

Clarence Street Bus Priority

VISSIM Option Testing

City of York Council

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Quality Information

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1. Introduction

1.1 Study Overview

AECOM have been working in collaboration with City of York Council (CYC) to produce weekday morning, inter peak and evening peak period base VISSIM micro-simulation models of the Clarence Street / Wigginton Road and Haxby Road corridors. Bus journey time data shows that bus reliability along these corridors is particularly poor. The agreed purpose of the base models was to provide a platform for scheme option assessment focussing on bus priority and addressing congestion hotspots along these corridors.

Following a meeting with CYC on 4th April 2017, 12 options were identified for testing. These options include a mixture of measures that could be delivered in the short and long term. The focus of these measures has been Wigginton Road and this link has the highest levels of friction, provides access to York District Hospital, and offers the most scope for improvement measures.

The objective of this commission has been to model each of the options in all time periods, and use model outputs to assess the impact of the proposals using agreed key performance indicators.

1.2 Site and Location

The modelled area covers the Clarence Street / Wigginton Road and Haxby Road corridors and includes six main junctions, which are summarised below:

- St Leonard's Place / Gillygate Road signalised junction;
- Gillygate Road / Lord Mayor's Walk signalised junction;
- Clarence Street / Haxby Road signalised junction;
- Wigginton Road / York Hospital main access roundabout;
- Wigginton Road / Crichton Ave signalised junction; and
- Haxby Road / Haley's Terrace roundabout.

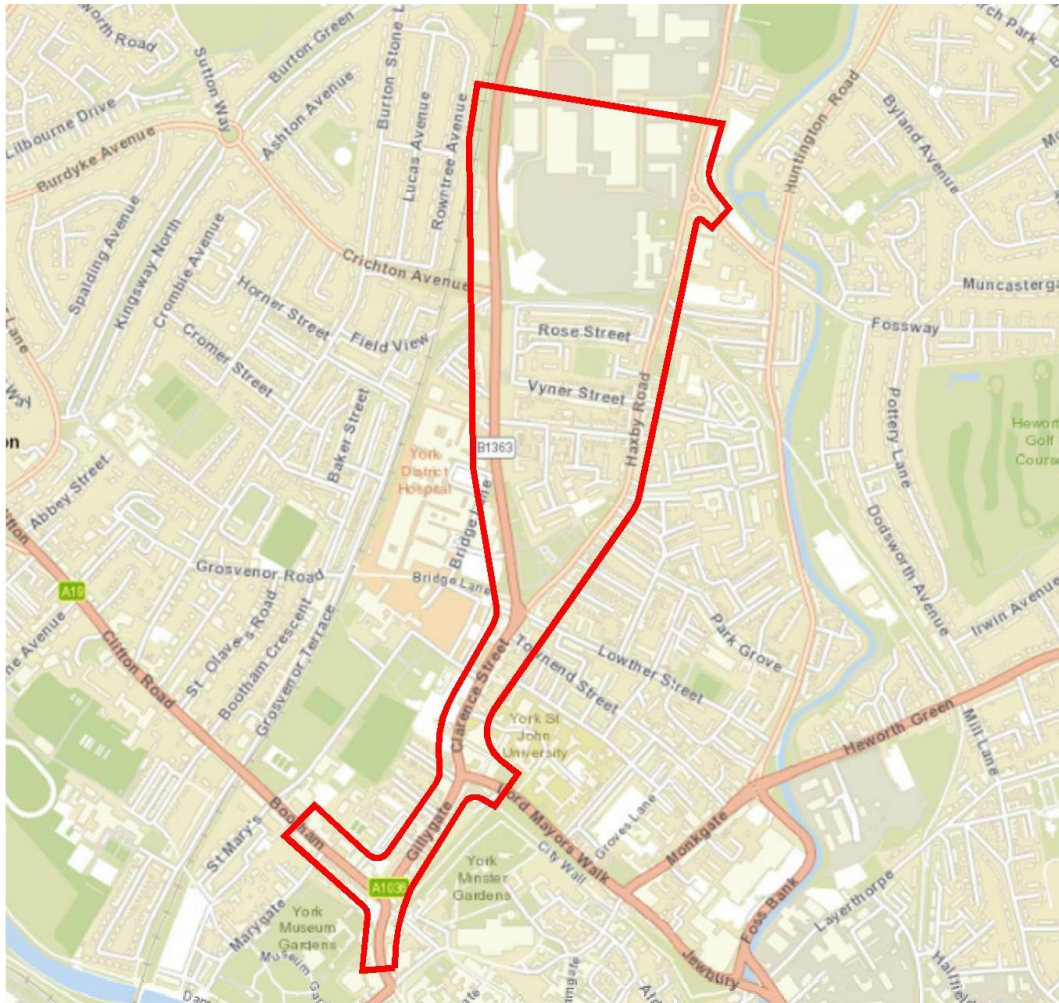
The Exhibition Square Interchange is located in the south of the modelled area, with services for more than ten bus routes, including seasonal tourist buses, departing from here.

St Leonard's Place and Gillygate form part of the Inner Ring Road. Clarence Street / Wigginton Road and Haxby Road are two radial routes that lead to the Outer Ring Road, both of which have frequent bus services. York Hospital is located to the west of Wigginton Road and accessed from this link. York St John's University buildings are located to the east of Clarence Street and accessed from this link.

Congestion and delay frequently occur in the study area, particularly on the Gillygate and Wigginton Road links. There are a range of contributory factors including geometric constraints associated with the historic nature of certain links, conflicting flows at the hospital accesses, friction between traffic and stopped buses and traffic signal controlled junctions operating at or close to capacity.

The model area extent is shown in **Figure 1** below:

Figure 1: Model area extent



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1.3 Report Structure

The report is structured as follows:

- **Section 2 Option Overview;**
- **Section 3 Option Assessment;** and
- **Section 4 Summary and Conclusions.**

2. Option Overview

2.1 Introduction

This section of the report details the scenarios that have been modelled as part of this commission. It is structured as follows:

- **Existing Conditions** - details the issues the options are trying to address;
- **Assessment Criteria** - how options have been assessed; and
- **Option Overview** - describes the options; and details the modelling methodology for each scenario.

Please note that no changes have been made to general traffic, cycle traffic or bus time tables between the base and the following scenarios.

2.2 Existing Conditions

Wigginton Road is a congested corridor, and is notable for the inter peak congestion that occurs. This is considered to reflect relatively high flow demands related to Inner Ring Road traffic and hospital traffic and the number of capacity pinch points within the study area.

Key capacity constraints within the study area include:

- Wigginton Road / Haxby Road signalised junction with low saturation flows and high cycle times, resulting in queuing on all approaches, particularly Wigginton Road southbound;
- Wigginton Road / York Hospital main access mini-roundabout with high right turn flows and occasional blocking back from internal queuing onto the highway. Wigginton Road southbound has to give way to the Hospital Access;
- Fountayne Street mini-roundabout: Wigginton Road traffic has to give way to side roads; and
- Wigginton Road / Crichton Avenue signalised junction with low saturation flows, high cycle times and right turning traffic from Wigginton Road to Crichton Avenue frequently obstructing ahead traffic.

Traffic is also slowed along the corridor due to “friction” associated with:

- Interaction between pedal cycles and general traffic in locations where narrow lanes make overtaking difficult;
- Buses stopping at bus stops delaying traffic at a number of locations where overtaking is either difficult or impossible, this can in turn exacerbate delays for following buses;
- Interaction between moving vehicles and parked vehicles;
- Vehicles from side roads or car park accesses aggressively joining main road traffic flow;
- The Zebra crossing on Haxby Road and the Toucan crossing by the hospital; and
- Geometric constraints and poor visibility.

Improving bus journey times on Wigginton Road is challenging due to the levels of traffic flow and physical constraints of the corridor which make it difficult to introduce additional capacity at junctions.

2.3 Scenario overview and modelling assumptions

Table 1 overleaf details the options that have been modelled as part of this commission and details modelling assumptions that were agreed with CYC.

The base model has been updated with the committed upgrade of the Clarence Street / Lord Mayor's Walk / Gillygate junction and revised signals. This Do Minimum is referred to as Lord Mayor's Walk (LMW) Improvements.

Table 1: Scenario overview and modelling assumption

| Type | Option number | Description | Purpose of Option |
|---------------------------------|------------------|--|---|
| Do Nothing Option | LMW Improvements | Inclusion of new Clarence Street / Lord Mayor's Walk junction layout and signal timings | Update base model to reflect committed changes to highway network |
| Clarence Street Option | Option 2 | LMW Improvements + Test of inbound bus lane on Clarence Street | Determine if an inbound bus lane and bus gate on Clarence Street would improve bus journey times |
| Wigginton Road Bus Diversion | Option 3 | LMW Improvements + Moving all buses (Routes 1 & 5) onto Wigginton Road (via Nestle development link road) with existing signal timings | Assess impact of increasing bus services which directly serve the hospital |
| | Option 4 | Option 3 + Amended signal timings at Haxby Road / Wigginton Road junction | Re-optimize signal timings because no buses run on Haxby Road and more buses run on Wigginton Road. |
| | Option 5 | Option 4 + Wigginton Road / Fountayne Street - Convert from mini roundabout to priority junction. | Reduce delay to Wigginton Road incurred by giving way to side arms. |
| | Option 6 | Option 4 + Wigginton Road / Hospital Access - Convert from mini roundabout to signal controlled junction. | Reduce friction on Wigginton Road caused by Wigginton Road traffic giving way to side arms |
| | Option 7 | Option 4 + Wigginton Road / Hospital Access - Convert from mini roundabout to signal controlled junction + removal of parking on east side of Wigginton Road to convert to traffic lane | Reduce friction on Wigginton Road caused by Wigginton Road traffic giving way to side arms and increase southbound capacity at the Hospital Access junction |
| | Option 8 | Option 4 + Amalgamation of bus stops on Wigginton Road | Reduce journey time for buses by consolidating bus stops and reduce exit blocking at Crichton Avenue caused by traffic queuing behind dwelling buses at Feversham Crescent bus stop |
| | Option 9 | Option 4 + Redesign of Wigginton Road / Haxby Road / Clarence Street junction | Simplify junction, improve pedestrian facilities, increase saturation flow from Clarence Street to Haxby Road; maintain capacity |
| | Option 10 | Option 5 + Option 8 + Option 9 | Combine benefits from options 5, 8 & 9 |
| Wigginton Road No Bus Diversion | Option 11 | Option 5 + Option 8 + Option 9 but with existing bus routing | Combine benefits from options 5, 8 & 9 and assess benefits if buses are not rerouted onto Wigginton Road. |
| | Option 12 | Option 11 + Route 6 stops within York Hospital grounds + Route 40 amalgamated bus stop | Assess impact of providing direct access for Route 6 into Hospital grounds. |

3. Option Assessment

3.1 Introduction

This chapter presents the results from the Option Assessments (for ease of reading detailed results are placed in the Appendices). This chapter is structured as follows:

- **Modelled Journey Times** - details the journey time segments used to assess the options;
- **Results Summary** - provides a summary of journey time results; and
- **Detailed Results** - are presented for each option separately, result charts are provided in Appendix B to Appendix M

3.2 Modelled Journey Times

The purpose of this study is to assess scheme options to improve bus reliability and address congestion hotspots along these corridors. The model outputs used to assess the effectiveness of each option are as follows:

- Route 1 Bus Journey Time;
- Route 6 Bus Journey Time; and
- General Traffic Journey Times.

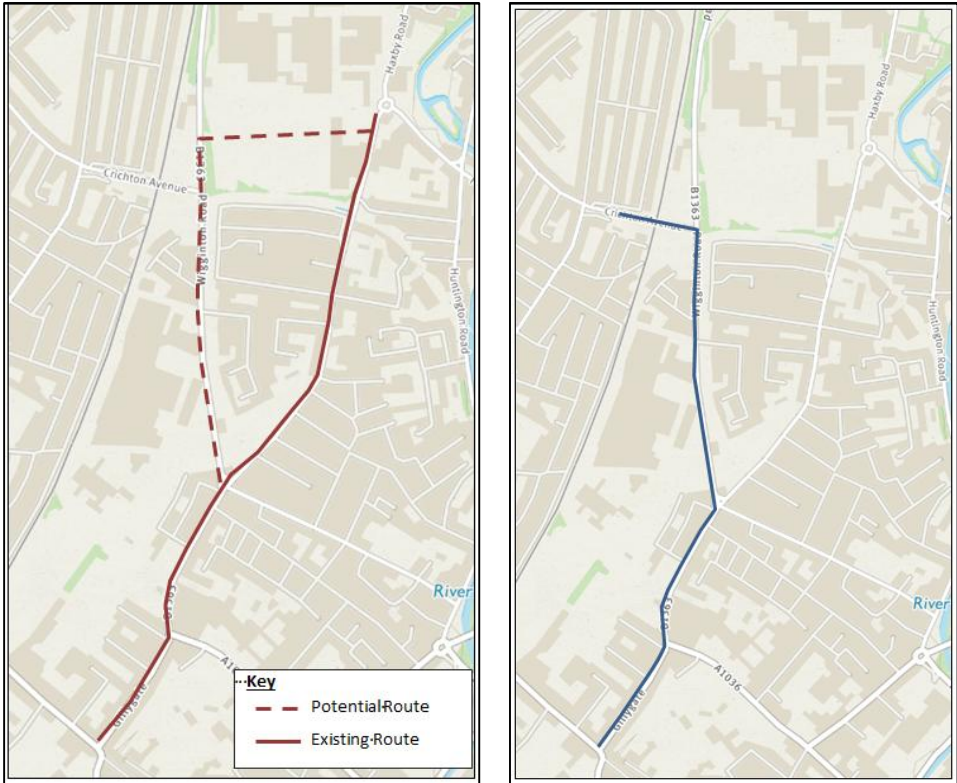
A successful option would reduce bus journey times and improve or maintain general traffic journey times. The assessment routes are shown overleaf.

3.2.1 Bus Journey Time Route

The existing Route 1 (solid red line) journey time starts from Haxby Road / Haley Terrace roundabout, and extends to the Gillygate / Bootham junction. The existing route is approximately 1.5 km long. In some options Route 1 is diverted through the Nestle South development site and down Wigginton Road.

The Route 6 journey time starts at Crichton Avenue and ends at the Gillygate / Bootham Junction. The Route 6 journey time route is approximately 1.4 km long.

Figure 2: Route 1 and Route 6 journey time routes

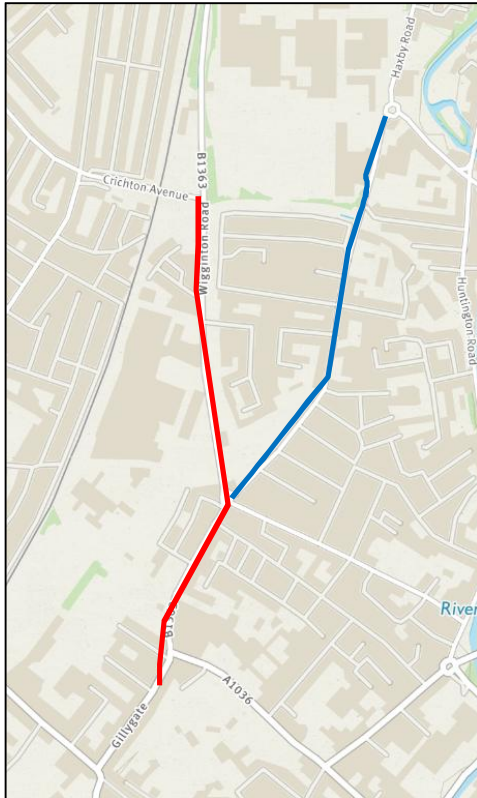


3.2.2 General Traffic Journey Time Routes

Two general traffic journey times have been extracted from the model. The first (red line) travels from Crichton Avenue / Wigginton Road to the Gillygate / Bootham junction.

The second journey time (blue line) starts at Haxby Road / Haley Terrace junction and extends to the Clarence Street / Haxby Road / Wigginton Road junction.

Figure 3: Route 1 general traffic journey time routes



3.3 Results Summary

Table 2 overleaf provides a high level summary of the option testing undertaken, each option is then discussed in detail in the following sections. Summary charts have also been added for bus and general traffic journey times. In summary:

- The Lord Mayor's Walk Improvements - bus journey times reduce in the AM and are maintained in the inter peak and PM;
- Diverting bus routes 1 and 5 onto Wigginton Road causes a significant increase in journey times for buses and general traffic. None of the options considered within this study reduce journey times back to those in the Lord Mayor's Walk Improvements; and
- Journey times can be improved on Wigginton Road with a combination of packages, but only if buses are **not** diverted onto Wigginton Road.

Table 2: Results summary

| Description | | Summary | Page |
|---|--|---|------|
| LMW Improvements (Do Nothing Option) | | | |
| 1 | New Clarence Street / Lord Mayor's Walk junction layout and signal timings | Additional green time given to Clarence Street and taken from Lord Mayor's Walk. Bus times improve in the AM by circa 1 minute, no change in inter peak and PM | 13 |
| Clarence Street | | | |
| 2 | LMW Improvements + Bus gate on Clarence Street | Bus gate reduces capacity of Clarence Street inbound for general traffic which causes delay to buses which is not mitigated by the bus lane provided | 15 |
| Wigginton Road Bus Diversion | | | |
| 3 | LMW Improvements + Moving all buses onto Wigginton Road. | Significant increase in bus journey times (up to 4 minutes southbound) due to additional buses (from approximately 5 to 14 in each direction) on Wigginton Road which dwell and cause increased queuing and blocking back | 16 |
| 4 | Option 3 + Amended signal timings at Haxby Road / Wigginton Road junction | Additional green time given to Wigginton Road improves times compared with Option 3 but times significantly greater than with LMW Improvements | 17 |
| 5 | Option 4 + Wigginton Road / Fountayne Street - priority junction | Improves times compared with Option 4 but times significantly greater than LMW Improvements | 18 |
| 6 | Option 4 + Wigginton Road / Hospital Access signal controlled junction | Journey times increase compared with Option 4, due to delay caused by signals and entry starving of junction due to short southbound flare | 19 |
| 7 | Option 4 + signal controlled junction with longer southbound flare | Southbound lane introduced however entry starving still occurs. Performs better than Option 6 but worse than Option 4 | 19 |
| 8 | Option 4 + Amalgamation of bus stops on Wigginton Road | Journey times improve in the AM Peak compared with Option 4, but increase in the inter peak and PM. Journey times are longer than with LMW Improvements | 20 |
| 9 | Option 4 + Redesign of Wigginton Road / Haxby Road / Clarence Street junction | Journey times improve in the AM compared with Option 4 and increase in inter peak and PM. Journey times longer than with LMW Improvements | 21 |
| 10 | Option 5 + Option 8 + Option 9 | AM journey times improve compared with Option 4. Journey times longer than with LMW Improvements | 22 |
| Wigginton Road No Bus Diversion | | | |
| 11 | Option 5 + Option 8 + Option 9 | Journey times improve compared with LMW Improvements. | 22 |
| 12 | Option 11 + Route 6 stops within York Hospital grounds | Journey times improve compared with LMW Improvements but to a lesser extent than Option 11. | 23 |

Figure 4 - Summary Bus Journey Time Charts

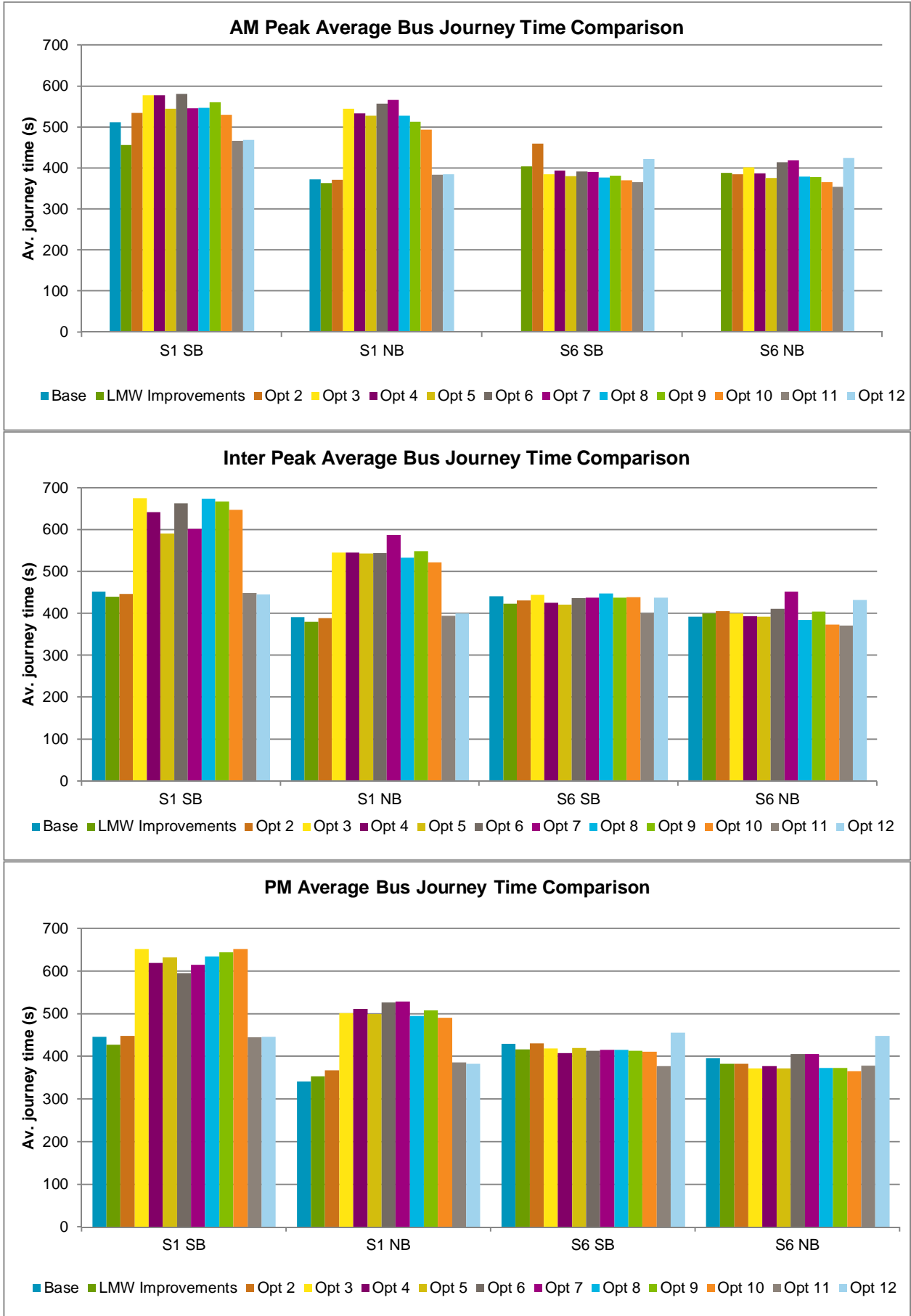


Figure 5 - Summary General Traffic Journey Time Charts



3.4 Baseline with Lord Mayor's Walk Junction Improvements

3.4.1 Introduction

Recent changes have been made to the Lord Mayor's Walk junction with Clarence Street which include:

- Widening of Clarence Street inbound;
- Traffic signal cycle time reduced to 96 seconds; and
- Green time reduced on Lord Mayor's Walk and increased on Clarence Street to give more priority to junction arm with bus services.

The Lord Mayor's Walk junction improvements journey times provides a baseline from which to compare options against.

3.4.2 Bus Journey Times

Bus journey times reduce southbound in all peaks, the time savings occur between York St John University's bus stop and Gillygate, as a result of the signal changes.

The greatest journey time improvement, of approximately one minute, takes place in the AM peak. Marginal improvements are seen in the inter peak and PM peak. The difference in impacts between peaks is likely to be associated with the extent of blocking back from Gillygate and the impact on Lord Mayor's Walk traffic.

3.4.3 General Traffic Journey times

Journey times reduce southbound in all peaks as a result of signal changes, with the majority of change between York St John University's bus stop and Gillygate. The results are consistent with the bus journey times, with an improvement of approximately 1 minute in the AM peak and minor improvements in the inter peak and PM peak.

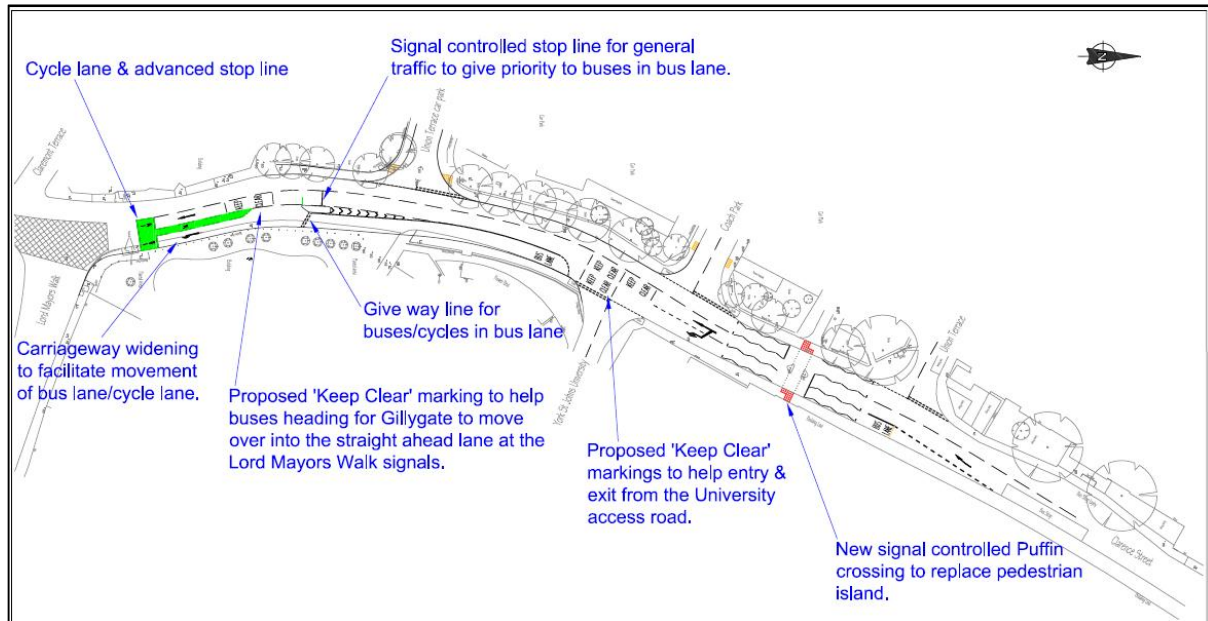
The different journey time impacts between peaks are likely to be associated with the extent of blocking back from Gillygate. If blocking back occurs, traffic from Clarence Street cannot proceed onto Gillygate.

Lord Mayor's Walk journey times increase in the AM peak by approximately 0.5 minutes. This is because additional green time is being provided to Clarence Street, and less green time provided to Lord Mayor's Walk.

3.5 Option 2 Inbound Bus Lane on Clarence Street

In this option, an inbound bus lane with bus gate is provided on Clarence Street, as shown in **Figure 6** below. A puffin crossing is provided to replace the existing pedestrian island. To accommodate the bus lane, the right turn pockets from Clarence Street into Bootham Hospital car park and Union Terrace are removed.

Figure 6: Bus gate layout



3.5.1 Option 2 Bus Journey Times

The inbound bus gate does not improve bus journey times. This is particularly true in the AM peak, where Route 1 southbound journey time increases by approximately 1.3 minutes and the Route 6 southbound journey time increases by 1.5 minutes. In the inter peak and PM peak the southbound journey times are increased to a lesser extent.

The bus gate and bus lane shift the traffic queue further back up Clarence Street; this can cause exit blocking from Wigginton Road and Haxby Road (which affects buses). The traffic queue is also increased by the removal of right turn pockets from Clarence Street. Furthermore the traffic queue can prevent buses from being able to enter the bus lane. The Puffin Crossing adds additional delay to traffic.

3.5.2 Option 2 General Traffic Journey Times

Southbound journey times increase. In the AM peak the Wigginton Road journey time increases by 2.5 minutes and Haxby Road by 0.8 minutes. The inter peak journey times are marginally affected. In the PM peak, southbound Wigginton Road journey times increase by approximately 0.5 minutes.

Vehicles turning right into Union Terrace car park can obstruct ahead traffic resulting in wasted green time.

3.6 Option 3 Routes 1 and 5 Divert onto Wigginton Road

In this option a bus only link is provided through the Nestle South Site allowing buses to divert from Haxby Road onto Wigginton Road. This would increase the number of services providing direct access to the Hospital.

Routes 1 and 5 stop at Feversham Crescent and Hospital stops with dwells taken from Route 6. No changes were made to Route 6 dwell times. There is an approximate increase in peak hour bus flows from 5 to 14 in each direction.

No changes were made to signal timings.

3.6.1 Option 3 Bus Journey Times

Journey time increases on Route 1, due to a combination of longer distance (*c300m*) to travel and the higher levels of congestion on Wigginton Road compared with Haxby Road. Journey times increase by 2 minutes in the AM peak, and by 4 minutes in the inter peak and PM peak.

Route 6 southbound increases by 1.5 minutes in the AM peak, 2.5 minutes in the inter peak and 4 minutes in the PM peak. Journey time increases on inbound Route 6 occur on Crichton Avenue, likely to be associated with increased exit blocking from Wigginton Road due to higher flows on Wigginton Road and more buses stopping at the bus stops.

The potential increases in journey time on Wigginton Road, caused by re-routing Routes 1 and 5 are significant. Options (3 to 10) examine ways to mitigate against this increase in journey time.

3.6.2 Option 3 General Traffic Times

Journey times increase southbound on Wigginton Road during the inter and PM peaks (by approximately 2 minutes and 1 minute respectively) on the approach to the junction with Crichton Avenue. This is likely to be associated with increased exit blocking from more stopped buses by Feversham Crescent and higher bus flows. Bus dwell times are greatest in the inter peak, resulting in a larger increase in journey time.

There are minor journey time increases northbound on Wigginton Road, on the approach to the Crichton Avenue junction; these may be associated with increased bus flows / stopping buses.

There are small reductions in Haxby Road journey time due to the removal of buses.

3.7 Option 4 Amend Signal Timings at Haxby Road / Wigginton Road

Option 4 is based on Option 3. In Option 4 the signal timings at Haxby Road / Wigginton Road have been amended to effectively transfer approximately 4 seconds green time to Wigginton Road (to accommodate the additional buses) time from Haxby Road (as all buses now travel on Wigginton Road).

3.7.1 Option 4 Bus Journey Times

There are reductions in southbound journey times between Option 3 and Option 4. In the inter peak, journey times reduce by between 0.5 and 0.8 minutes, and in the PM peak, by between 0.5 and 1.8 minutes; there is no improvement in the AM peak southbound. Despite the improved journey times in Option 4 compared to Option 3, they are not comparable with those achieved by the LMW Improvements.

The journey time reductions on Route 1 are smaller than on Route 6 due to the different approach to the Crichton Avenue junction.

3.7.2 Option 4 General Traffic Journey Times

Southbound journey times on Wigginton Road reduce by approximately 0.5 minutes in the inter peak and PM peak compared with Option 3. However, southbound journey times on Wigginton Road compared with LMW Improvements increase by 1.3 minutes in the inter peak and 0.3 minutes in the PM peak.

3.8 Option 5 - Convert Wigginton Road / Fountayne Street from mini roundabout to priority junction

A cause of friction on Wigginton Road is that Wigginton Road traffic must give way to traffic emerging from the northern Hospital access and Fountayne Street. In this option the friction is removed by converting the Wigginton Road / Fountayne Street mini roundabout to a priority junction, as shown in **Figure 7** below.

Option 5 is built on Option 4 with re-routed buses and amended Wigginton Road / Haxby Road signal timings.

Figure 7: Wigginton Road / Fountayne Street priority option



3.8.1 Option 5 Bus Journey Times

Option 5 reduces the frequency of exit blocking at the Crichton Avenue junction. In the AM peak the Route 1 southbound journey time reduces by 0.5 minutes and for Route 6 by 1.8 minutes. In the inter peak the reduction is 0.85 minutes and 1 minute respectively. In the PM peak, southbound journey times increase slightly.

Route 6 journey times are between 0.3 and 2.7 minutes greater in Option 5 compared with those for the LMW Improvements.

3.8.2 Option 5 General Traffic Journey Times

Southbound journey times improve by 0.3 minutes in the AM peak and 0.5 minutes in the inter peak. PM journey times increase marginally by 8 seconds, this is in effect 'no change'. Option 5 southbound journey times are still 0.3 to 0.8 minutes greater than those for the LMW Improvements.

Converting Wigginton Road / Fountayne Street into a priority junction does not reduce journey times back to those achieved by the LMW Improvements.

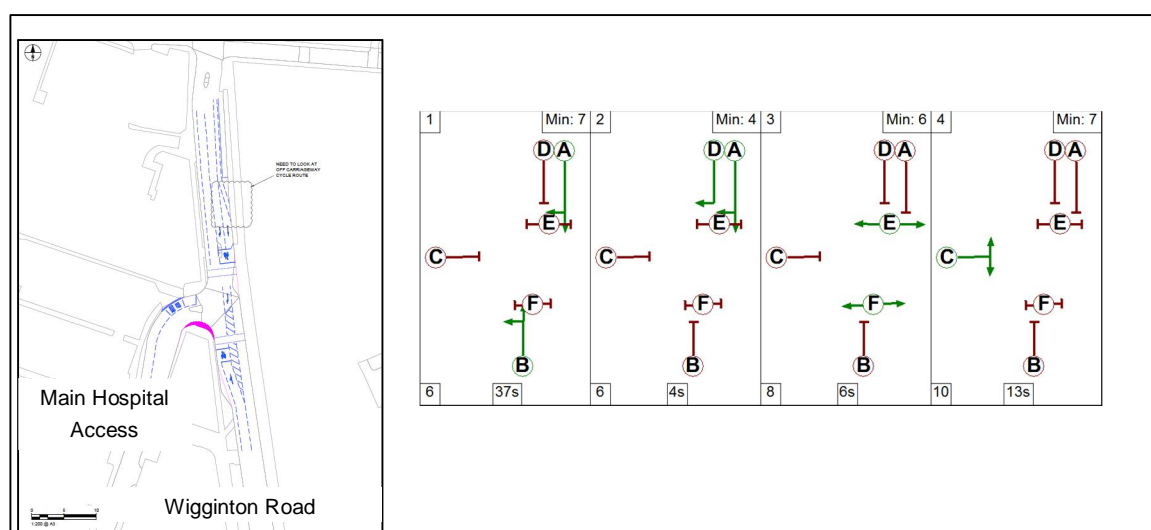
3.9 Option 6 Convert Wigginton Road / Hospital Access from a mini roundabout to a signal controlled junction.

Option 6 is built on Option 4 with:

- Re-routed buses;
- Amended Wigginton Road / Haxby Road signal timings; and
- Wigginton Road / Main Hospital Access converted from a mini roundabout to a signal controlled junction.

The junction layout and signal stages are shown below in **Figure 8**.

Figure 8: Signal controlled hospital access



3.9.1 Option 6 Bus Journey Times

Journey times increase as a result of blocking back to Crichton Avenue from the signalised junction at the main hospital access. The short southbound flare into the junction results in frequent entry starvation due to queuing right turning vehicles. The increased journey times may also be associated with the extent of exit blocking from the downstream southbound bus stops. The greatest increase in journey times occurs during the inter peak and PM peak which have the longest bus dwell times.

3.9.2 Option 6 General Traffic Journey Times

Journey times increase in all time periods, caused by the issues noted above.

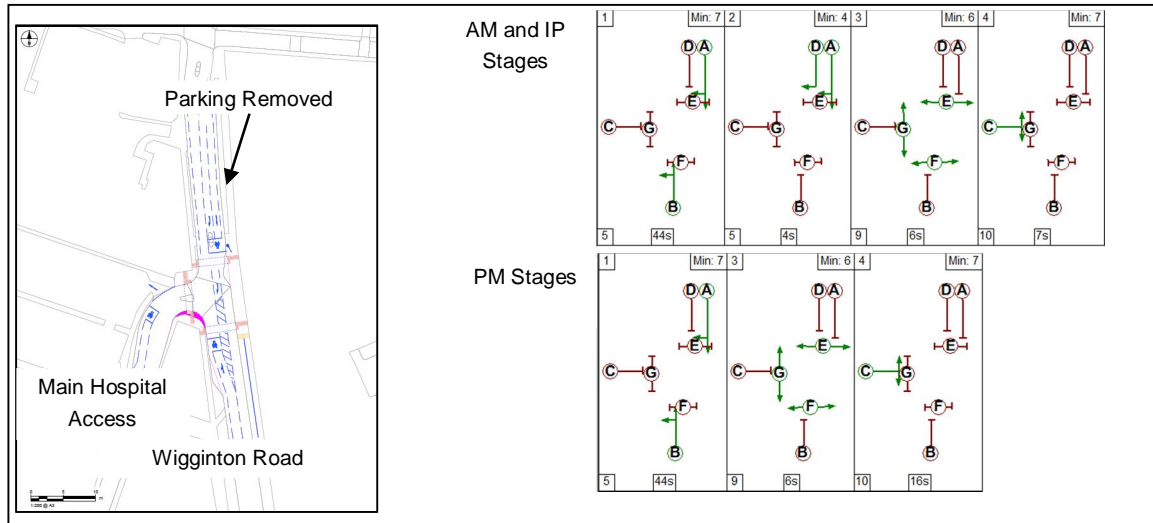
3.10 Option 7 Increased Flare at Signalised Hospital Access

Option 7 is built on Option 4 with:

- Re-routed buses;
- Amended Wigginton Road / Haxby Road signal timings;
- Wigginton Road / Main Hospital Access converted from a mini roundabout to a signal controlled junction; and
- Removal of parking on east side of Wigginton Road to extend the two lane southbound flare.

The junction layout and signal stages are shown below in **Figure 9**.

Figure 9: Signal controlled hospital access with extended flare



3.10.1 Option 7 Bus Journey Times

Option 7 performs better than Option 6, particularly during the inter peak however it does not perform as well as Option 4.

3.10.2 Option 7 General Traffic Journey Times

General traffic journey times reflect the changes shown in bus journey times. In the AM peak southbound flows increased by approximately 50 vehicles (8%) on Wigginton Road south of Hospital access (smaller increases in other time periods) compared with Option 6, confirming that this option provides increased capacity.

Observation of model simulation confirms reduced blocking at the flare but there is still a considerable amount of wasted green due to blocking through the junction.

3.11 Option 8 Consolidation of Bus Stops on Wigginton Road

This option examines consolidating the bus stops on Wigginton Road into a single stop at the Hospital. The rationale being that this would reduce blocking back at Crichton Avenue and reduce the amount of time buses dwell on Wigginton Road.

The average bus dwells for all services at the York Hospital stop were increased by 50% of the Feversham Crescent average dwell time. The southbound Hospital bus stop length was extended to 40m to allow two buses to dwell simultaneously. The standard deviations used in the model were reduced to limit excessive dwells from occurring. The dwell time assumptions are summarised in **Table 3** below.

Table 3: Consolidated bus dwell times

| Destination | Stop | Average Dwell (SD) | | |
|-------------|---------------------------|--------------------|------------------|------------------|
| | | AM | IP | PM |
| SB | Original | 43s (19s) | 78s (24s) | 47s (18s) |
| | Consolidated stops | 55s (16s) | 96s (20s) | 62s (16s) |
| NB | Original | 12s (6s) | 17s (10s) | 12s (9s) |
| | Consolidated stops | 17s (6s) | 26s (10s) | 18s (9s) |

3.11.1 Option 8 Bus Journey Times

The inbound AM peak journey time reduces by 0.5 minutes (Route 1) and 1.7 minutes (Route 6). The time savings are generated on the Crichton Avenue approach. In the AM peak the inbound travel time is similar to that experienced with the LMW Improvements.

The inbound inter peak and PM peak journey times increase. The journey times do decrease through Crichton Avenue, however this is offset by increased queuing from the Hospital bus stop and increased inefficiency of the Wigginton Road / Haxby Road junction. This is caused by buses dwelling for longer on the approach to Wigginton Road / Haxby Road junction, resulting in wasted green time.

Small increases are found in the inter peak and PM peak inbound journey times. This may reflect the increased queuing resulting from the Hospital bus stop and increased inefficiency of the Wigginton Road / Haxby Road junction operation.

3.11.2 Option 8 General Traffic Journey Times

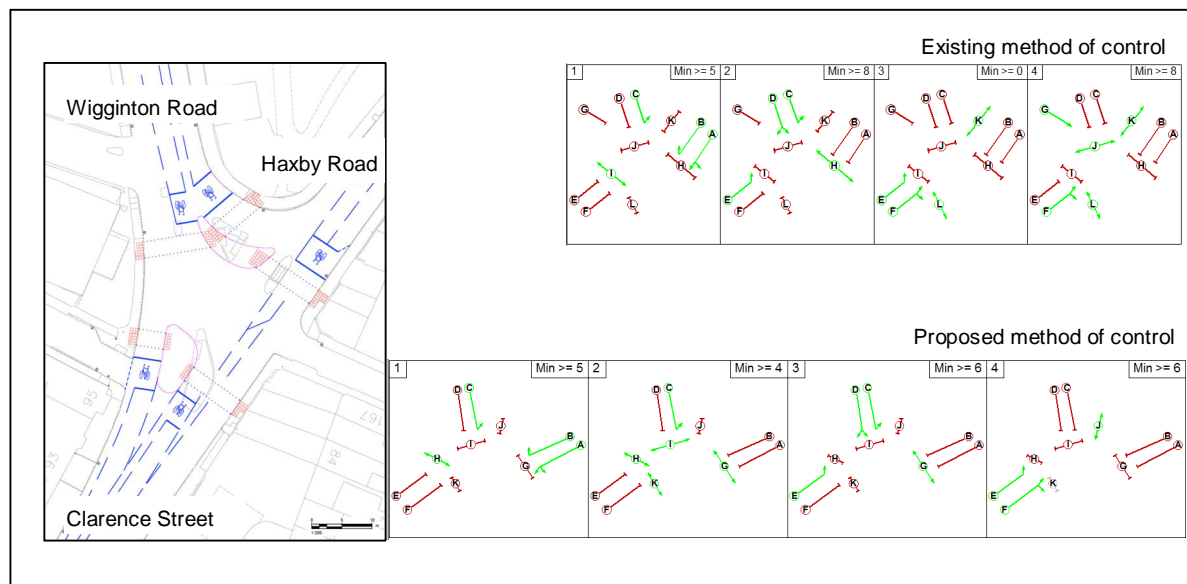
The general traffic southbound journey time changes on Wigginton Road mirror those of buses. In the AM peak, the journey time improves between Crichton Avenue and the main Hospital access where the Feversham Crescent bus stop has been removed. The southbound increase in journey time is likely to reflect the increased queue lengths from the Hospital bus stop.

3.12 Option 9 Redesign of Wigginton Road / Haxby Road / Clarence Street junction

Option 9 is built on Option 4 with:

- Re-routed buses;
- Amended Wigginton Road / Haxby Road signal timings. Bridge Lane cycle phase removed. Fixed time with 120s cycle modelled.; and
- Revised Wigginton Road / Haxby Road / Clarence Street junction layout (see **Figure 10** below).

Figure 10: Redesign of Wigginton Road / Haxby Road



3.12.1 Option 9 Bus Journey Times

In the AM peak the southbound journey time decreases by 0.5 minutes. In the inter peak and PM peak the journey time increases by 1.3 and 2.2 minutes due to an increase in delay at Crichton Avenue.

3.12.2 Option 9 General Traffic Journey Times

The southbound Wigginton Road journey time increases in the inter peak by 0.5 minutes and by 0.3 in the PM peak. The southbound Haxby Road travel time increases by approximately 0.3 minutes across each peak.

The southbound Wigginton Road journey time increases take place between Crichton Avenue and York Hospital.

The model has been configured to simulate a “worst case” scenario with demand dependent stages called every cycle. This is likely to impact the inter peak to the greatest extent. In addition, the signals have been modelled as fixed time, so if traffic is held back behind a dwelling bus the green stage will not be terminated early in the model.

3.13 Option 10 – “Mixed Package”

The following (above) options had some positive impacts on journey times on Wigginton Road:

- Option 5 – Wigginton Road / Fountayne Street converted from mini roundabout to priority junction;
- Option 8 – consolidation of Wigginton Road bus stops; and
- Option 9 – redesign of Wigginton Road / Haxby Road / Clarence Street junction.

Option 10 is formed by combining Options 5, 8 and 9.

3.13.1 Option 10 Bus Journey Times

There are journey time savings in all AM peak journeys, in particular for Route 6 southbound which experiences an improvement of 1.8 minutes. However, in the inter peak and PM peak, southbound journey times increase. Northbound journeys improve slightly in all scenarios.

3.13.2 Option 10 General Traffic Journey Times

Journey times for Wigginton Road southbound improve in the AM peak only. Northbound journey times on Wigginton Road improve slightly in all periods. Haxby Road southbound journey times reduce in all time periods and are unchanged northbound.

3.13.3 Option 10 Summary

The package of measures in Option 10 is not sufficient to offset increased journey times caused by re-routing of Routes 1 and 5 from Haxby Road onto Wigginton Road.

3.14 Option 11 Better Bus Area Package

In previous options (3 to 10) Routes 1 and 5 have been re-routed onto Wigginton Road from Haxby Road. In Option 3 it was evident that this caused an increase in journey times on Wigginton Road.

The following (above) options had some positive impacts on journey times on Wigginton Road:

- Option 5 – Wigginton Road / Fountayne Street converted from mini roundabout to priority junction;
- Option 8 – consolidation of Wigginton Road bus stops; and
- Option 9 – redesign of Wigginton Road / Haxby Road / Clarence Street junction.

Option 11 includes the above options while Routes 1 and 5 remain on Haxby Road. Option 11 has been compared with the journey times experienced with the LMW Improvements because Routes 1 and 5 have not been diverted in this option.

3.14.1 Option 11 Bus Journey Times

Route 6 southbound journey time decreases by 1.5 minutes in the AM peak, 0.4 minutes in the inter peak and 0.9 minutes in the PM peak. The majority of these savings are achieved on the Crichton Avenue approach and due to the Fountayne Street priority junction.

Route 6 northbound journey time decreases by 0.5 minutes in the AM peak, by 0.5 in the inter peak and is unchanged in the PM peak, this is achieved due to the Fountayne Street priority junction.

The Route 1 southbound journey time increases by 0.2 minutes in the AM peak, 0.1 minutes in the inter peak and by 0.3 minutes in the PM peak. Route 1 northbound journey time increases by 0.3 minutes in the AM peak, 0.2 minutes in the inter peak and 0.5 minutes in the PM peak. The delays are experienced through the Wigginton Road / Haxby Road / Clarence Street junction which has increased the journey time for Wigginton Road.

3.14.2 Option 11 General Traffic Journey Times

General traffic journey times reflect the changes shown in bus journey times. Southbound journey times improve on Wigginton Road but Haxby Road southbound journey times increase. This may be a consequence of the updated signal timings at the revised Wigginton Road / Haxby Road / Clarence Street junction combined with the return of bus services to Haxby Road (the Option 4 vs Option 9 increase was previously in the order of 20 seconds).

3.14.3 Option 11 summary

Option 11 provides a significant journey time saving for buses and general traffic on Wigginton Road, however journey times on Haxby Road increase. The redesign of Wigginton Road / Haxby Road / Clarence Street junction has been modelled as a worst case with fixed demand and demand dependent stages called each cycle so it is possible that delays may be overestimated.

3.15 Option 12 Hospital Access Option

Option 12 is a variation of Option 11, where Route 6 stops within the York Hospital site and does not stop on Wigginton Road. The rationale for this option is that it would increase bus accessibility to the Hospital. This scenario has been compared with Option 11.

3.15.1 Option 12 Bus Journey Times

The Route 6 southbound diversion into the Hospital grounds increases the journey time by circa 1 minute through the Hospital section of Wigginton Road. This increase is offset by reduced journey time from Crichton Avenue and single stop on Wigginton Road, and is quicker than the LMW Improvements journey time.

Route 6 northbound journey times also increase by approximately 1 minute due to diversion into Hospital grounds.

This option provides improved accessibility to York Hospital but with the disadvantage of additional journey time. This study has not considered if a bus stop could be practically provided within the Hospital grounds.

3.15.2 Option 12 General Traffic Journey Times

Wigginton Road southbound journey times reduce by approximately 1 minute in all time periods compared with Option 11 and by 1 minute compared with LMW Improvements. Wigginton Road northbound journey times are unaffected (compared with Option 11), and remain lower than LMW Improvements in the AM and PM peaks.

4. Summary and Conclusions

4.1 Introduction

AECOM have been working in collaboration with City of York Council (CYC) to produce weekday morning, inter and evening peak period base VISSIM micro-simulation models of the Clarence Street, Wigginton Road and Haxby Road corridors. The purpose of the base models is to provide a platform for scheme option assessment, focussing on bus priority and addressing congestion hotspots along these corridors in particular Wigginton Road.

This study could have considered other options, including more extensive redevelopment, however these were not considered within the scope of this study due to the associated timescales and political challenges.

4.2 Summary

The base VISSIM model was updated with the “on street” redesign of the Lord Mayor’s Walk, Clarence Street, and Gillygate Junction, and renewed signal timings to create a Do Minimum option called LMW Improvements. It was found that this provided a benefit to inbound bus journeys in the AM peak. This Do Minimum model was used as a basis to test the impact of a range of options on bus and general traffic journey times.

The study evaluated the provision of a southbound bus lane and bus gate on Clarence Street. It was found to increase journey times for buses because it offset the traffic queue to be further back, causing exit blocking at Wigginton Road and Haxby Road.

The study considered the impact of re-routing Routes 1 and 5 from Haxby Road via the proposed Nestle South Development onto Wigginton Road. It was found that could potentially increase journey times by up to 4 minutes southbound. This is due to increasing the number of bus services from approximately 5 to 14 per hour in each direction and the associated dwell times at the Feversham Crescent and York Hospital bus stops.

In order to mitigate the increased journey times the following options were assessed, however none of the options returned Wigginton Road journey times back to those provided by the LMW Improvements:

- Option 4: Amended Wigginton Road / Clarence Street / Haxby Road signal times to increase green time for Wigginton Road at the expense of Haxby Road;
- Option 5: Conversion of Fountayne Street / Wigginton Road junction from a mini roundabout to a priority junction;
- Option 6 & 7: Conversion of the Main Hospital Access from a mini roundabout to alternative signal controlled junction layouts;
- Option 8: Consolidation of the Wigginton Road bus stops to a single stop in each direction at the current location of the Hospital stop;
- Option 9: Upgrade of the Wigginton Road / Clarence Street / Haxby Road junction, and
- Option 10: A combination of Options 5, 8 and 9.

Two further options were considered in which bus Routes 1 and 5 were not diverted onto Wigginton Road.

Option 11 was very similar to Option 10, but without the bus diversions, and resulted in improved south- and northbound journey times on Wigginton Road.

Option 12 built upon Option 11, with a bus stop for Route 6 provided within the Hospital grounds. This provided south- and northbound travel time benefits on Wigginton Road compared with those achieved by the LMW Improvements, but to a lesser extent than Option 11.

4.3 Conclusions

It has been concluded that Routes 1 and 5 cannot be diverted onto Wigginton Road without having some detrimental impact on journey times. This is due to a combination of the requirement for buses to travel longer distances and the impact of additional bus services on the already congested Wigginton Road corridor. It is noted that other benefits, such as improved accessibility for hospital patients, visitors and staff, have not been considered within this assessment.

The Option 11 assessment provided evidence that a package of measures, comprising the removal of the mini-roundabout at Fountayne Street; the consolidation of Wigginton Road bus stops; and a revised Wigginton Road / Haxby Road junction layout, whilst maintaining existing bus routing, may deliver some journey time benefits along Wigginton Road.

There was some evidence that there may be small increases in journey times on Haxby Road although it is noted that the Wigginton Road / Clarence Street / Haxby Road proposed signals were modelled as a "Worst Case" fixed time. This means that stage lengths were not reduced when there was no traffic demand and that demand dependent pedestrian stages were called every cycle. A more efficient operation may mitigate journey time increases on Haxby Road whilst retaining the benefits shown on Wigginton Road.

It is noted that other impacts of the proposals, such as the cost to passengers currently using the existing Feversham Crescent bus stop, have not been considered as part of this appraisal. It is also recognised that changes to priority at the Fountayne Street junction may increase delays for drivers egressing the hospital grounds.

Finally the Option 12 assessment did suggest that diverting Route 6 into the hospital grounds, and removing the associated Wigginton Road stop, may have the potential to reduce delays on Wigginton Road that could reduce general traffic journey times and also mitigate against some of the additional travel time caused by the diversion. This option would also provide improved accessibility and waiting area benefits for bus passengers travelling to and from York District Hospital that have not been considered as part of this appraisal.

Appendix A Option Modelling Assumptions

| Option number | Description | Data provided by CYC | Model Assumptions |
|------------------|---|--------------------------------|--|
| LMW Improvements | Inclusion of new Clarence Street / Lord Mayor's Walk junction layout and signal timings | Layout drawing LinSig model | <p>Saturation flows assumed to remain similar to existing junction</p> <p>Claremont Terrace stage will be demand dependant and is likely to run 4 to 5 times per hour, other stages will run to their maximum.</p> <p>AECOM added an inter peak scenario to the LinSig for LMW. The inter peak operation will be similar to the AM peak and PM peak.</p> |
| Option 2 | LMW Improvements + Test of inbound bus lane on Clarence Street | Layout drawing LinSig model | <p>Highway Network on Clarence Street to be amended in accordance with Better Bus Area Funding (BBAF) – Clarence Street Bus Lane Consultation Option 1 drawing</p> <p>Cycle Lane at head of junction will NOT be provided</p> <p>Puffin Standard operation operating under VA as described by CYC. Puffin will be demand dependent, sufficient pedestrian demand will be added so that the Puffin is called approximately 40 times an hour in each time period.</p> <p>Bus Gate Stop Line for Bus is 'Give Way' and is not signal controlled.</p> <p>Bus Gate signals have to be tied to Clarence Street LMW.</p> <p>When Clarence Street is green in general Bus Gate (for general traffic) will be red.</p> <p>When Clarence Street is red the bus gate (for general traffic) will be green; appropriate lags will be applied</p> <p>VAP will detect a bus entering the bus lane on the approach to the Bus Gate. If the Bus Gate for general traffic is red, it will not turn green until the bus has cleared the bus lane.</p> <p>If Clarence Street is about to turn red, and there is a bus at the end of the bus lane the green stage can be extended to allow the bus time to clear the signals.</p> |

| | | | |
|----------|--|--|---|
| Option 3 | LMW Improvements + Moving all buses onto Wigginton Road with existing signal timings | Layout drawing | <p>Toucan demand (same as base models).</p> <p>Route 1 and Route 5 to have the same dwell times as Route 6 for Wigginton Road stops.</p> <p>Toucan Demand on Wigginton Road to remain the same as in the base.</p> <p>The bus link in Nestle South will have a 20 mph speed limit.</p> <p>The rising bollards on the bus link will not be explicitly modelled.</p> <p>Not modelling other Nestle South traffic.</p> <p>Nestle South Junctions will be priority controlled.</p> <p>On the Nestle South Master Plan, bus stops have been provided to the south of the bus link. In Option 3 no buses will use these stops as all services have transferred onto Wigginton Road.</p> |
| Option 4 | Option 3 + Amended signal timings at Haxby Road / Wigginton Road junction | n.a. | <p>Signal timings split (to be modelled as fixed time).</p> <p>Calls for demand dependent stages (S3 and S4) (same as base models).</p> |
| Option 5 | Option 4 + Wigginton Road / Fountayne Street - Convert from mini roundabout to priority junction. | Layout drawing | N/A |
| Option 6 | Option 4 + Wigginton Road / Hospital Access - Convert from mini roundabout to signal controlled junction. | Layout drawing LinSig model (including saturation flows) | N/A |
| Option 7 | Option 4 + Wigginton Road / Hospital Access - Convert from mini roundabout to signal controlled junction + Removal of parking on east side of Wigginton Road to convert to traffic lane | Layout drawing LinSig model (including saturation flows) | N/A |
| Option 8 | Option 4 + Amalgamation of bus stops on Wigginton Road. | Layout drawing | <p>Toucan demand (same as base models).</p> <p>Bus dwell times for Hospital bus stop increased by half of the dwell time at Feversham</p> |

| | | | |
|-----------|---|--|---|
| | | | Crescent. Bus cage at Hospital expanded to allow two buses to dwell southbound on Wigginton Road. |
| Option 9 | Option 4 + Redesign of Wigginton Road / Haxby Road / Clarence Street junction | Layout drawing LinSig model (including saturation flows) | Saturation flows unchanged with exception of Clarence Street to Haxby Road which is increased by 50. Demand dependent stages (S3 and S4) appear every cycle (unlike base models which were based on MONI log files). |
| Option 10 | Option 5 + Option 8 + Option 9 | n.a. | |
| Option 11 | Option 5 + Option 8 + Option 9 | Layout drawing LinSig model (including saturation flows) | |
| Option 12 | Option 11 + Route 6 stops within York Hospital grounds + Route 40 amalgamated bus stop | n.a. | Bus accesses hospital via main Hospital Access. Stops provided within car park at the main Hospital Entrance. |

Appendix B LMW Improvement Charts

Chart 1: Baseline and LMW Improvement bus journey times

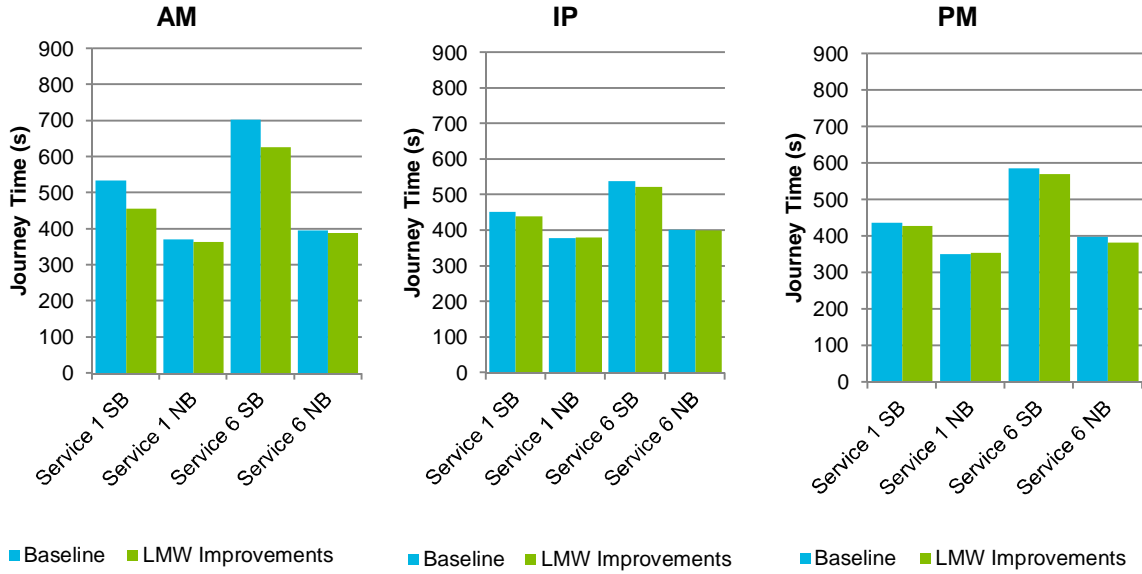
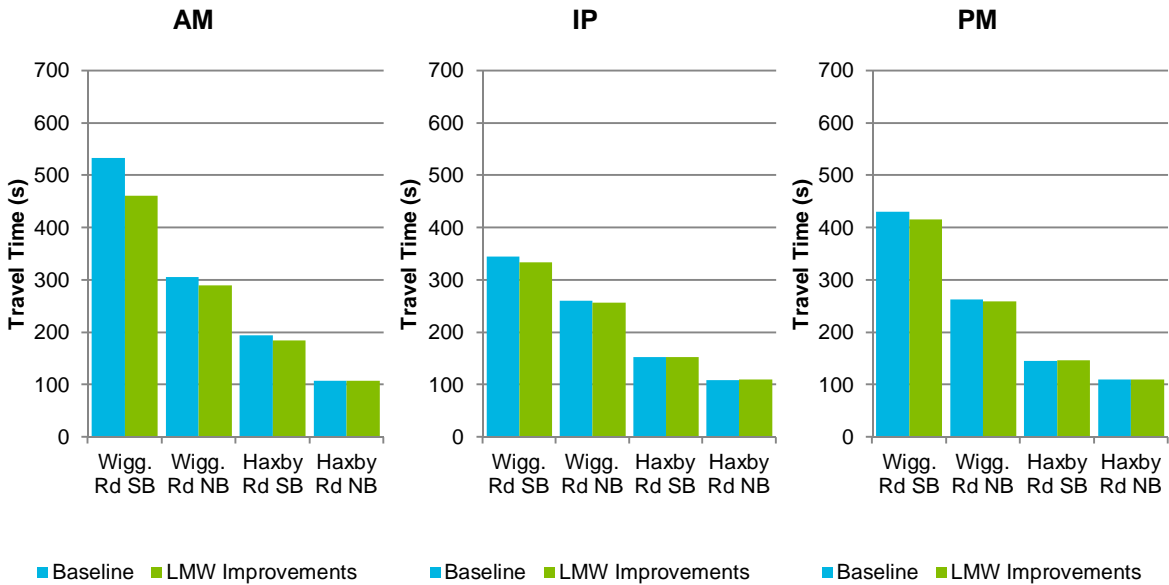


Chart 2: Baseline and LMW Improvement general traffic journey times



Appendix C Option 2 Charts

Chart 3: Option 2 bus journey times

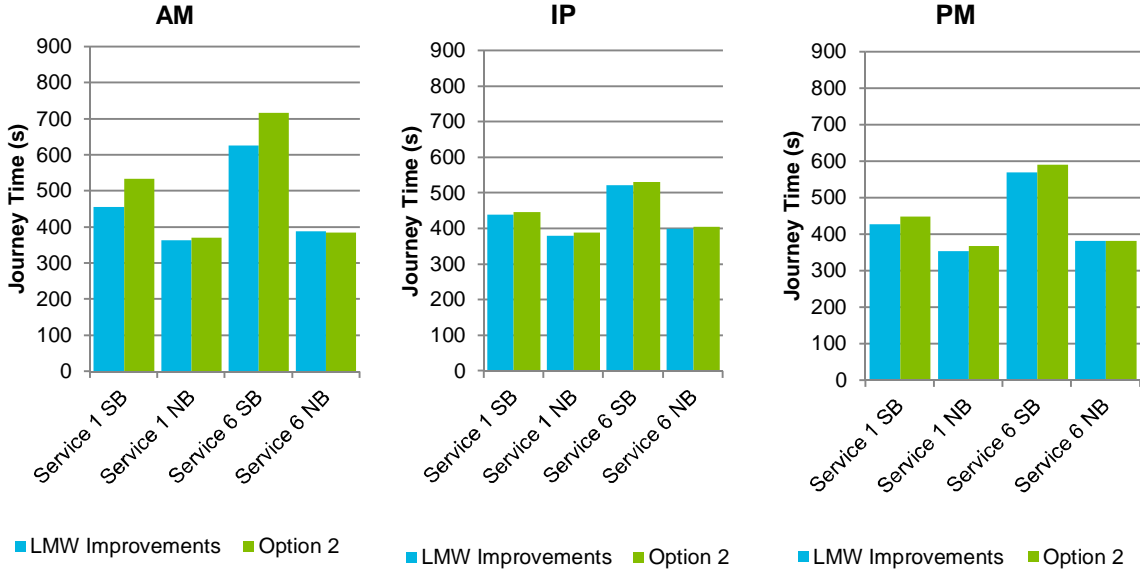
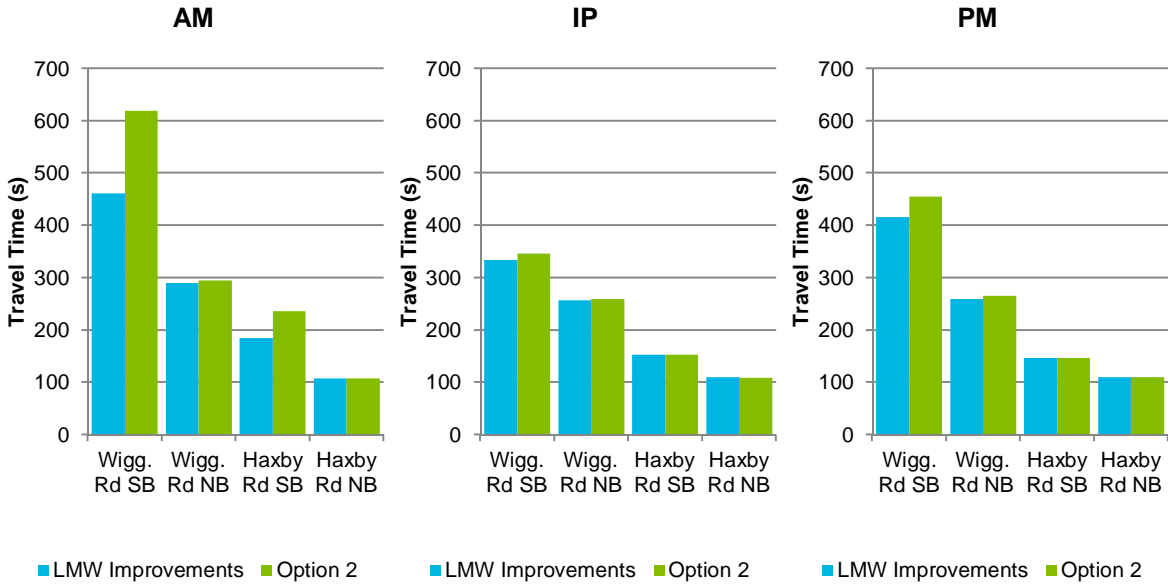


Chart 4: Option 2 general traffic journey times



Appendix D Option 3 Charts

Chart 5: Option 3 bus journey times

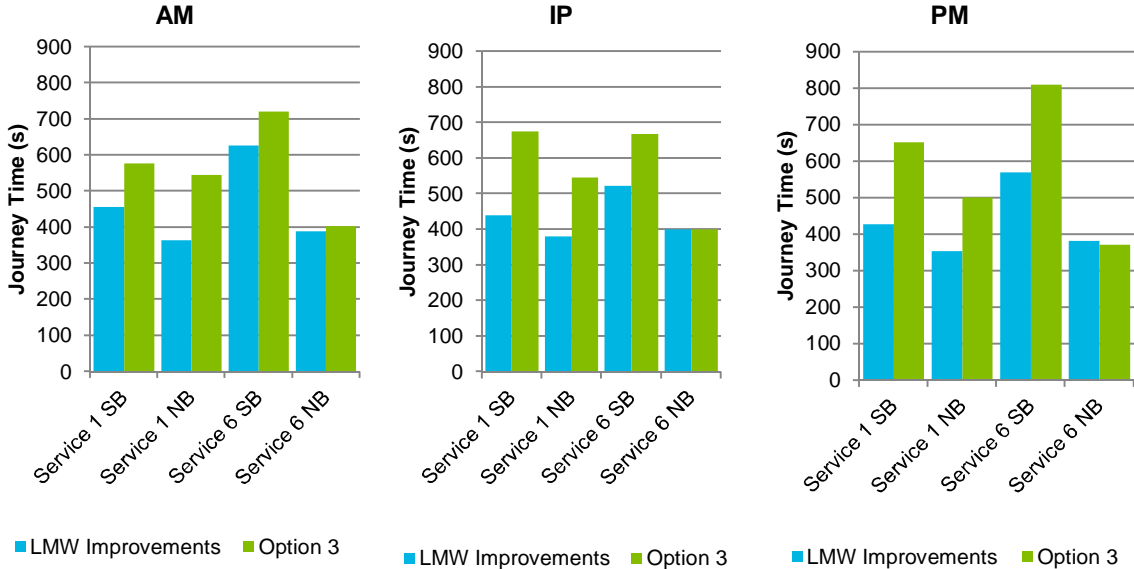
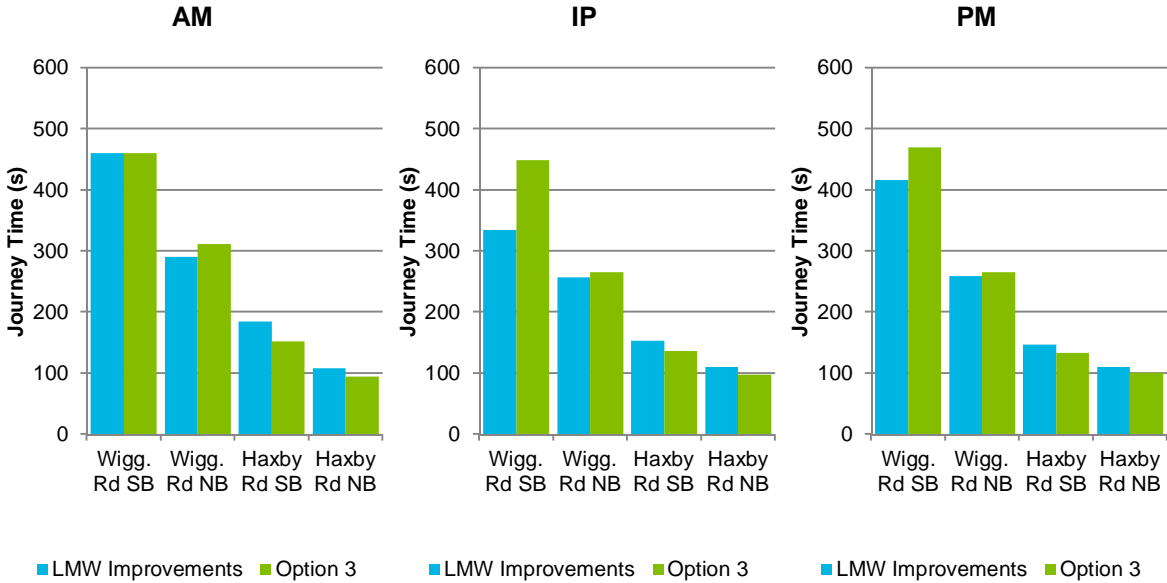


Chart 6: Option 3 general traffic journey times



Appendix E Option 4 Charts

Chart 7: Option 4 bus journey times

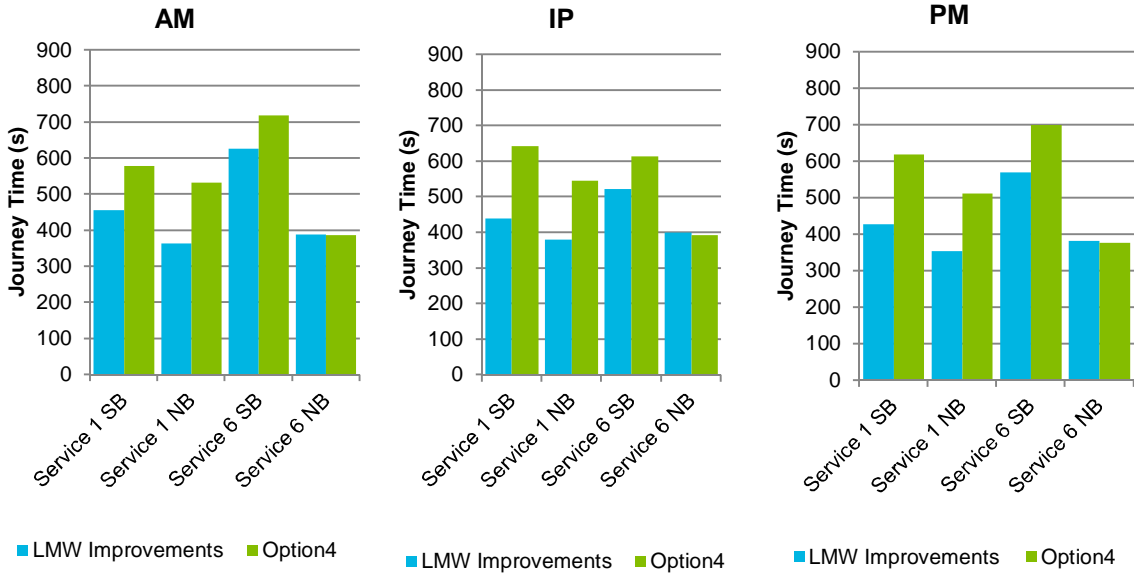
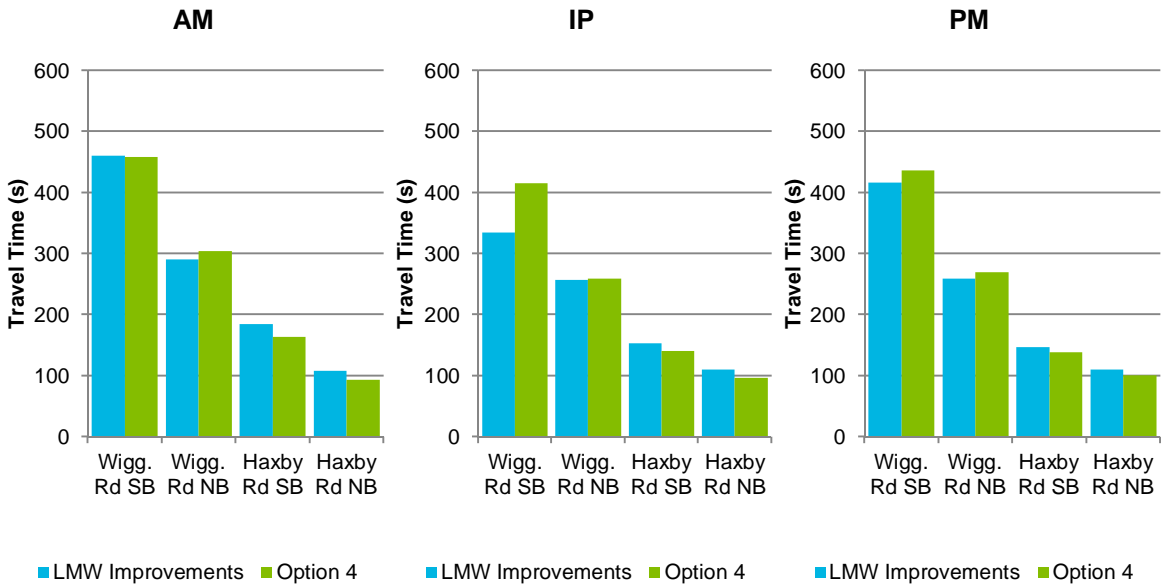


Chart 8: Option 4 general traffic journey times



Appendix F Option 5 Charts

Chart 9: Option 5 bus journey times

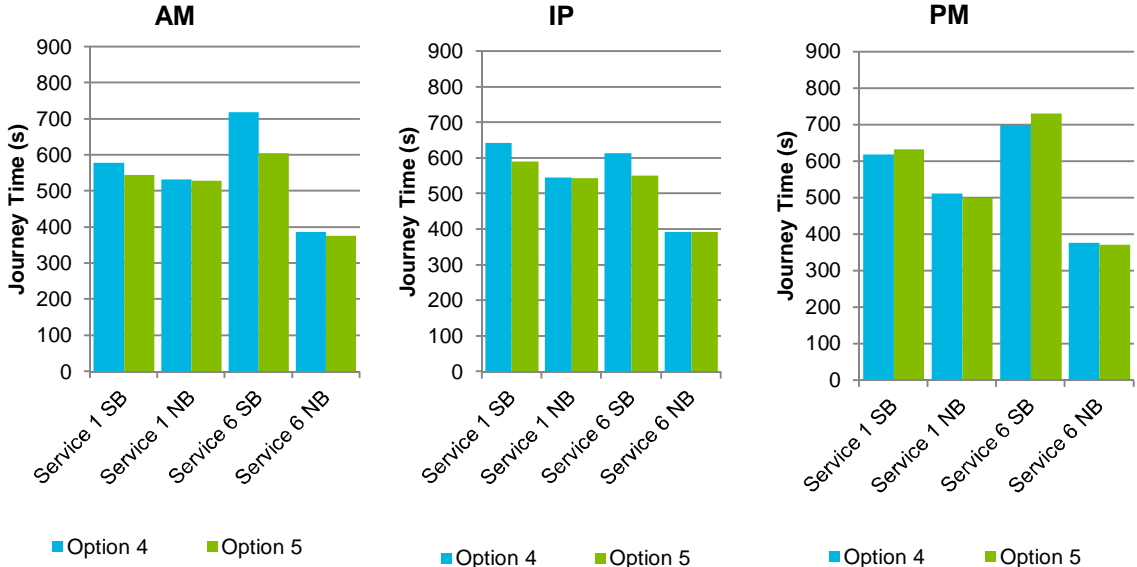
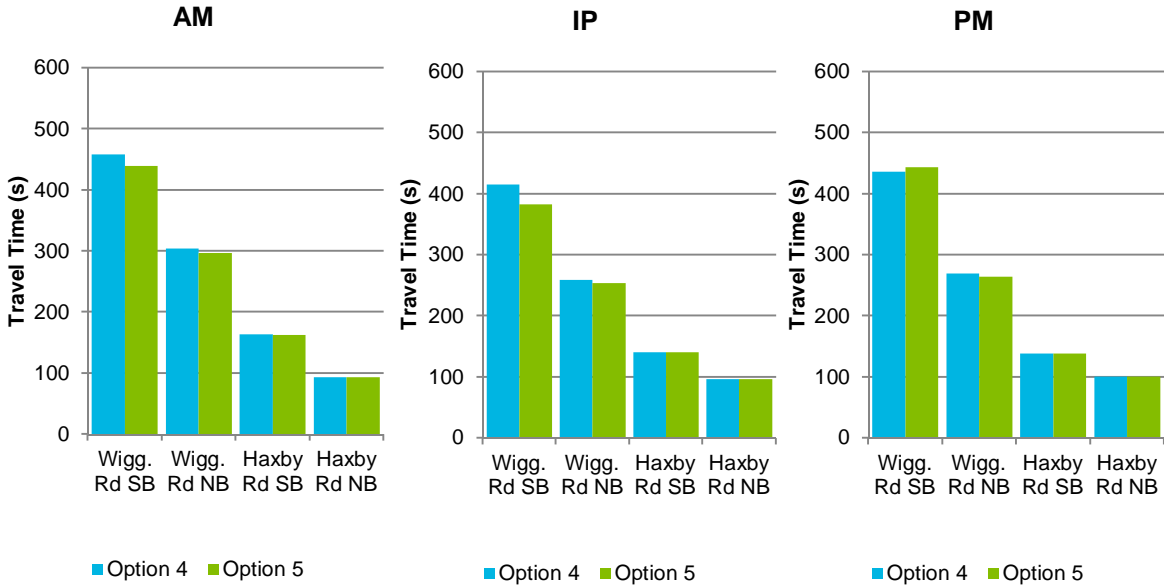


Chart 10: Option 4 general traffic journey times



Appendix G Option 6 Charts

Chart 11: Option 6 bus journey times

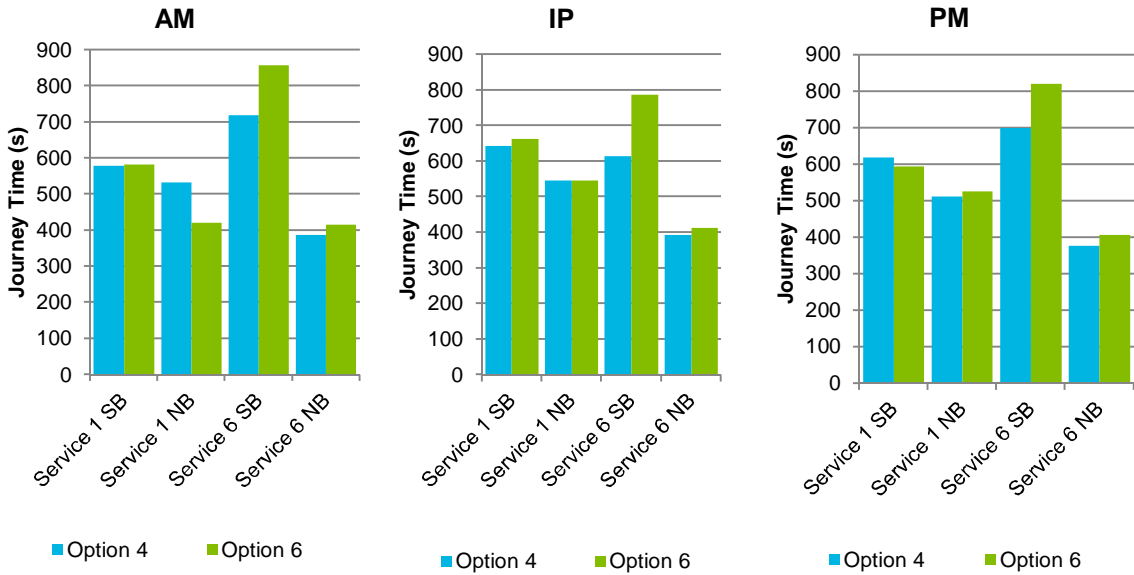
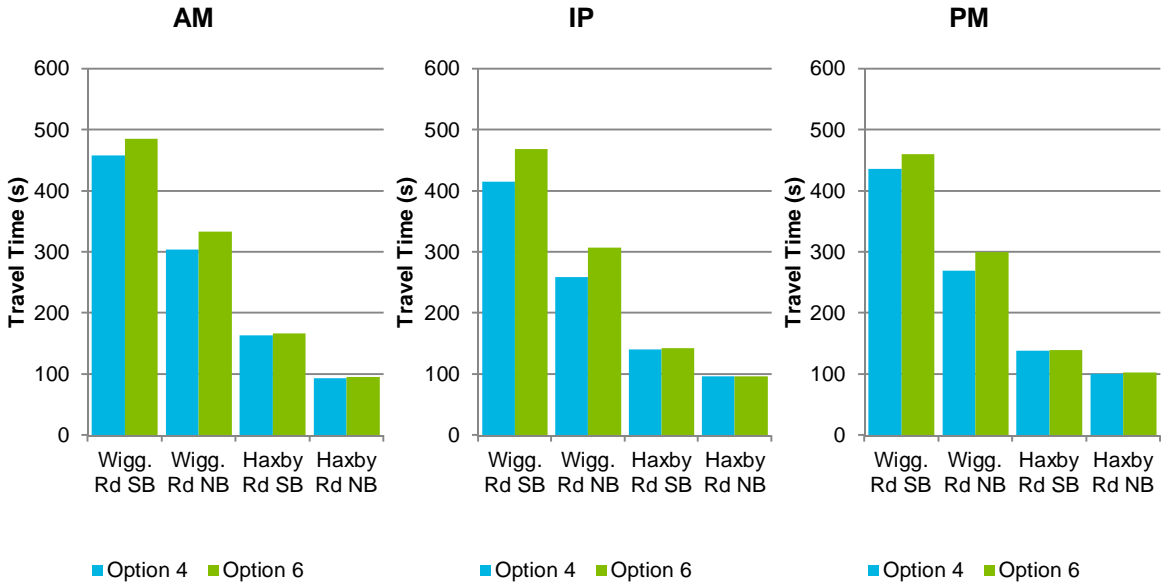


Chart 12: Option 6 general traffic journey times



Appendix H Option 7 Charts

Chart 13: Option 7 bus journey times

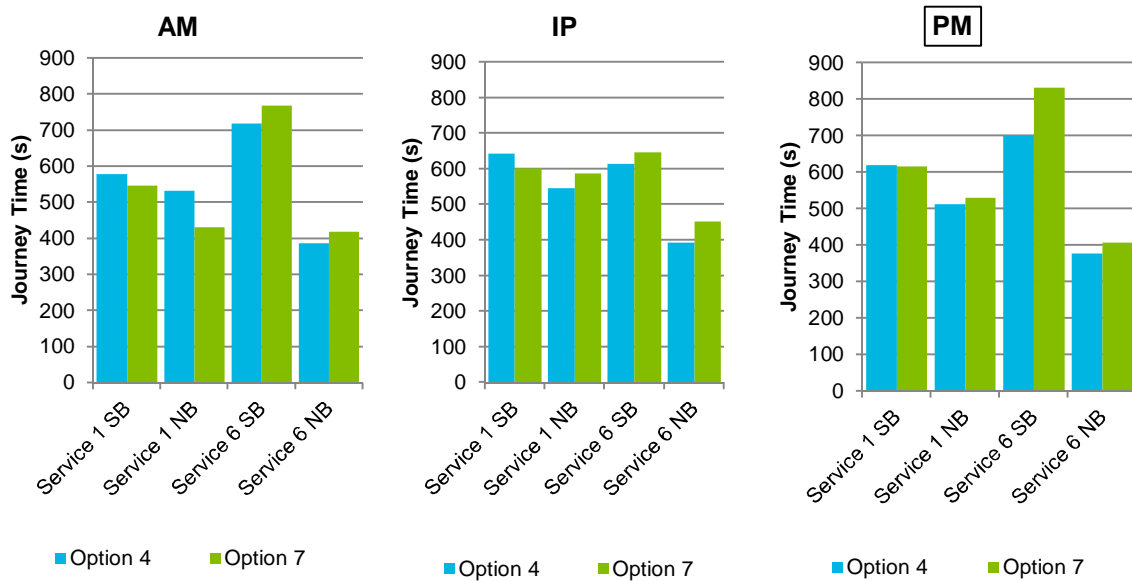
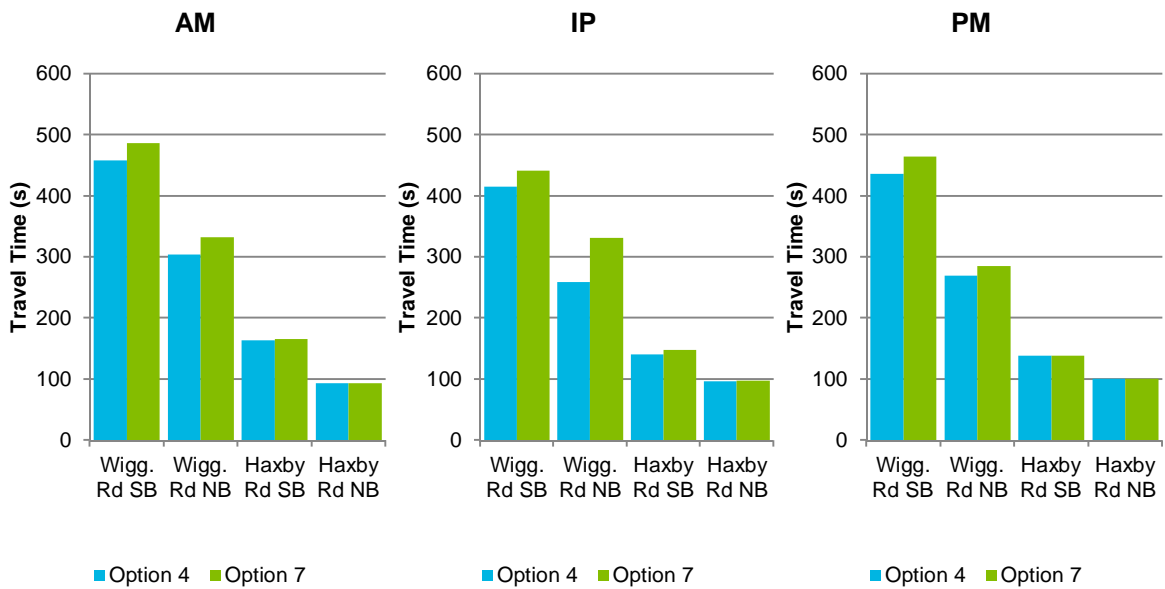


Chart 14: Option 7 general traffic journey times



Appendix I Option 8 Charts

Chart 15: Option 8 bus journey times

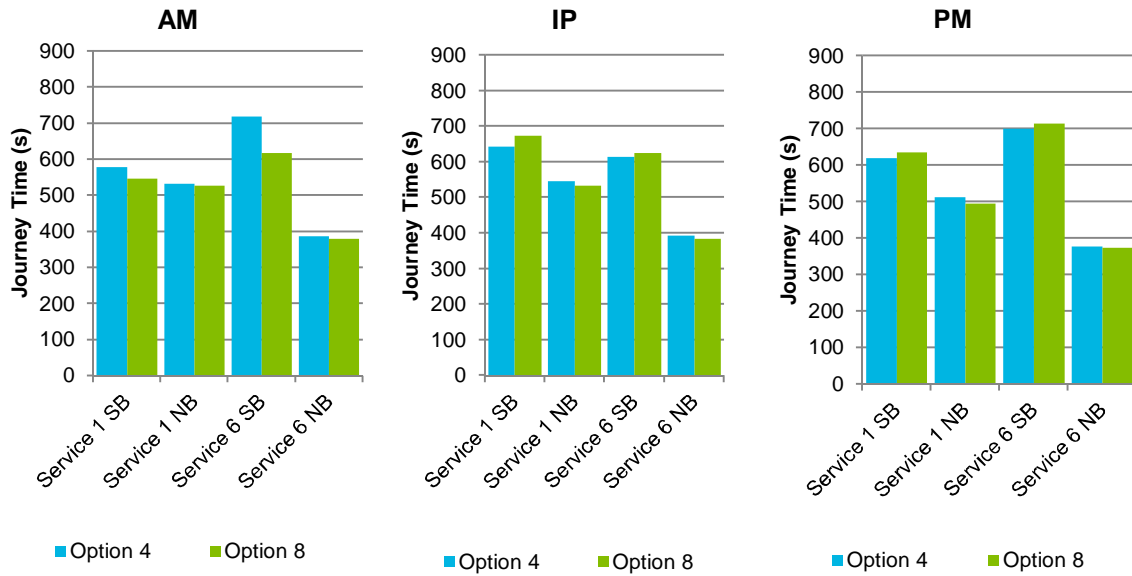
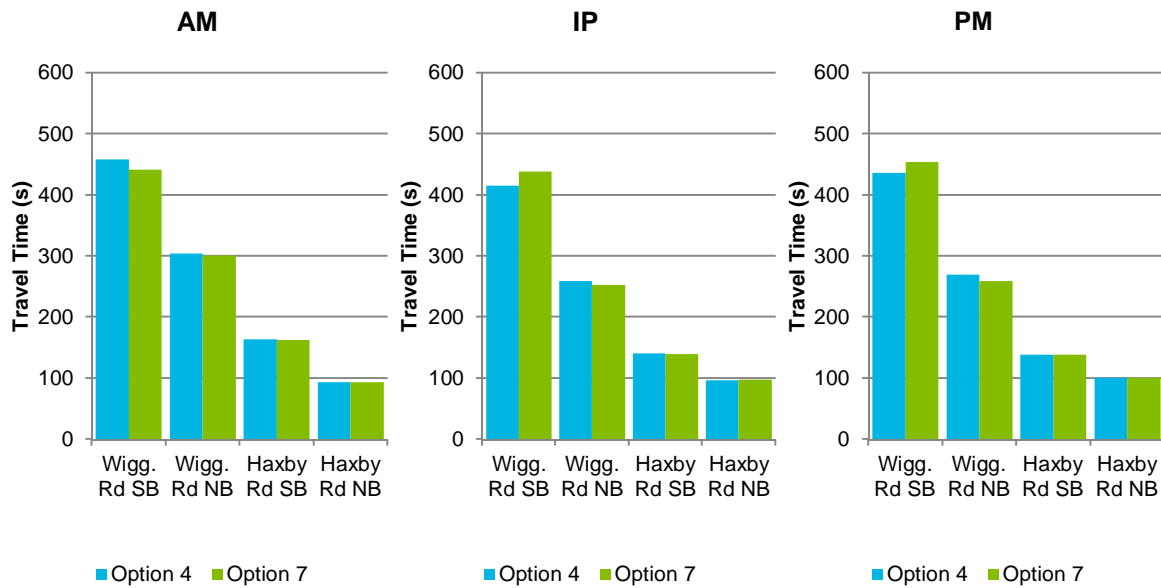


Chart 16: Option 8 bus journey times



Appendix J Option 9 Charts

Chart 17: Option 9 bus journey times

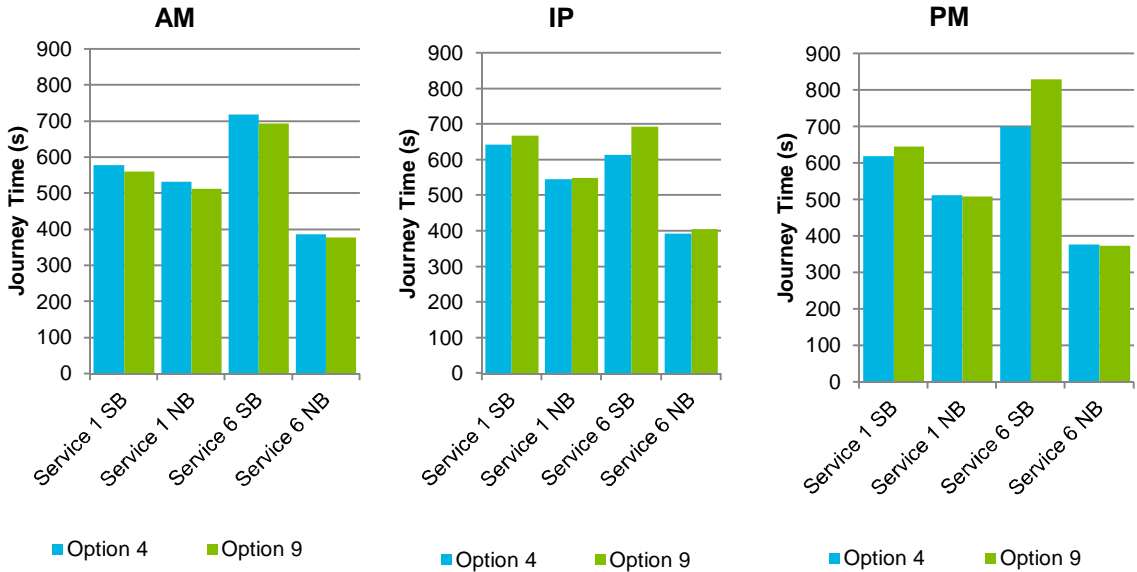
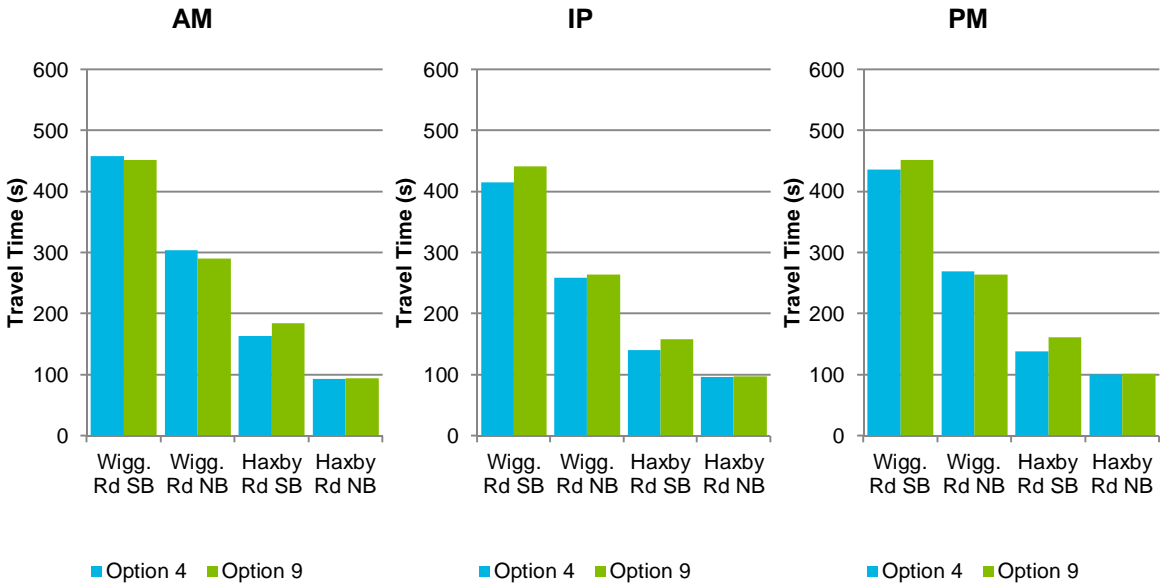


Chart 18: Option 9 general traffic journey times



Appendix K Option 10 Charts

Chart 19: Option 10 bus journey times

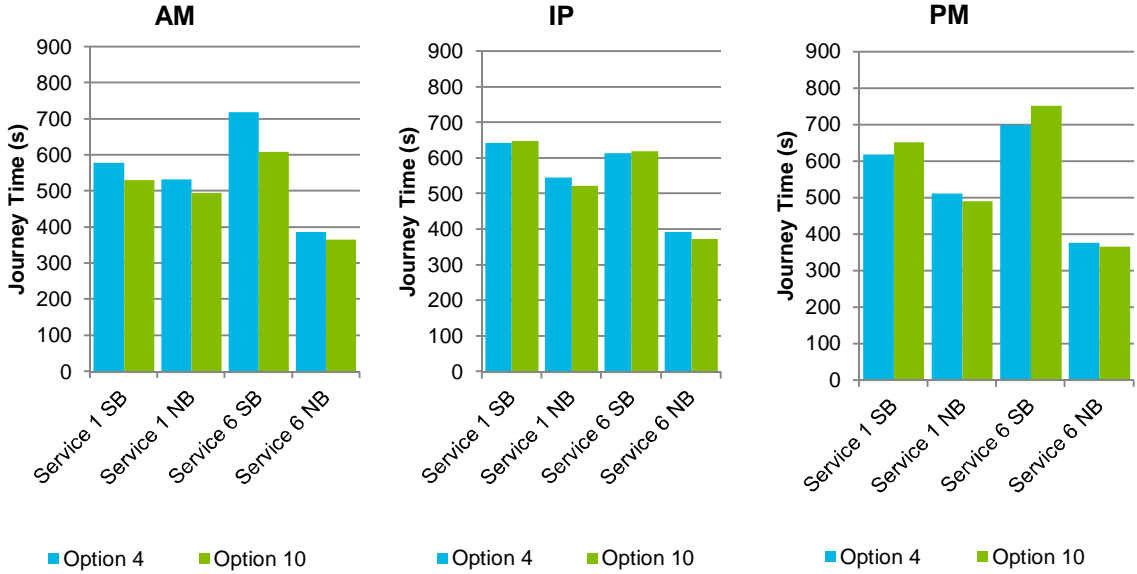
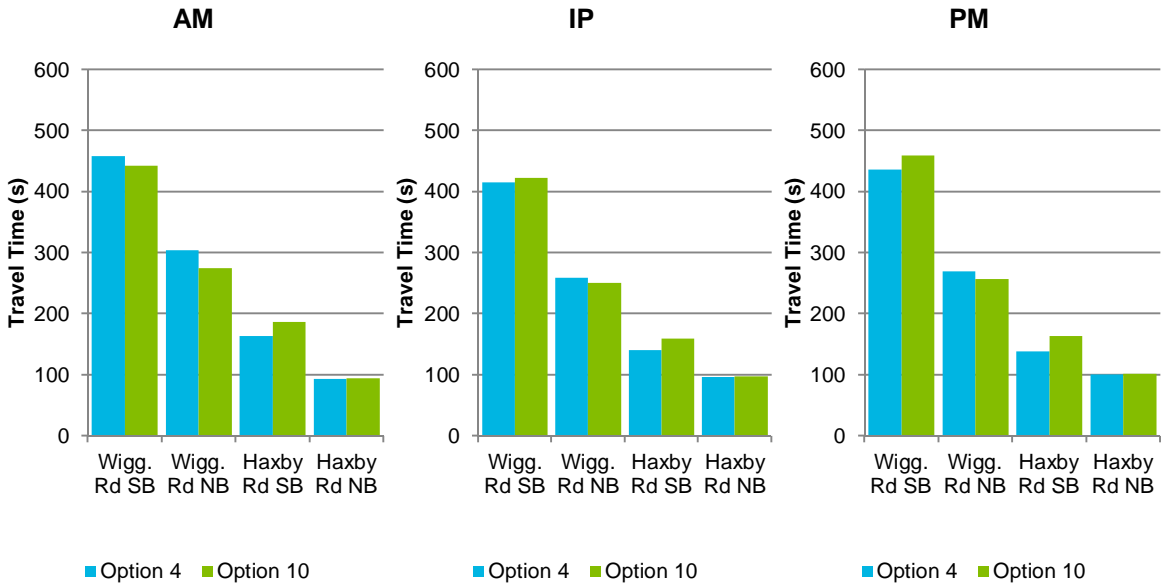


Chart 20: Option 10 general traffic journey times



Appendix L Option 11 Charts

Chart 21: Option 11 bus journey times

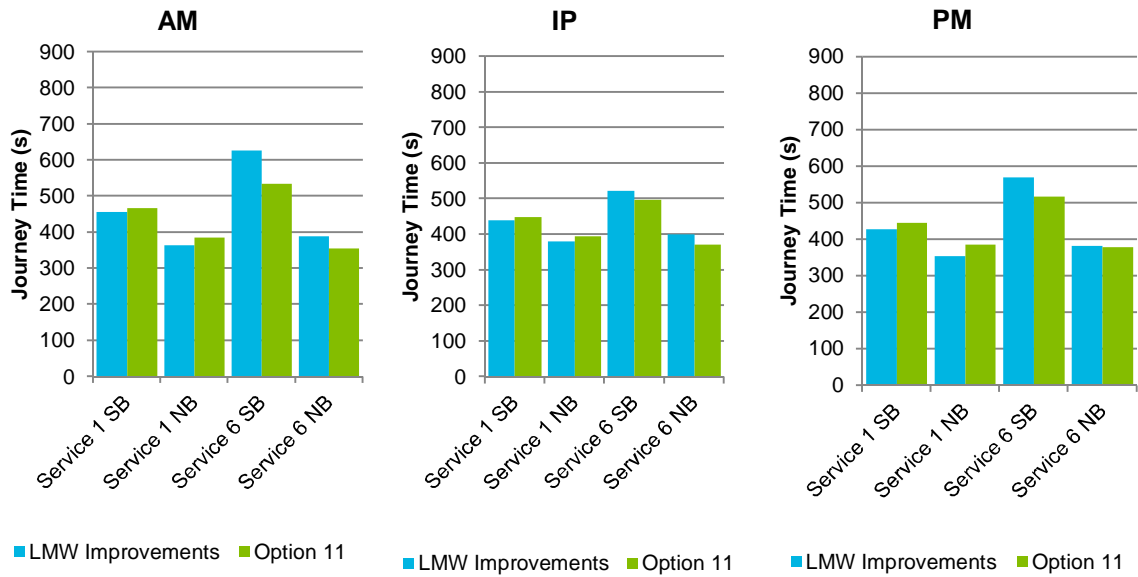
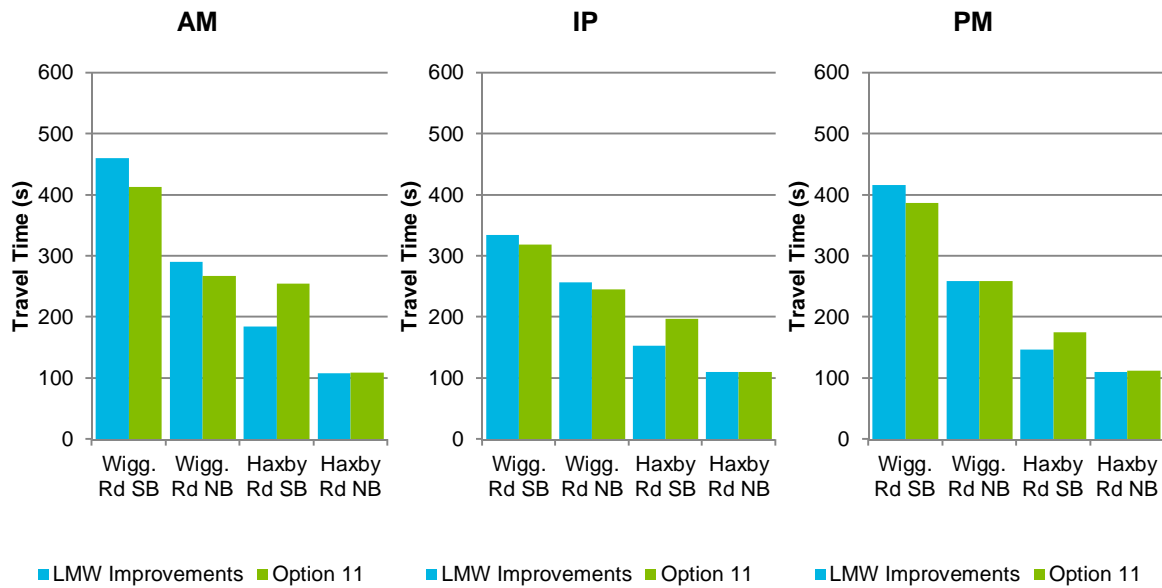


Chart 22: Option 10 general traffic journey times



Appendix M Option 12 Charts

Chart 23: Option 12 bus journey times

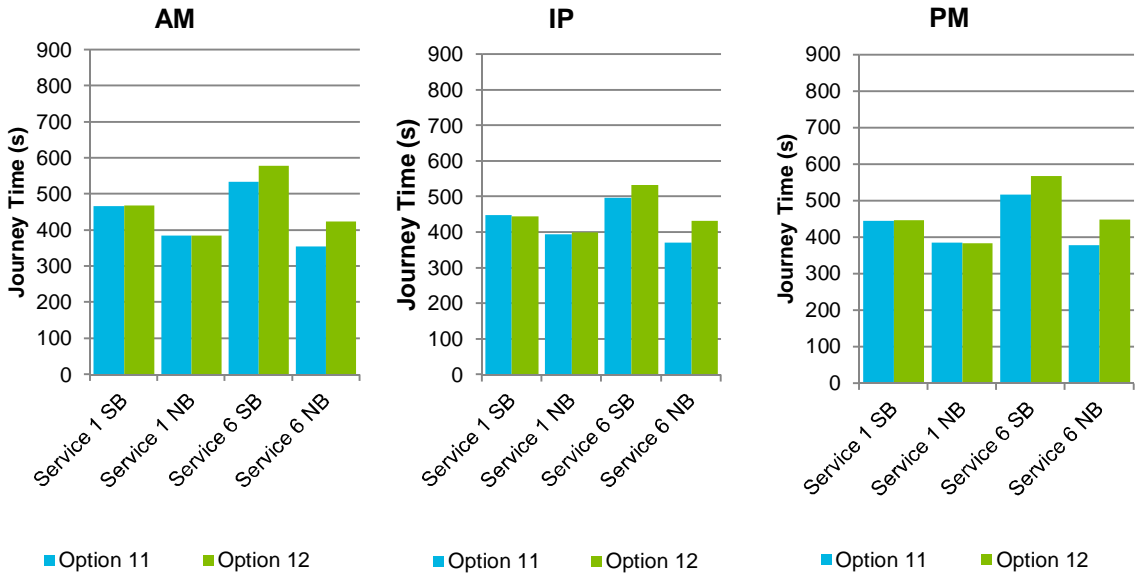


Chart 24: Option 12 general traffic journey times

