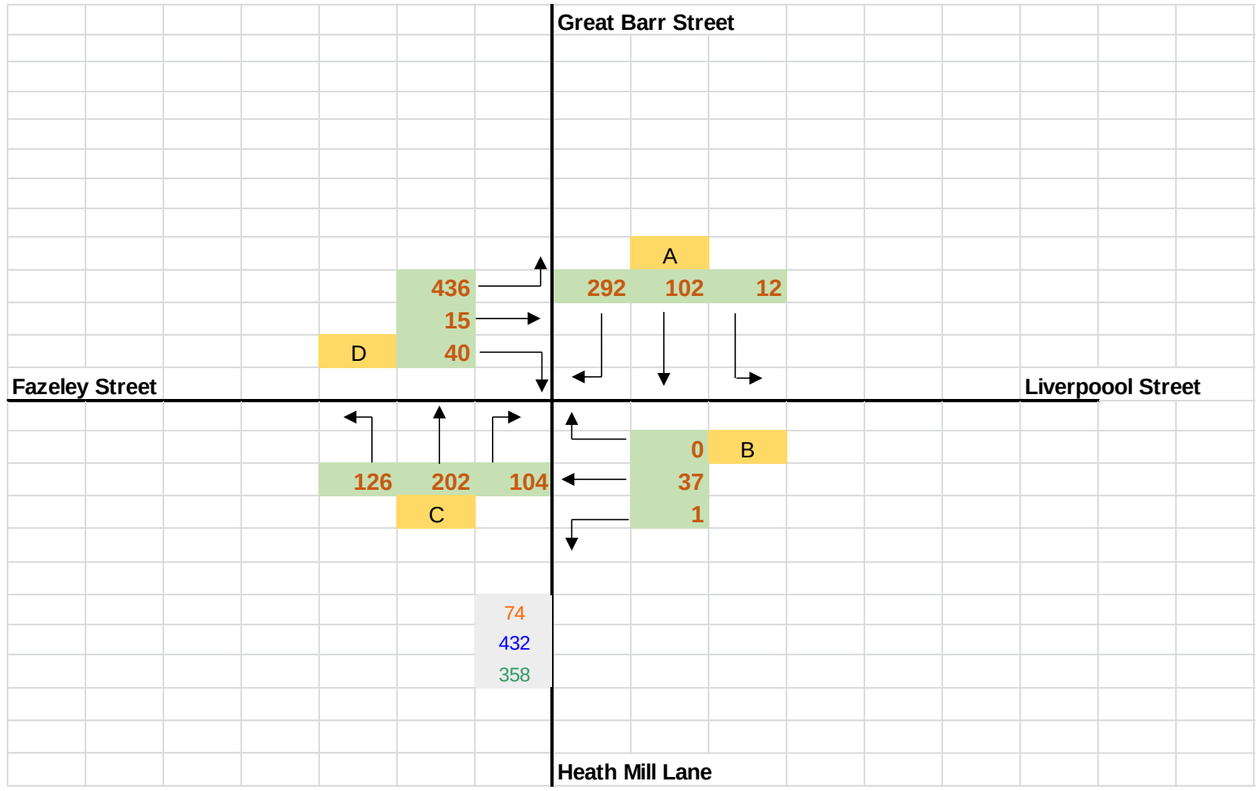


F.4.4 Off-line Junction 4 – Heath Mill Lane / Liverpool Street

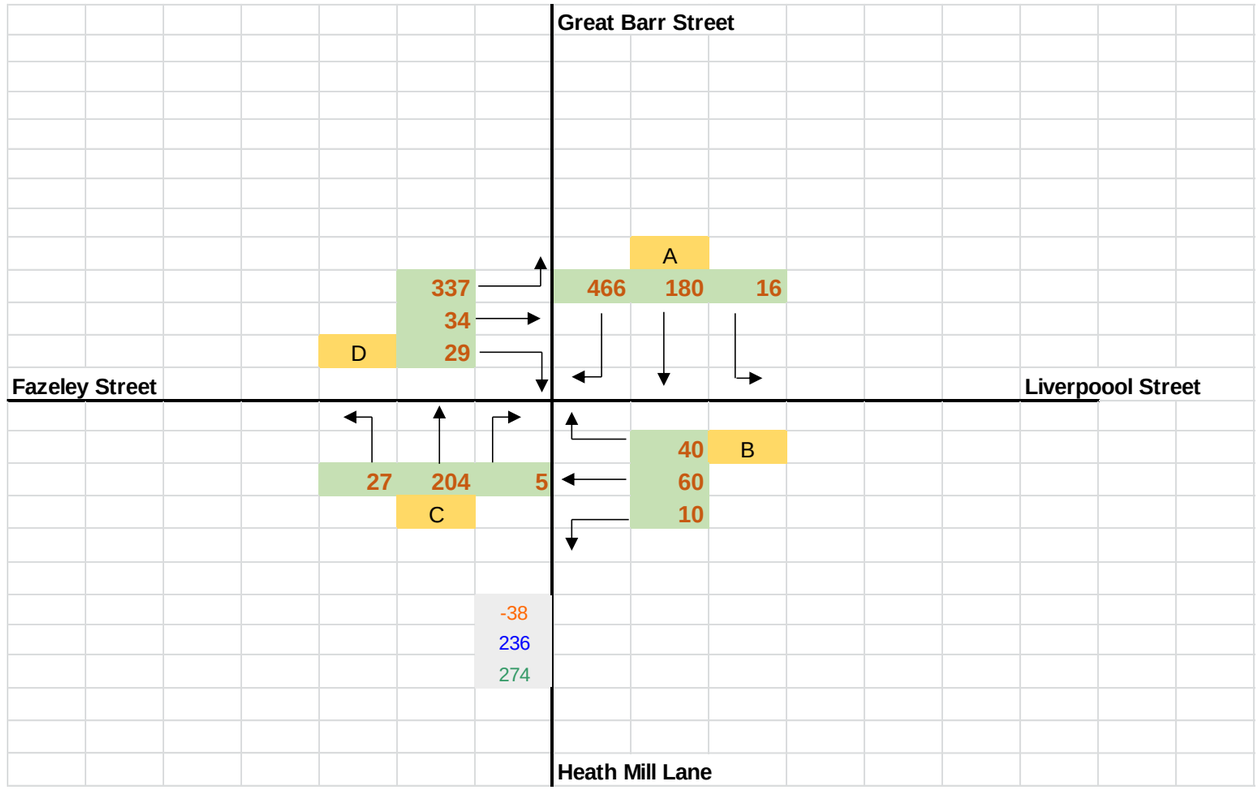
AM 2021 DS (Heath Mill Lane / Liverpool Street)



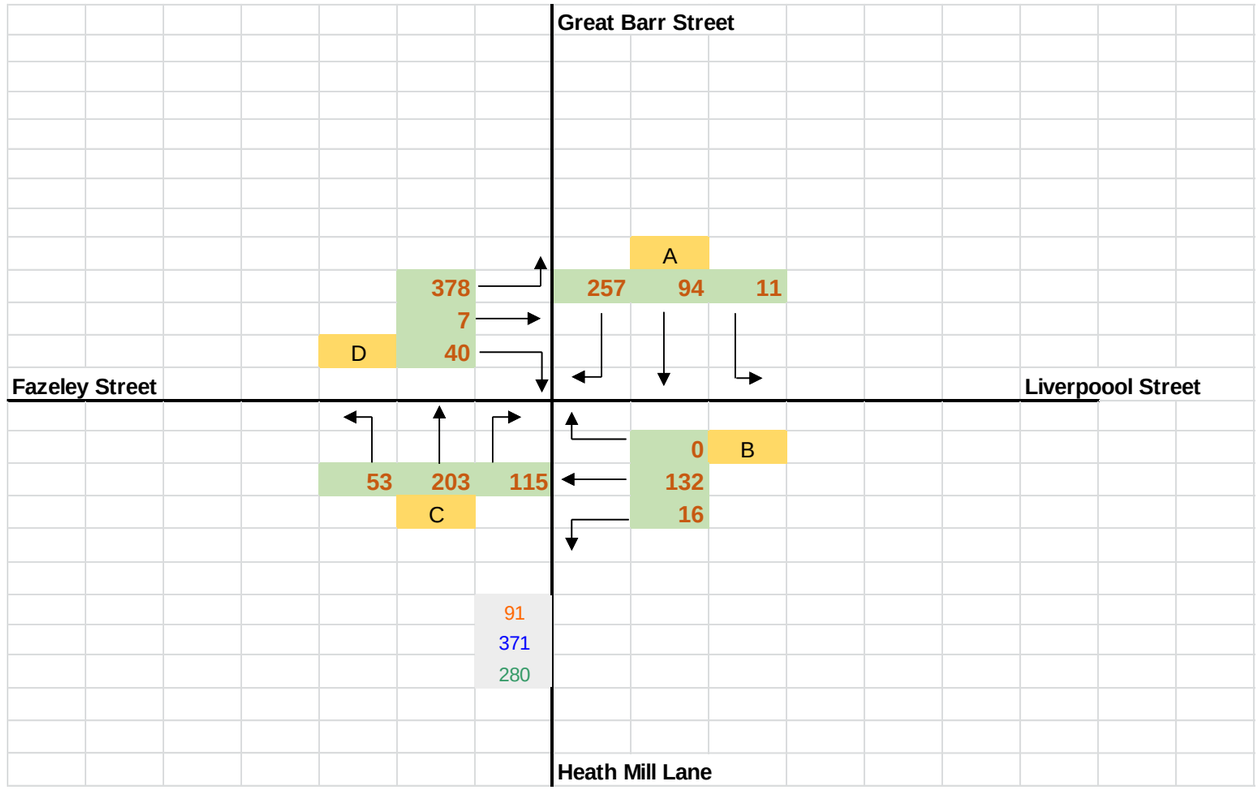
PM 2021 DS (Heath Mill Lane / Liverpool Street)



AM 2031 DS (Heath Mill Lane / Liverpool Street)



PM 2031 DS (Heath Mill Lane / Liverpool Street)



Appendix G. Bus Timetable Information

Bus Service Information

List of Operator Codes

ARR	Arriva Midlands
CEB	Central Buses
DIA	Diamond Bus
IGO	igo
JON	Johnson's Execelbus
NXWM	National Express West Midlands

Site A - Corporation Street (North)

Bus Stop	Route Number	Operator Codes	Route Description	First Bus	Last Bus	Monday to Friday			Saturday			Sunday		
						Peaks	Daytime	Evenings	Early	Daytime	Evenings	Early	Daytime	Evenings
BS6														
	98	NXWM	Birmingham - Rubery via Northfield and QE Hosp	04:55	23:30	20	20	30-60	30	20	30-60	-	30	60
	99	NXWM	Birmingham - Halesowen via Harborne and QE Hc	06:05	21:15	-	60	-	-	60	-	-	-	-
	108	DIA	Birmingham - Newhall via Tyburn Road	16:02	18:12	☎	-	-	-	-	-	-	-	-
	110	ARR	Birmingham - Tamworth via Sutton Coldfield	07:16	23:15	20	15	60	20-30	15	60	☎	30	60
	116	ARR	Tamworth - Kingsbury - Birmingham	07:30	19:20	☎	60	-	☎	60	-	-	-	-
	902	NXWM	Birmingham - Hill Hook via Sutton Coldfield	05:35	19:40	30	30	-	30	30	-	-	-	-
	904	NXWM	Birmingham - Falcon Lodge via Sutton Coldfield	05:05	01:10	15	15	20-40	30	15	20-40	60	10-60	20-60
	905	NXWM	Birmingham - Roughley via Sutton Coldfield	06:20	23:40	30	30	60	30	30	60	-	60	60
	914	NXWM	Birmingham - Sutton Coldfield	05:57	23:40	30	30	60	30	30	60	30	60	60
	X73	CEB	Tamworth - Stonydelph - Birmingham	17:16	-	☎	-	-	-	-	-	-	-	-
BS5														
	82	NXWM	Birmingham - Bearwood via Cape Hill	05:28	23:33	8-10	10	30	12-30	10	30	☎	20	30
	87	NXWM	Birmingham - Dudley via Smethwick	04:43	00:08	8-10	10	15-30	10-30	10	30	15-30	15	30
	X64	NXWM	Birmingham - Woodgate via Selly Oak	06:00	23:15	20-30	30	30-60	30	30	30-60	30-60	30	60

Site B - Bull Street

BS4														
	51	NXWM	Birmingham - Walsall	05:10	01:02	7-8	8	15-30	15	8	15-30	15-30	15	20-30
	X56	NXWM	Birmingham - Boney Hay	17:40	-	☎	-	-	-	-	-	-	-	-
BS3														
	33	NXWM	Birmingham - Pheasey via Perry Barr, Kingstanding	05:00	00:17	7-8	8	15-30	15	8	15-30	20	15	20-30
	52	NXWM	Birmingham - Perry Beeches via Perry Barr	06:20	23:07	20	20	60	60	20	60	-	60	60
	52A	NXWM	Birmingham - Booths Farm via Perry Barr	06:05	23:37	15-60	20	30	30-60	20	60	-	60	60
	907	NXWM	Birmingham - Sutton Coldfield via Perry Barr	06:25	23:55	15	20	30	20	20	30	-	30	30
	X51	NXWM	Birmingham - Walsall via Newtown	06:50	21:30	7-15	10-20	-	20-30	15	-	-	30	-
BS2														
	56	DIA	Birmingham - Brownhills West	19:30	23:30	15-30	30	-	30	30	-	-	-	-
	934	NXWM	Birmingham - Queslett Asda via Kingstanding	07:03	23:47	30	30	60	30-60	30	60	60	60	60
	935	NXWM	Birmingham - Walsall via Streetly	06:43	19:32	15-30	30	☎	30	30	☎	-	-	-
	935A	NXWM	Birmingham - Brownhills West	19:17	23:17	☎	-	60	-	-	60	☎	60	60
	936	NXWM	Birmingham - Brownhills	06:53	18:40	15-30	30	-	30	30	-	-	-	-
	997	NXWM	Walsall - Birmingham	05:57	02:00	10-20	10-30	30-60	15-30	10-30	30-60	30-60	30-60	30-60
	997E	NXWM	Pheasey - Birmingham	07:10	23:02	30-40	10	60	30	10-30	60	-	-	-

Site C - High Street (North)

BS16														
	6	NXWM	Birmingham - Solihull	05:50	00:15	6-8	6-8	15-30	15-20	6-8	20-30	30	15	20-30
	37	NXWM	Birmingham - Elmdon	04:40	00:00	4-5	5-6	15-30	10-20	5-6	15-30	3-	10	20-30

Site D - Moor Street Queensway (South)

MS8

97	NXWM	Birmingham - Chelmsley Wood via Meadway	04:36	23:51	3-5	4-5	10-30	5-10	5	10-30	15	10	30
97A	NXWM	Birmingham - Birmingham Airport via Meadway	04:06	03:06	30	30	30	30	30	30	30	30	30

MS14

33	NXWM	Birmingham - Pheasey via Perry Barr, Kingstanding			7-8	8	15-30	15	8	15-30	20	15	20-30
51	NXWM	Birmingham - Walsall	05:10	01:02	7-8	8	15-30	15	8	15-30	15-30	15	20-30
52	NXWM	Birmingham - Perry Beeches via Perry Barr	06:20	23:07	20	20	60	60	20	60	-	60	60
52A	NXWM	Birmingham - Booths Farm via Perry Barr	06:05	23:37	15-60	20	30	30-60	20	60	-	60	60
56	DIA	Birmingham - Brownhills West	19:30	23:30	15-30	30	-	30	30	-	-	-	-
907	NXWM	Birmingham - Sutton Coldfield via Perry Barr	06:25	23:55	15	20	30	20	20	30	-	30	30
907A	NXWM	Birmingham - Sutton Coldfield via Perry Barr	08:20	-	15	-	8	-	-	-	-	-	-
934	NXWM	Birmingham - Queslett Asda via Kingstanding	07:03	23:47	30	30	60	30-60	30	60	60	60	60
935	NXWM	Birmingham - Walsall via Streetly	06:43	19:32	15-30	30	☎	30	30	☎	-	-	-
935A	NXWM	Birmingham - Brownhills West	19:17	23:17	☎	-	60	-	-	60	☎	60	60
936	NXWM	Birmingham - Brownhills	06:53	18:40	15-30	30	-	30	30	-	-	-	-
997	NXWM	Walsall - Birmingham	05:57	02:00	10-20	10-30	30-60	15-30	10-30	30-60	30-60	30-60	30-60

MS15

16	NXWM	Hamstead - Birmingham via Hockley	05:04	23:00	6-7	6-8	10-30	10-15	6-8	20-30	20-60	12	30
45	NXWM	Birmingham - Longbridge via Pershore Road	05:17	01:03	7-10	12	30	20	12	30	☎	20	30
47	NXWM	Birmingham - Cofton Hackett via Pershore Road	05:02	00:33	7-10	12	30	20	12	30	☎	20	30
61	NXWM	Birmingham - Frankley via Bristol Road	04:01	00:01	8-10	10	30	10-30	10	30	30-60	15	30
63	NXWM	Birmingham - Frankley via Bristol Road	04:55	23:30	8-10	10	30	10-30	10	30	30-60	15	30
98	NXWM	Birmingham - Rubery via Queen Elizabeth Hospital	06:05	21:15	20	20	30-60	30	20	30-60	-	30	60
99	IGO	Birmingham - Halesowen via Harborne and QE Hc	06:05	21:15	20	20	60	20-30	20	60	☎	30	60
116	ARR	Tamworth - Kingsbury - Birmingham	07:30	19:20	☎	60	-	☎	60	-	-	-	-
424	IGO	Birmingham - Perry Beeches via Witton, Hamstea	10:04	14:06	60	60	-	☎	60	-	-	-	-
X64	NXWM	Birmingham - Woodgate via Selly Oak	06:00	23:15	20-30	30	30-60	30	30	30-60	30-60	30	60

MS16

2	NXWM	Birmingham - Maypole via Warstock	06:00	00:00	20	20	30	30	20	30	30-60	30	30
3	NXWM	Birmingham - Shirley via Yardley Wood	05:30	23:45	20	20	30	30	20	30	30	30	30
5	NXWM	Birmingham - Solihull via Monkspath	06:25	22:57	20	20	60	30	20	60	-	30	60
6	NXWM	Birmingham - Solihull	05:50	00:15	6-8	6-8	15-30	15-20	6-8	20-30	30	15	20-30
31	NXWM	Birmingham - Solihull	05:00	23:37	20	20	30	30	20	30	☎	30	30
37	NXWM	Birmingham - Elmdon	04:40	00:00	4-5	5-6	15-30	10-20	5-6	15-30	30	10	20-30
X20	JON	Birmingham - Stratford via Henley in Arden	07:01	19:35	☎	60	☎	☎	60	☎	☎	60	☎

Site E - Moor Street Queensway (South)

MS9

10H	IGO	Birmingham - Quinton via Harborne	08:46	15:14	-	30	-	-	30	-	-	-	-
17	NXWM	Birmingham - Tile Cross	05:37	23:55	5-7	7-8	30	10-30	7-8	30	30-60	15	30
73	NXWM	Birmingham - Solihull via Heartlands Hospital	07:11	20:05	30	30	☎	30	30	☎	-	-	-

MS12

82	NXWM	Birmingham - Bearwood via Cape Hill	05:28	23:33	8-10	10	30	12-30	10	30	20-30	15	30
87	NXWM	Birmingham - Dudley via Smethwick	04:43	00:08	-	-	-	-	-	-	-	30-45	-
110	ARR	Birmingham - Tamworth via Sutton Coldfield	07:16	23:15	20	15	60	20-30	15	60	☎	30	60
902	NXWM	Birmingham - Hill Hook via Sutton Coldfield	05:35	19:40	30	30	-	30	30	-	-	-	-
904	NXWM	Birmingham - Falcon Lodge via Sutton Coldfield	05:05	01:10	15	15	20-40	30	15	20-40	60	10-60	20-60
905	NXWM	Birmingham - Roughley via Sutton Coldfield	06:20	23:40	30	30	60	30	30	60	-	60	60
914	NXWM	Birmingham - Sutton Coldfield	05:57	23:40	30	30	60	30	30	60	30	60	60

Site F - Park Street (North)

PA1

17	NXWM	Birmingham - Tile Cross	05:37	23:55	5-7	7-8	30	10-30	7-8	30	30-60	15	30
58	NXWM	Birmingham - Solihull via Sheldon	06:03	18:38	30	30	-	30	30	-	-	-	-
59	NXWM	Birmingham - Kingshurst via Coventry Road	06:23	19:07	30	30	-	30	30	-	-	-	-
60	NXWM	Birmingham - Cranes Park via Coventry Road	04:38	00:07	15	15	20	15-30	15	20	20-60	10-20	20
73	NXWM	Birmingham - Solihull via Heartlands Hospital	07:11	20:05	30	30	☎	30	30	☎	-	-	-
97	NXWM	Birmingham - Chelmsley Wood via Meadway	04:36	23:51	3-5	4-5	10-30	5-10	5	10-30	15	10	30
97A	NXWM	Birmingham - Birmingham Airport via Meadway	04:06	03:06	30	30	30	30	30	30	30	30	30
900	NXWM	Birmingham - Coventry via Airport	04:50	00:02	15-30	15-30	30-60	15-30	15-30	30-60	30-60	30	30-60
900A	NXWM	Birmingham - Airport via Sheldon	07:50	08:20	15-30	15-30	30-60	15-30	15-30	30-60	30-60	30	30-60
957	NXWM	Birmingham - Solihull via Yardley, Sheldon	04:55	23:45	15	15	30	15-30	15	30	30	20	30

Site G - Masshouse

BT1

56	DIA	Birmingham - Brownhills West	19:30	23:30	15-30	30	-	30	30	-	-	-	-
70	NXWM	Birmingham - Solihull	05:03	23:03	30	30	60	30	30	60	-	60	60

Site H - Digbeth (West)

DS4

17	NXWM	Birmingham - Tile Cross	05:37	23:55	5-7	7-8	30	10-30	7-8	30	30-60	15	30
73	NXWM	Birmingham - Solihull via Heartlands Hospital	07:11	20:05	30	30	☎	30	30	☎	-	-	-
97	NXWM	Birmingham - Chelmsley Wood via Meadway	04:36	23:51	3-5	4-5	10-30	5-10	5	10-30	15	10	30
97A	NXWM	Birmingham - Birmingham Airport via Meadway	04:06	03:06	30	30	30	30	30	30	30	30	30

DS9

2	NXWM	Birmingham - Maypole via Warstock	06:00	00:00	20	20	30	30	20	30	30-60	30	30
3	NXWM	Birmingham - Shirley via Yardley Wood	05:30	23:45	20	20	30	30	20	30	30	30	30
5	NXWM	Birmingham - Solihull via Monkspath	06:25	22:57	20	20	60	30	20	60	-	30	60
31	NXWM	Birmingham - Solihull	05:50	00:15	20	20	30	30	20	30	☎	30	30
34	DIA	Birmingham - Kings Heath via Sparbrook	05:00	23:37	-	60	-	-	60	-	-	-	-
50	NXWM	Birmingham - Druids Heath via Moseley, Maypole	04:03	03:03	3-5	4-5	10-15	5-10	4-5	10-15	15-30	6-8	15
50A	DIA	Birmingham - Wythall via Moseley	07:45	18:33	12-15	10	☎	☎	10	-	-	15	-
150	JON	Redditch - Wythall - Birmingham	09:17	19:28	☎	60	-	☎	60	-	-	-	-
X50	JON	Redditch - Wythall - Birmingham	07:17	17:17	☎	-	-	☎	-	-	-	-	-

DS10

6	NXWM	Birmingham - Solihull	05:50	00:15	6-8	6-8	15-30	15-20	6-8	20-30	30	15	20-30
17	NXWM	Birmingham - Tile Cross	05:37	23:55	5-7	7-8	30	10-30	7-8	30	30-60	15	30
34	DIA	Birmingham - Kings Heath via Sparbrook	05:00	23:37	-	60	-	-	60	-	-	-	-
37	NXWM	Birmingham - Elmdon	04:40	00:00	4-5	5-6	15-30	10-20	5-6	15-30	30	10	20-30
58	NXWM	Birmingham - Solihull via Sheldon	06:03	18:38	30	30	-	30	30	-	-	-	-
59	NXWM	Birmingham - Kingshurst via Coventry Road	06:23	19:07	30	30	-	30	30	-	-	-	-
60	NXWM	Birmingham - Cranes Park via Coventry Road	04:38	00:07	15	15	20	15-30	15	20	20-60	10-20	20
73	NXWM	Birmingham - Solihull via Heartlands Hospital	07:11	20:05	30	30	☎	30	30	☎	-	-	-
97	NXWM	Birmingham - Chelmsley Wood via Meadway	04:36	23:51	3-5	4-5	10-30	5-10	5	10-30	15	10	30
97A	NXWM	Birmingham - Birmingham Airport via Meadway	04:06	03:06	30	30	30	30	30	30	30	30	30
900	NXWM	Birmingham - Coventry via Airport	04:50	00:02	15-30	15-30	30-60	15-30	15-30	30-60	30-60	30	30-60
957	NXWM	Birmingham - Solihull via Yardley, Sheldon	04:55	23:45	15	15	30	15-30	15	30	30	20	30
X20	JON	Birmingham - Stratford via Henley in Arden	07:01	19:35	☎	60	☎	☎	60	☎	☎	60	☎

DS6

58	NXWM Birmingham - Solihull via Sheldon	06:03	18:38	30	30	-	30	30	-	-	-	-
59	NXWM Birmingham - Kingshurst via Coventry Road	06:23	19:07	30	30	-	30	30	-	-	-	-
60	NXWM Birmingham - Cranes Park via Coventry Road	04:38	00:07	15	15	20	15-30	15	20	20-60	10-20	20
900	NXWM Birmingham - Coventry via Airport	04:50	00:02	15-30	15-30	30-60	15-30	15-30	30-60	30-60	30	30-60
900A	NXWM Birmingham - Airport via Sheldon	07:50	08:20	15-30	15-30	30-60	15-30	15-30	30-60	30-60	30	30-60
957	NXWM Birmingham - Solihull via Yardley, Sheldon	04:55	23:45	15	15	30	15-30	15	30	30	20	30

Site I - High Street Deritend

adj Gibb Street

6	NXWM Birmingham - Solihull	05:50	00:15	6-8	6-8	15-30	15-20	6-8	20-30	30	15	20-30
17	NXWM Birmingham - Tile Cross	05:37	23:55	5-7	7-8	30	10-30	7-8	30	30-60	15	30
34	NXWM Birmingham - Kings Heath via Sparbrook	05:00	23:37	-	60	-	-	60	-	-	-	-
37	NXWM Birmingham - Elmdon	04:40	00:00	4-5	5-6	15-30	10-20	5-6	15-30	30	10	20-30
58	NXWM Birmingham - Solihull via Sheldon	06:03	18:38	30	30	-	30	30	-	-	-	-
59	NXWM Birmingham - Kingshurst via Coventry Road	06:23	19:07	30	30	-	30	30	-	-	-	-
60	NXWM Birmingham - Cranes Park via Coventry Road	04:38	00:07	15	15	20	15-30	15	20	20-60	10-20	20
73	NXWM Birmingham - Solihull via Heartlands Hospital	07:11	20:05	30	30	☎	30	30	☎	-	-	-
97	NXWM Birmingham - Chelmsley Wood via Meadway	04:36	23:51	3-5	4-5	10-30	5-10	5	10-30	15	10	30
97A	NXWM Birmingham - Birmingham Airport via Meadway	04:06	03:06	30	30	30	30	30	30	30	30	30
900A	NXWM Birmingham - Airport via Sheldon	07:50	08:20	15-30	15-30	30-60	15-30	15-30	30-60	30-60	30	30-60

opp Gibb Street

6	NXWM Birmingham - Solihull	05:50	00:15	6-8	6-8	15-30	15-20	6-8	20-30	30	15	20-30
17	NXWM Birmingham - Tile Cross	05:37	23:55	5-7	7-8	30	10-30	7-8	30	30-60	15	30
37	NXWM Birmingham - Elmdon	04:40	00:00	4-5	5-6	15-30	10-20	5-6	15-30	30	10	20-30
58	NXWM Birmingham - Solihull via Sheldon	06:03	18:38	30	30	-	30	30	-	-	-	-
59	NXWM Birmingham - Kingshurst via Coventry Road	06:23	19:07	30	30	-	30	30	-	-	-	-
60	NXWM Birmingham - Cranes Park via Coventry Road	04:38	00:07	15	15	20	15-30	15	20	20-60	10-20	20
73	NXWM Birmingham - Solihull via Heartlands Hospital	07:11	20:05	30	30	☎	30	30	☎	-	-	-
97	NXWM Birmingham - Chelmsley Wood via Meadway	04:36	23:51	3-5	4-5	10-30	5-10	5	10-30	15	10	30
97A	NXWM Birmingham - Birmingham Airport via Meadway	04:06	03:06	30	30	30	30	30	30	30	30	30

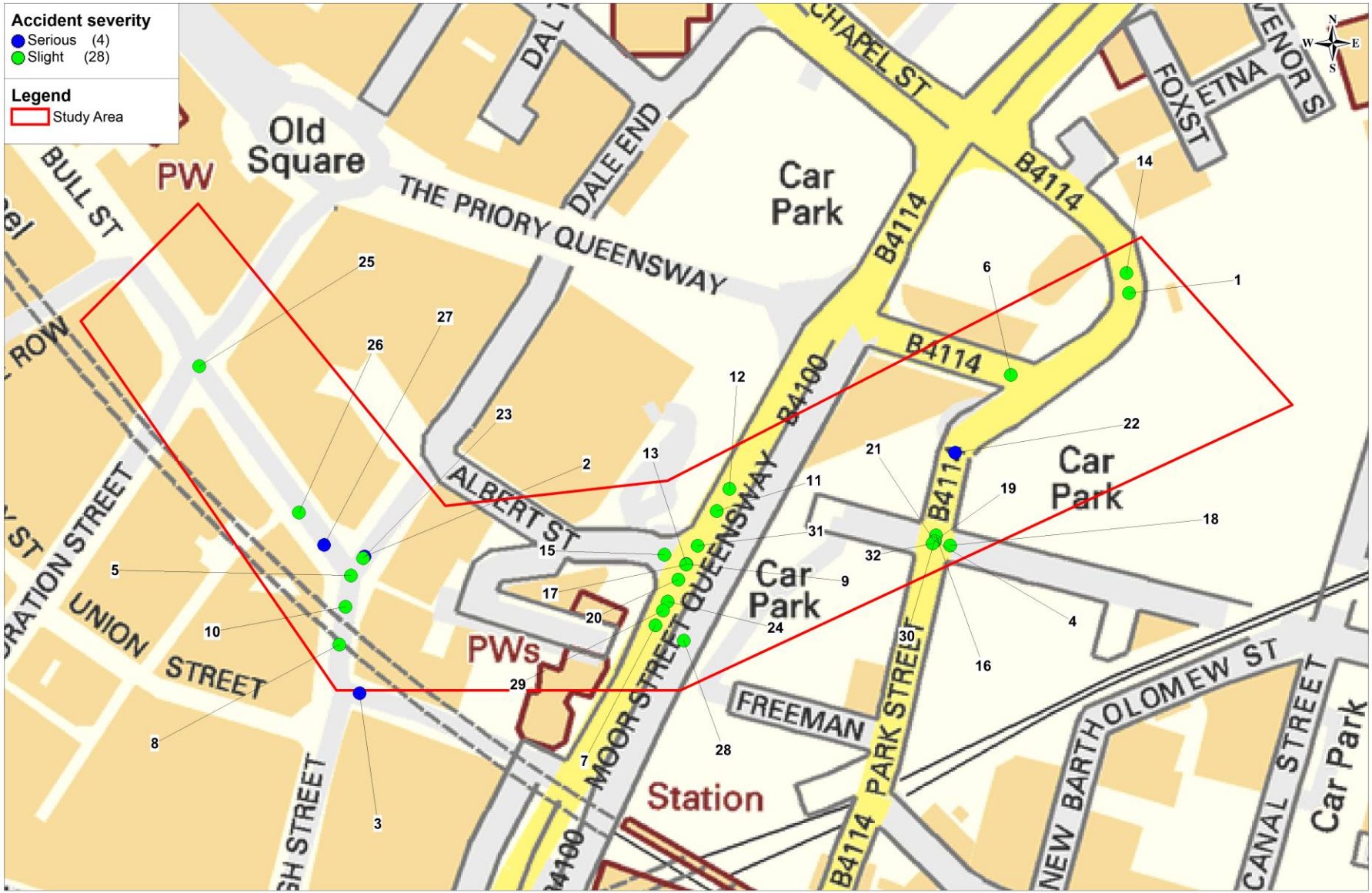
Appendix H. Parking Beat Survey Results

Time Period	New Canal Street between Curzon Street and Banbury Street			New Canal Street between Banbury Street and Fazeley Street			New Canal Street between Fazeley Street and Bordesley Street			Meriden Street between Bordesley Street and Coventry Street			Meriden Street between Coventry Street and High Street		
	Clear (metres)	Single Yellow (metres)	Double Yellow (metres)	Clear (metres)	Single Yellow (metres)	Double Yellow (metres)	Clear (metres)	Single Yellow (metres)	Double Yellow (metres)	Clear (metres)	Single Yellow (metres)	Double Yellow (metres)	Clear (metres)	Single Yellow (metres)	Double Yellow (metres)
	0	81	141	0	86	100	0	97	259	0	90	172	0	0	272
07:00	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1
08:00	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1
09:00	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0
10:00	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0
11:00	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0
12:00	0	0	0	0	0	0	0	1	0	0	5	0	0	0	1
13:00	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0
14:00	0	0	0	0	0	0	0	1	0	0	3	0	0	0	1
15:00	0	0	1	0	0	0	0	0	0	0	5	0	0	0	2
16:00	0	0	0	0	0	0	0	0	0	0	4	0	0	0	2
17:00	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0
18:00	0	0	0	0	0	0	0	0	0	0	3	0	0	0	2
Total	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**2**	**0**	**0**	**48**	**0**	**0**	**0**	**10**

Time Period	Summary (all locations)		
	Clear (metres)	Single Yellow (metres)	Double Yellow (metres)
	0	354	944
07:00	0	2	1
08:00	0	2	1
09:00	0	6	0
10:00	0	6	0
11:00	0	7	0
12:00	0	6	1
13:00	0	3	0
14:00	0	4	1
15:00	0	5	3
16:00	0	4	2
17:00	0	3	0
18:00	0	3	2
Total	0	51	11

Appendix I. Accident Data

Area 1 Accidents 2011 - 2015



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MOTT MACDONALD

(Accident Date Between 01/01/2011 and 31/12/2015)

Acc Ref	Severity	Num Vehicles	Num Casualties	Date	Day	Time	1st Road	2nd Road	Lighting	Weather	Ped	CPed	PCyc	P2W	Cause 1	Veh 1 Compass	Veh 2 Compass
1	Slight	1	1	Fri 3/2011	Friday	1845	Jennens Road	ALBERT STREET	Darkness: street lights present and lit	Fine without high winds	0	0	0	0	Other	16	
2	Serious	1	1	Mon 3/2011	Monday	1349	Dale End	BULL STREET AND HIGH STREET	Daylight: street lights present	Fine without high winds	1	0	0	0	Failed to look properly	82	
3	Serious	1	1	Mon 11/2011	Monday	1530	Carrs Lane	HIGH STREET	Daylight: street lights present	Fine without high winds	1	0	0	0	Disobeyed automatic traffic signal	13	
4	Slight	2	1	Mon 11/2011	Monday	1550	Park Street	SEYMOUR STREET AND FAZELEY STREET	Daylight: street lighting unknown	Fine without high winds	0	0	0	0	Failed to look properly	37	15
5	Slight	1	1	Mon 7/2012	Monday	1719	Dale End	BULL STREET AND HIGH STREET	Daylight: street lights present	Fine without high winds	1	0	0	0	Failed to judge vehicles path or speed	52	
6	Slight	2	1	Wed 10/2012	Wednesday	1230	Masshouse Lane	PARK STREET	Daylight: street lights present	Fine without high winds	0	0	1	1	Vehicle travelling along pavement	37	17
7	Slight	1	1	Mon 12/2012	Monday	1600	Moor Street Queensway	ALBERT STREET	Daylight: street lights present	Fine without high winds	1	0	0	0	Careless or Reckless or In a hurry	62	
8	Slight	1	1	Tue 12/2012	Tuesday	1230	High Street	CARRS LANE	Daylight: no street lighting	Fine without high winds	1	0	0	0	Poor turn or manoeuvre	15	
9	Slight	2	1	Fri 12/2012	Friday	1620	Moor Street Queensway	ALBERT STREET	Darkness: street lights present and lit	Other	0	0	0	0	Poor turn or manoeuvre	86	62
10	Slight	1	1	Fri 1/2013	Friday	1820	High Street	BULL STREET AND DALE END	Darkness: street lights present and lit	Fine without high winds	1	0	0	0	Poor turn or manoeuvre	15	

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11	Slight	1	1	Sun 2/2013	Sunday	1315	Moor Street Queensway	ALBERT STREET	Daylight: street lights present	Raining with high winds	1	0	0	0	Failed to look properly	62	
12	Slight	1	1	Sat 2/2013	Saturday	1925	Moor Street Queensway	ALBERT STREET	Darkness: street lights present and lit	Fine without high winds	1	0	0	0	Failed to look properly	62	
13	Slight	2	2	Sat 4/2013	Saturday	1640	Moor Street Queensway	ALBERT STREET	Daylight: street lights present	Fine without high winds	0	0	0	0	Failed to look properly	72	62
14	Slight	2	1	Fri 5/2013	Friday	946	Park Street	ALBERT STREET	Daylight: street lights present	Fine without high winds	0	0	1	1	Failed to signal or Misleading signal	15	15
15	Slight	2	1	Thu 6/2013	Thursday	1800	Albert Street	MOOR STREET QUEENSWAY	Daylight: street lights present	Unknown	0	0	1	1	Poor turn or manoeuvre	75	75
16	Slight	2	1	Mon 7/2013	Monday	1400	Park Street	SEYMOUR STREET AND FAZELEY STREET	Daylight: street lights present	Fine without high winds	0	0	0	0	Poor turn or manoeuvre	17	15
17	Slight	2	1	Sun 10/2013	Sunday	655	Moor Street Queensway	ALBERT STREET	Darkness: street lights present and lit	Fine without high winds	0	0	0	1	Poor turn or manoeuvre	62	62
18	Slight	2	1	Tue 11/2013	Tuesday	1309	Fazeley Street	SEYMOUR STREET AND PARK STREET	Daylight: street lights present	Unknown	0	0	0	0	Careless or Reckless or In a hurry	53	35
19	Slight	2	1	Fri 2/2014	Friday	1015	Park Street	SEYMOUR STREET AND FAZELEY STREET	Daylight: street lights present	Fine without high winds	0	0	0	0	Failed to look properly	37	15
20	Slight	2	2	Sat 5/2014	Saturday	1710	Moor Street Queensway	ALBERT STREET	Daylight: street lights present	Fine without high winds	0	0	0	0	Other	62	62
21	Slight	2	6	Sat 8/2014	Saturday	823	Park Street	SEYMOUR STREET AND	Daylight: street lights present	Fine without high winds	0	0	0	0	Disobeyed Give Way or Stop	73	15

								FAZELEY STREET						sign or markings			
22	Serious	1	1	Sat 9/2014	Saturday	115	Park Street	SEYMOUR STREET AND FAZELEY STREET	Darkness: street lights present and lit	Fine without high winds	0	0	0	0	Exceeding speed limit	25	
23	Slight	1	1	Sun 9/2014	Sunday	2130	Dale End	BULL STREET AND HIGH STREET	Darkness: street lights present and lit	Fine without high winds	1	0	0	0	Other	62	
24	Slight	1	1	Mon 1/2015	Monday	1245	Moor Street Queensway	ALBERT STREET	Daylight: street lights present	Fine with high winds	0	0	0	0	Failed to look properly	60	
25	Slight	2	1	Thu 3/2015	Thursday	1625	Corporation Street	BULL STREET	Daylight: street lights present	Fine without high winds	0	0	1	1	Junction overshoot	14	42
26	Slight	1	1	Fri 4/2015	Friday	1630	Bull Street	DALE END AND HIGH STREET	Daylight: street lights present	Fine without high winds	1	1	0	0	Other	84	
27	Serious	1	2	Fri 5/2015	Friday	1210	Bull Street	DALE END AND HIGH STREET	Daylight: street lights present	Fine without high winds	2	0	0	0	Failed to look properly	48	
28	Slight	1	1	Tue 7/2015	Tuesday	1	Moor Street Queensway	ALBERT STREET	Darkness: street lights present and lit	Fine without high winds	1	0	0	0	Stationary or parked vehicle(s)	26	
29	Slight	1	1	Wed 8/2015	Wednesday	930	Moor Street Queensway	ALBERT STREET	Daylight: street lights present	Fine without high winds	1	0	0	0	Crossed road masked by stationary or parked vehicle	62	
30	Slight	2	1	Tue 9/2015	Tuesday	1515	Park Street	SEYMOUR STREET AND FAZELEY STREET	Daylight: street lights present	Raining without high winds	0	0	0	0	Failed to look properly	15	17
31	Slight	1	1	Fri 9/2015	Friday	1646	Moor Street Queensway	ALBERT STREET	Daylight: street lights present	Fine without high winds	1	0	0	0	Crossed road masked by stationary or parked vehicle	62	

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32	Slight	1	1	Wed 12/2015	4	2030	PARK STREET UNSPECIFIED ROAD OR LOCATION FAZELEYS		Darkness: street lights present and lit	Fine without high winds	0	0	0	1		46

Area 2 Accidents 2011 - 2015



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(Accident Date Between 01/01/2011 and 31/12/2015)

Acc Ref	Severity	Num Vehicles	Num Casualties	Date	Day	Time	1st Road	2nd Road	Lighting	Weather	Ped	CPed	PCyc	P2W	Cause 1	Veh 1 Compass	Veh 2 Compass
1	Slight	3	4	Fri 4/2011	Friday	2030	New Canal Street	BORDESLEY STREET AND MERIDEN STREET	Darkness: street lights present and lit	Fine without high winds	0	0	0	0	Disobeyed Give Way or Stop sign or markings	84	51
2	Slight	2	2	Wed 6/2011	Wednesday	1943	New Canal Street	FAZELEY STREET	Daylight: street lights present	Fine without high winds	0	0	0	0	Disobeyed automatic traffic signal	37	51
3	Serious	2	3	Tue 11/2011	Tuesday	952	Coventry Street	MERIDEN STREET	Daylight: street lights present	Fine without high winds	0	0	0	0	Slippery road (due to weather)	26	37
4	Slight	2	1	Fri 12/2011	Friday	1510	Meriden Street	COVENTRY STREET	Daylight: street lights present	Raining without high winds	0	0	0	0	Failed to look properly	84	26
5	Slight	2	6	Sat 4/2013	Saturday	1642	New Canal Street	MERIDEN STREET AND BORDESLEY STREET	Daylight: street lights present	Fine without high winds	0	0	0	0	Junction overshoot	84	51
6	Slight	2	4	Sat 8/2013	Saturday	2250	New Canal Street	MERIDEN STREET AND BORDESLEY STREET	Darkness: street lights present and lit	Fine without high winds	0	0	0	0	Disobeyed Give Way or Stop sign or markings	84	51
7	Slight	2	1	Tue 9/2013	Tuesday	1730	Bordesley Street	MERIDEN STREET AND NEW CANAL STREET	Daylight: street lights present	Fine without high winds	0	0	0	0	Poor turn or manoeuvre	84	40
8	Slight	2	2	Mon 9/2013	Monday	12	New Canal Street	BORDESLEY STREET AND MERIDEN STREET	Darkness: street lights present and lit	Fine without high winds	0	0	0	0	Careless or Reckless or In a hurry	81	51
9	Slight	3	1	Mon 10/2013	Monday	758	New Canal Street	MERIDEN STREET	Daylight: street lights	Raining without high	0	0	0	0	Slippery road (due	84	51

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								AND BORDESLEY STREET	present	winds					to weather)		
10	Slight	2	2	Mon 10/2013	Monday	1730	New Canal Street	MERIDEN STREET AND BORDESLEY STREET	Darkness: street lights present and lit	Raining without high winds	0	0	0	0	Junction overshoot	84	15
11	Slight	4	1	Mon 11/2013	Monday	1240	New Canal Street	MERIDEN STREET AND BORDESLEY STREET	Daylight: street lights present	Raining without high winds	0	0	0	0	Impaired by alcohol	48	51
12	Serious	2	1	Thu 12/2013	Thursday	1415	Meriden Street	COVENTRY STREET	Daylight: street lights present	Raining with high winds	0	0	0	0	Junction overshoot	48	62
13	Slight	2	1	Sun 3/2014	Sunday	1730	New Canal Street	MERIDEN STREET AND BORDESLEY STREET	Darkness: street lights present and lit	Raining without high winds	0	0	0	0	Disobeyed Give Way or Stop sign or markings	84	15
14	Slight	2	2	Sun 9/2014	Sunday	1750	New Canal Street	MERIDEN STREET AND BORDESLEY STREET	Daylight: street lights present	Fine without high winds	0	0	0	0	Junction overshoot	74	15
15	Slight	2	1	Wed 11/2014	Wednesday	2055	Bordesley Street	MERIDEN STREET AND NEW CANAL STREET	Darkness: street lights present and lit	Fine without high winds	0	0	1	1	Junction overshoot	84	51
16	Slight	3	2	Wed 12/2014	Wednesday	1455	New Canal Street	MERIDEN STREET AND BORDESLEY STREET	Daylight: street lights present	Fine without high winds	0	0	0	0	Junction overshoot	81	51
17	Slight	2	2	Sat 2/2015	Saturday	1309	Bordesley Street	MERIDEN STREET AND NEW	Daylight: street lights present	Fine without high winds	0	0	0	0	Other	74	15

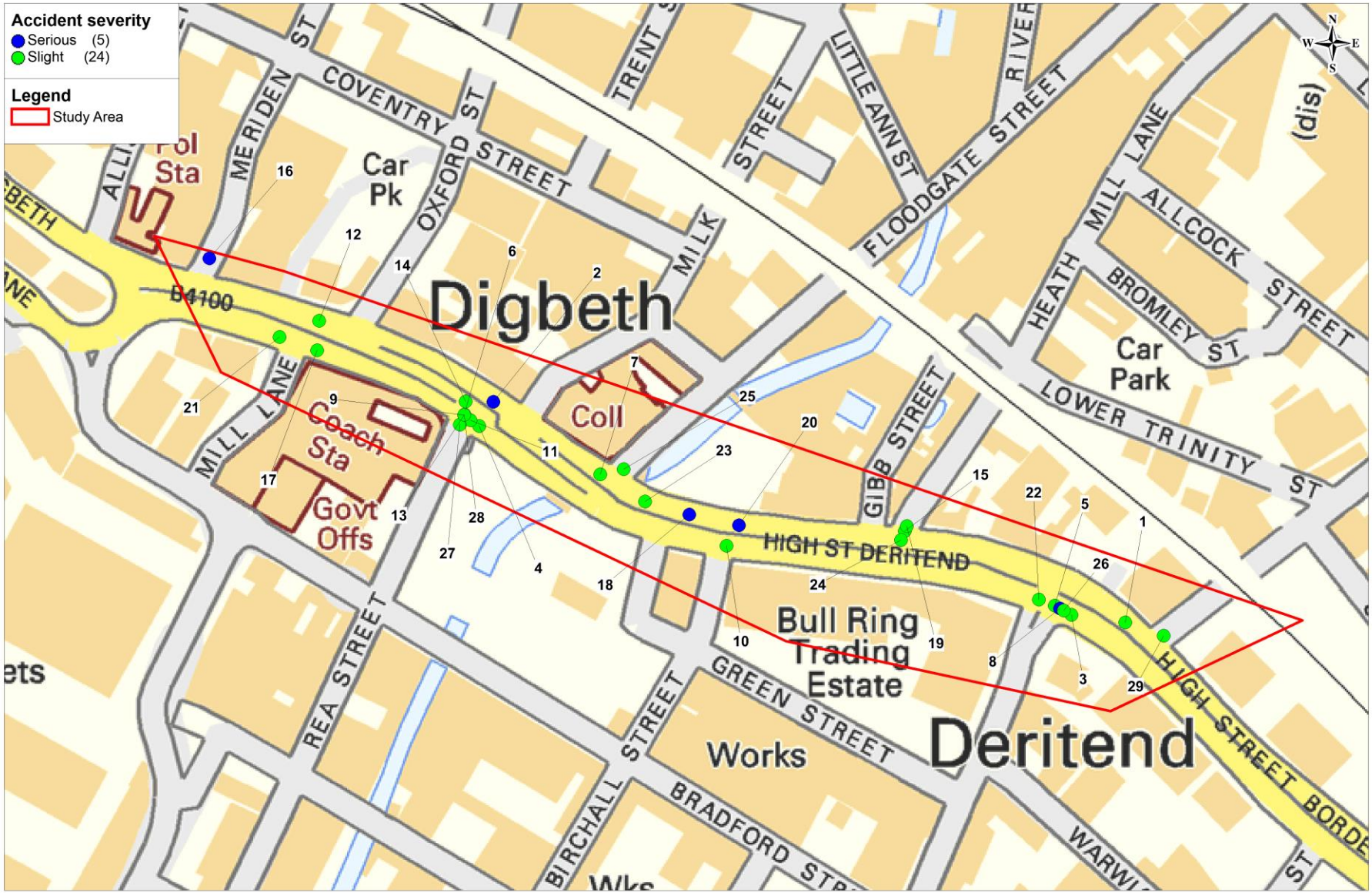
								CANAL STREET									
18	Slight	2	4	Mon 2/2015	Monday	1755	New Canal Street	MERIDEN STREET AND BORDESLEY STREET	Darkness: street lights present and lit	Raining without high winds	0	0	0	0	Slippery road (due to weather)	48	15
19	Slight	2	1	Sun 3/2015	Sunday	2040	Fazeley Street	NEW CANAL STREET	Darkness: street lights present and lit	Fine without high winds	0	0	0	0	Road layout (e.g. bend, hill, narrow carriageway)	73	51
20	Slight	3	1	Tue 3/2015	Tuesday	1600	Meriden Street	BORDESLEY STREET AND NEW CANAL STREET	Daylight: street lights present	Fine without high winds	0	0	0	0	Junction overshoot	84	62
21	Serious	2	5	Wed 4/2015	Wednesday	1236	Meriden Street	BORDESLEY STREET AND NEW CANAL STREET	Daylight: street lights present	Fine without high winds	0	0	0	0	Distraction outside vehicle	84	15
22	Slight	2	1	Thu 5/2015	Thursday	1750	New Canal Street	MERIDEN STREET AND BORDESLEY STREET	Daylight: street lights present	Fine without high winds	0	0	0	0	Poor turn or manoeuvre	18	51

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Area 3 Accidents 2011 - 2015



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MOTT MACDONALD

(Accident Date Between 01/01/2011 and 31/12/2015)

Acc Ref	Severity	Num Vehicles	Num Casualties	Date	Day	Time	1st Road	2nd Road	Lighting	Weather	Ped	CPed	PCyc	P2W	Cause 1	Veh 1 Compass	Veh 2 Compass
1	Slight	2	2	Wed 6/2011	Wednesday	1740	High Street Bordesley	ADDERLEY STREET	Daylight: street lights present	Fine without high winds	0	0	0	0	Poor turn or manoeuvre	84	84
2	Serious	1	1	Sat 6/2011	Saturday	3	Digbeth	HIGH STREET DERITEND AND MILK STREET	Darkness: street lights present and lit	Raining without high winds	1	0	0	0	Failed to judge vehicles path or speed	84	
3	Slight	1	1	Sun 6/2011	Sunday	1320	High Street Bordesley	ALCESTER STREET	Daylight: street lights present	Fine without high winds	1	0	0	0	Crossed road masked by stationary or parked vehicle	48	
4	Slight	5	1	Thu 9/2011	Thursday	1806	Digbeth	REA STREET	Daylight: street lights present	Fine without high winds	0	0	0	0	Aggressive driving	48	48
5	Slight	3	1	Mon 10/2011	Monday	1848	High Street Bordesley	ALCESTER STREET	Daylight: street lights present	Fine without high winds	0	0	0	0	Junction overshoot	47	86
6	Slight	1	1	Fri 11/2011	Friday	2220	Digbeth	REA STREET	Darkness: street lights present and lit	Raining without high winds	1	0	0	0	Dangerous action in carriageway (e.g. playing)	16	
7	Slight	2	1	Tue 8/2012	Tuesday	1412	High Street Deritend	FLOODGATE STREET	Daylight: street lights present	Fine without high winds	0	0	0	0	Failed to look properly	84	82
8	Serious	1	1	Fri 2/2013	Friday	1935	High Street Bordesley	ALCESTER STREET	Darkness: street lights present and lit	Fine without high winds	1	1	0	0	Failed to look properly	37	
9	Slight	2	1	Fri 4/2013	Friday	721	Digbeth	REA STREET	Daylight: street lights present	Raining without high winds	0	0	1	1	Failed to judge other persons path or speed	46	48
10	Slight	2	1	Fri 4/2013	Friday	1125	High Street Deritend	CHAPEL HOUSE STREET	Daylight: street lights present	Unknown	0	0	0	0	Careless or Reckless or In a hurry	35	37

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11	Slight	1	1	Fri 5/2013	Friday	21	Digbeth	REA STREET	Darkness: street lights present and lit	Fine without high winds	0	0	0	0	Exceeding speed limit	46	
12	Slight	2	1	Wed 6/2013	Wednesday	1720	Digbeth	OXFORD STREET	Daylight: street lights present	Fine without high winds	0	0	1	1	Failed to look properly	73	25
13	Slight	3	1	Wed 9/2013	Wednesday	1615	Digbeth	REA STREET	Daylight: street lights present	Raining without high winds	0	0	0	0	Slippery road (due to weather)	86	48
14	Slight	1	1	Tue 1/2014	Tuesday	1111	Digbeth	REA STREET	Daylight: street lights present	Fine without high winds	0	0	0	0	Other	85	
15	Slight	1	1	Sat 2/2014	Saturday	1826	Heath Mill Lane	HIGH STREET DERITEND	Darkness: street lights present and lit	Raining with high winds	1	0	0	0	Slippery road (due to weather)	72	
16	Serious	1	1	Sun 2/2014	Sunday	300	Meriden Street	DIGBETH	Darkness: street lights present and lit	Unknown	1	0	0	0	Vehicle travelling along pavement	72	
17	Slight	1	1	Tue 3/2014	Tuesday	1042	Digbeth	MILL LANE	Daylight: street lights present	Fine without high winds	1	0	0	0	Crossed road masked by stationary or parked vehicle	37	
18	Serious	2	2	Sat 4/2014	Saturday	305	High Street Deritend	FLOODGATE STREET	Darkness: street lights present and lit	Fine without high winds	0	0	0	0	Other	37	73
19	Slight	3	5	Sat 4/2014	Saturday	506	Heath Mill Lane	HIGH STREET DERITEND	Daylight: street lights present	Raining without high winds	0	0	0	0	Other	72	25
20	Serious	2	1	Sat 7/2014	Saturday	1320	High Street Deritend	GIBB STREET	Daylight: street lights present	Fine without high winds	0	0	0	0	Failed to look properly	73	73
21	Slight	2	1	Wed 10/2014	Wednesday	1746	Digbeth	MILL LANE	Daylight: street lights present	Raining without high winds	0	0	1	1	Slippery road (due to weather)	37	57
22	Slight	2	2	Fri 10/2014	Friday	2120	High Street Deritend	ALCESTER STREET AND HIGH STREET BORDESL	Darkness: street lights present and lit	Fine without high winds	0	0	0	0	Impaired by alcohol	54	48

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23	Slight	1	1	Sun 10/2014	Sunday	154	High Street Deritend	FLOODGATE STREET	Darkness: street lights present and lit	Fine without high winds	1	0	0	0	Wrong use of pedestrian crossing facility	83	
24	Slight	2	1	Sat 2/2015	Saturday	2128	High Street Deritend	HEATH MILL LANE	Darkness: street lights present and lit	Fine without high winds	0	0	0	0	Poor turn or manoeuvre	72	73
25	Slight	1	1	Tue 3/2015	Tuesday	1230	Floodgate Street	HIGH STREET DERITEND	Daylight: street lights present	Fine with high winds	1	0	0	0	Failed to look properly	24	
26	Slight	2	1	Thu 3/2015	Thursday	1813	High Street Bordesley	ALCESTER STREET	Daylight: street lights present	Fine without high winds	0	0	0	0	Failed to judge other persons path or speed	48	47
27	Slight	1	1	Mon 3/2015	Monday	1755	Rea Street	DIGBETH	Daylight: street lights present	Unknown	1	0	0	0	Other	46	
28	Slight	2	2	Mon 7/2015	Monday	1536	Digbeth	REA STREET	Daylight: street lights present	Fine without high winds	0	0	0	0	Disobeyed automatic traffic signal	48	86
29	Slight	1	1	Sun 7/2015	Sunday	115	Adderley Street	HIGH STREET BORDESLEY	Darkness: street lights present and lit	Fine without high winds	1	0	0	0	Poor turn or manoeuvre	62	

Area OS1 Accidents 2011 - 2015



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(Accident Date Between 01/01/2011 and 31/12/2015)

Acc Ref	Severity	Num Vehicles	Num Casualties	Date	Day	Time	1st Road	2nd Road	Lighting	Weather	Ped	CPed	PCyc	P2W	Cause 1	Veh 1 Compass	Veh 2 Compass
1	Slight	2	2	Sat 3/2011	Saturday	1132	Moor Street Queensway	MASSHOUSE LANE	Daylight: street lights present	Fine without high winds	0	0	0	0	Disobeyed automatic traffic signal	62	38
2	Slight	1	1	Sat 5/2011	Saturday	1116	Jennens Road	MOOR STREET QUEENSWAY	Daylight: street lights present	Raining without high winds	0	0	0	0	Illness or disability, mental or physical	62	
3	Slight	2	1	Fri 7/2011	Friday	1030	Jennens Road	CHAPEL STREET	Daylight: street lights present	Fine without high winds	0	0	0	0	Failed to look properly	62	64
4	Serious	2	1	Sun 8/2011	Sunday	2129	Jennens Road	CHAPEL STREET	Darkness: street lights present and lit	Fine without high winds	0	0	0	0	Failed to look properly	84	26
5	Slight	2	1	Fri 11/2011	Friday	2225	Jennens Road	MOOR STREET QUEENSWAY AND PARK STREET	Darkness: street lights present and lit	Raining without high winds	0	0	0	0	Disobeyed automatic traffic signal	62	84
6	Slight	2	1	Tue 12/2011	Tuesday	1320	Moor Stret Queensway	CHAPEL STREET AND PARK STREET AND JENNENS ROAD	Daylight: street lights present	Fine without high winds	0	0	0	0	Disobeyed automatic traffic signal	62	84
7	Slight	2	1	Tue 3/2012	Tuesday	1252	Moor Street Queensway	CHAPEL STREET AND PARK STREET	Daylight: street lights present	Fine without high winds	0	0	1	1	Poor turn or manoeuvre	68	62
8	Slight	2	1	Thu 5/2012	Thursday	1430	Chapel Street	MOOR STREET QUEENSWAY AND PARK STREET AND JENNENS ROAD	Daylight: street lights present	Raining without high winds	0	0	0	0	Failed to look properly	62	84

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9	Slight	2	4	Thu 7/2012	Thursday	1159	Moor Street Queensway	PARK STREET AND CHAPEL STREET AND JENNENS ROAD	Daylight: street lights present	Fine without high winds	0	0	0	0	Defective traffic signals	84	62
10	Slight	2	1	Tue 10/2012	Tuesday	2303	Jennens Road	MOOR STREET QUEENSWAY AND PARK STREET AND CHAPEL STREET	Darkness: street lights present and lit	Fine without high winds	0	0	0	0	Disobeyed automatic traffic signal	62	84
11	Slight	2	1	Mon 12/2012	Monday	814	Chapel Street	MOOR STREET QUEENSWAY AND PARK STREET AND JENNENS ROAD	Daylight: street lights present	Fine without high winds	0	0	0	0	Junction restart	84	62
12	Slight	2	4	Sat 12/2012	Saturday	1	Chapel Street	MOOR STREET QUEENSWAY AND PARK STREET AND JENNENS ROAD	Darkness: street lights present and lit	Raining without high winds	0	0	0	0	Disobeyed automatic traffic signal	62	84
13	Slight	2	6	Sun 12/2012	Sunday	1822	Jennens Road	MOOR STREET QUEENSWAY AND PARK STREET AND CHAPEL STREET	Darkness: street lights present and lit	Other	0	0	0	0	Disobeyed automatic traffic signal	62	84

14	Slight	2	1	Wed 12/2012	Wednesday	2026	Moor Street Queensway	PARK STREET AND CHAPEL STREET AND JENNENS ROAD	Darkness: street lights present and lit	Other	0	0	0	0	Disobeyed automatic traffic signal	62	84
15	Serious	1	2	Tue 2/2013	Tuesday	1625	Park Street	MOOR STREET QUEENSWAY AND CHAPEL STREET AND JENNENS ROAD	Daylight: street lights present	Fine without high winds	1	0	0	0	Failed to look properly	64	
16	Slight	2	1	Wed 8/2013	Wednesday	1430	Chapel Street	MOOR STREET QUEENSWAY AND PARK STREET	Daylight: street lights present	Fine without high winds	0	0	0	0	Failed to look properly	48	48
17	Slight	1	1	Tue 8/2013	Tuesday	1613	Moor Street Queensway	THE PRIORY QUEENSWAY AND MASSHOUSE LANE	Daylight: street lights present	Fine without high winds	1	0	0	0	Failed to look properly	62	
18	Slight	1	1	Thu 10/2013	Thursday	1615	Moor Street Queensway	THE PRIORY QUEENSWAY	Darkness: street lights present and lit	Fine without high winds	1	0	0	0	Crossed road masked by stationary or parked vehicle	62	
19	Slight	2	1	Tue 9/2014	Tuesday	1917	Chapel Street	MOOR STREET QUEENSWAY	Darkness: street lights present and lit	Fine without high winds	0	0	0	0	Failed to look properly	48	48
20	Slight	2	1	Fri 9/2014	Friday	1800	Chapel Street	MOOR STREET QUEENSWAY AND PARK STREET	Daylight: street lights present	Unknown	0	0	0	0	Failed to look properly	84	84

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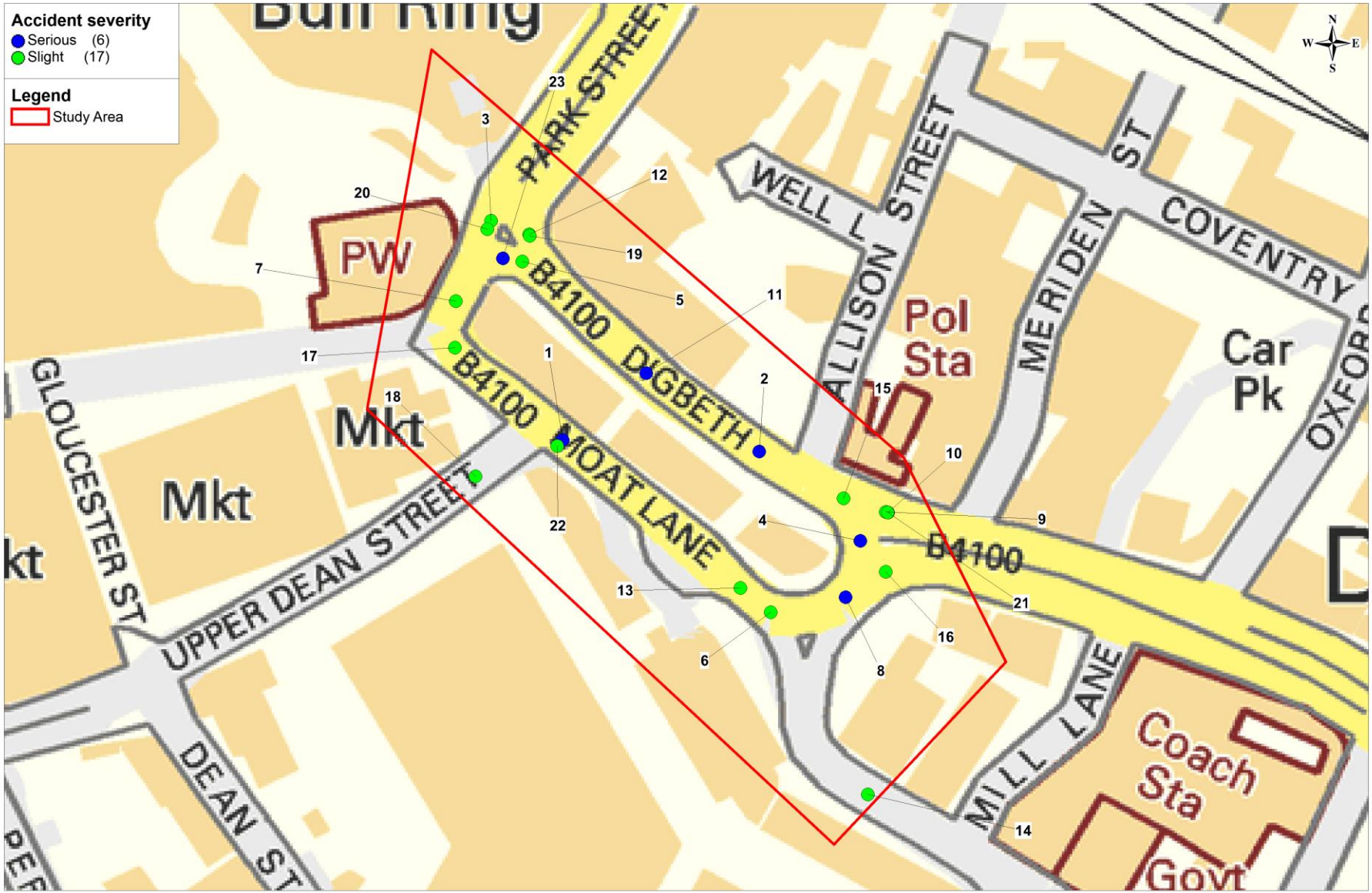
								AND JENNENS ROAD									
21	Slight	2	1	Tue 10/2014	Tuesday	1500	Moor Street Queensway	JENNENS ROAD AND CHAPEL STREET	Daylight: street lights present	Unknown	0	0	1	1	Poor turn or manoeuvre	82	62
22	Slight	2	2	Sat 6/2015	Saturday	15	Moor Street Queensway	THE PRIORY QUEENSWAY AND MASSHOUSE LANE	Darkness: street lights present and lit	Fine without high winds	0	0	0	0	Exceeding speed limit	62	61
23	Slight	1	1	Fri 11/2015	6	1935	HOTEL LATOUR PARK STREET UNSPECIFIED ROAD OR LOCAT		Darkness: street lights present and lit	Raining without high winds	0	0	0	1	Failed to look properly	73	

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(Accident Date Between 01/01/2011 and 31/12/2015)

Acc Ref	Severity	Num Vehicles	Num Casualties	Date	Day	Time	1st Road	2nd Road	Lighting	Weather	Ped	CPed	PCyc	P2W	Cause 1	Veh 1 Compass	Veh 2 Compass
1	Serious	1	1	Fri 3/2011	Friday	1950	Moat Lane	UPPER DEAN STREET	Darkness: street lights present and lit	Fine without high winds	1	0	0	0	Failed to judge vehicles path or speed	48	
2	Serious	2	1	Fri 1/2012	Friday	1210	Digbeth	ALLISON STREET	Daylight: street lights present	Fine without high winds	1	0	0	0	Crossed road masked by stationary or parked vehicle	84	84
3	Slight	1	1	Mon 3/2012	Monday	1305	Park Street	MOAT LANE AND DIGBETH	Daylight: street lights present	Fine without high winds	1	0	0	0	Wrong use of pedestrian crossing facility	61	
4	Serious	2	1	Wed 8/2012	Wednesday	1908	Digbeth	MOAT LANE	Daylight: street lights present	Fine without high winds	0	0	0	0	Careless or Reckless or In a hurry	85	85
5	Slight	1	1	Sun 10/2012	Sunday	1841	Digbeth	PARK STREET	Darkness: street lights present and lit	Raining without high winds	1	0	0	0	Impaired by alcohol	73	
6	Slight	2	1	Wed 11/2012	Wednesday	1855	Moat Lane	BRADFORD STREET	Darkness: street lights present and lit	Fine without high winds	0	0	1	1	Junction overshoot	58	38
7	Slight	1	1	Sun 12/2012	Sunday	1900	Moat Lane	EDGBASTON STREET	Darkness: street lights present and lit	Unknown	0	0	0	0	Sudden braking	52	
8	Serious	1	1	Sun 1/2013	Sunday	255	Moat Lane	BRADFORD STREET	Darkness: street lights present and lit	Fine without high winds	1	0	0	0	Impaired by alcohol	27	
9	Slight	2	1	Fri 2/2013	Friday	1630	Digbeth	MOAT LANE	Daylight: street lights present	Fine without high winds	0	0	0	0	Failed to judge other persons path or speed	73	73

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10	Slight	1	1	Fri 3/2013	Friday	1330	Digbeth	MERIDEN STREET	Daylight: street lights present	Other	1	0	0	0	Disobeyed automatic traffic signal	73	
11	Serious	1	3	Tue 3/2013	Tuesday	1000	Digbeth	ALLISON STREET	Daylight: street lights present	Fine without high winds	1	0	0	0	Failed to judge vehicles path or speed	84	
12	Slight	1	1	Wed 5/2013	Wednesday	1830	Park Street	DIGBETH	Daylight: street lights present	Fine without high winds	1	1	0	0	Failed to look properly	14	
13	Slight	2	1	Wed 5/2013	Wednesday	1320	Moat Lane	BRADFORD STREET	Daylight: street lights present	Fine without high winds	0	0	0	0	Vehicle blind spot	48	48
14	Slight	2	2	Tue 5/2013	Tuesday	1056	Bradford Street	MILL LANE	Daylight: street lights present	Raining without high winds	0	0	0	0	Slippery road (due to weather)	84	48
15	Slight	1	1	Sun 8/2013	Sunday	144	Digbeth	ALLISON STREET	Darkness: street lights present and lit	Unknown	1	0	0	0	Failed to look properly	84	
16	Slight	1	2	Wed 4/2014	Wednesday	2130	Digbeth	MOAT LANE	Darkness: street lights present and lit	Fine without high winds	2	0	0	0	Exceeding speed limit	36	
17	Slight	1	1	Wed 4/2014	Wednesday	1402	Moat Lane	EDGBASTON STREET	Daylight: street lights present	Fine without high winds	1	0	0	0	Failed to look properly	41	
18	Slight	2	1	Thu 7/2014	Thursday	1638	Upper Dean Street	MOAT LANE	Daylight: street lights present	Fine without high winds	0	0	1	1	Failed to look properly	26	26
19	Slight	1	2	Sun 11/2014	Sunday	1925	Park Street	DIGBETH	Darkness: street lights present and lit	Raining without high winds	2	0	0	0	Wrong use of pedestrian crossing facility	15	
20	Slight	1	1	Tue 11/2014	Tuesday	1620	Park Street	DIGBETH AND MOAT LANE	Darkness: street lights present and lit	Fine without high winds	1	0	0	0	Failed to look properly	62	
21	Slight	1	1	Wed 12/2014	Wednesday	1550	Digbeth	MERIDEN STREET	Daylight: street lights present	Fine without high winds	1	0	0	0	Inexperienced or learner driver or	73	

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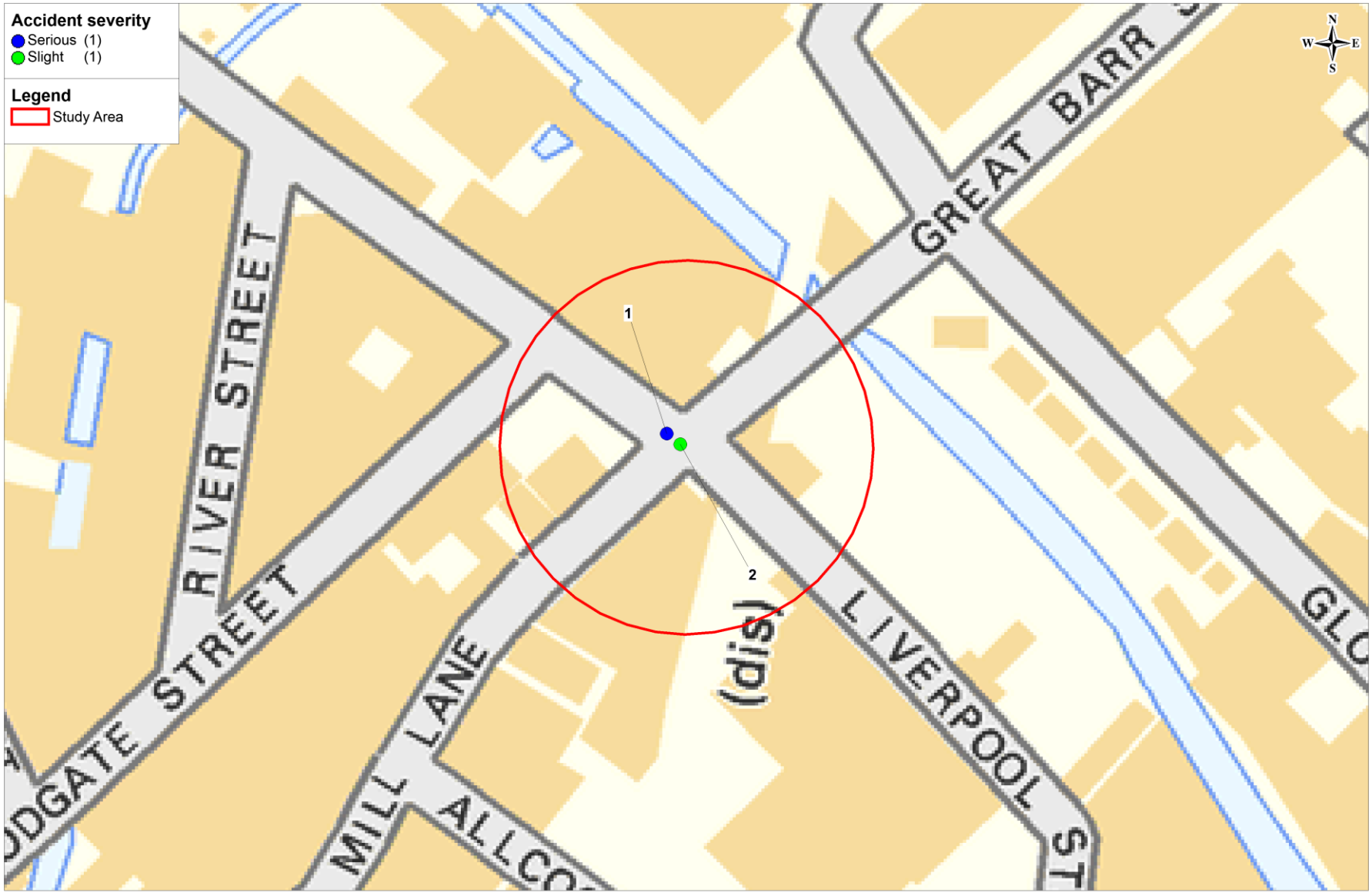
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22	Slight	2	2	Sat 2/2015	Saturday	2100	Upper Dean Street	MOAT LANE	Darkness: street lights present and lit	Fine without high winds	0	0	0	0	Travelling too fast for conditions	46	47
23	Serious	1	1	Wed 9/2015	Wednesday	1338	Digbeth	PARK STREET AND MOAT LANE	Daylight: street lights present	Fine without high winds	1	0	0	0	Failed to look properly	73	

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(Accident Date Between 01/01/2011 and 31/12/2015)

Acc Ref	Severity	Num Vehicles	Num Casualties	Date	Day	Time	1st Road	2nd Road	Lighting	Weather	Ped	CPed	PCyc	P2W	Cause 1	Veh 1 Compass	Veh 2 Compass
1	Serious	1	2	Sun 12/2012	Sunday	1654	Fazeley Street	LIVERPOOL STREET AND HEATH MILL LANE	Darkness: street lights present and lit	Fine without high winds	2	1	0	0	Failed to look properly	28	
2	Slight	2	1	Mon 10/2014	Monday	750	Heath Mill Lane	LIVERPOOL STREET AND FAZELEY STREET AND GREAT BARR STREET	Daylight: street lights present	Fine without high winds	0	0	1	1	Careless or Reckless or In a hurry	68	62

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