CABINET MEMBER FOR ECONOMIC DEVELOPMENT, PLANNING AND TRANSPORTATION

Venue: **Training Room, 3rd Floor, Bailey House, Rawmarsh Road, ROTHERHAM. S60 1TD**

Date: **Monday, 21st June, 2010**

Time: ***10.00 a.m.**

*Please note the start time for this meeting

A G E N D A

1. To determine if the following matters are to be considered under the categories suggested in accordance with Part 1 of Schedule 12A (as amended March 2006) to the Local Government Act 1972.

2. To determine any item which the Chairman is of the opinion should be considered later in the agenda as a matter of urgency.

3. Minutes of a meeting of the Chesterfield Canal Partnership Executive Steering Group held on 11th March, 2010. (copy attached) (Pages 1 - 6)

4. Minutes of a meeting of the Townscape Heritage Initiative Partnership held on 7th June, 2010 (copy attached) (Pages 7 - 8)

5. B6098 Bolton Road, Manvers; Ward 19 Wath - Proposed New Shared Use Pedestrian / Cycle Footway (Pages 9 - 11)
   Nigel Davey, Engineer, to report.
   - to inform Cabinet Member of a proposal to provide a new length of pedestrian / cycle footway on the B6098 Bolton Road, Manvers.

6. A630 Rotherham to Thrybergh Smart Route - Proposed improvements. (report attached) (Pages 12 - 113)
   Tom Finnegan-Smith, Acting Transportation Unit Manager, to report.
   - to seek Cabinet Member approval to undertake the detailed design and implementation of highway improvements at Mushroom roundabout (the junction of the A630 Fitzwilliam Road/Doncaster Road and A6123 Herringthorpe Valley Road/Aldwarke Lane).

   Please note that copies of the Appendices to this report are available in the Members' Room in the Eric Manns Building, 45 Moorgate Street, Rotherham.

   Copies are also available electronically via the Intranet/Internet.

Agenda Item 3

MINUTES of a meeting of the **CHESTERFIELD CANAL PARTNERSHIP EXECUTIVE STEERING GROUP** held at the Westthorpe Business Innovation Centre, Killamarsh on Thursday 11th March 2010.

Derbyshire County Council

Mr M Dowson, Ms G Gregory and Mr P Storey

Nottinghamshire County Council

Councillor Mrs E Yates and Mr A Wickham

Rotherham Metropolitan Borough Council

Councillor Mrs J Whysall and Mr P Cassy

Bassetlaw District Council

Ms S Withington

Chesterfield Borough Council

Councillor P Proctor and Mr M Shewring

North East Derbyshire District Council

Councillor H Laws, Ms H Fairfax and Ms L Chapman

Chesterfield Canal Partnership

Dr G Coles and Mr S Reaney

Chesterfield Canal Trust

Mr R Stonebridge and Mr D Trickett

Inland Waterway Association

Mr J Baylis

Hyder Consulting (For Agenda Item 5 Only)

Mr G Webber and Mr P Moss

(Mr J Baylis, representing the IWA, took the Chair for the first three items on the agenda)

1. APOLOGIES

Apologies for absence were received from Cllr C Jackson (Derbyshire County Council), Councillor I Jones (Bassetlaw District Council), Mr E Green (Derbyshire Wildlife Trust), Ms F Clarke (Groundwork Creswell, Ashfield & Mansfield), Mr M Bloomfield (Chesterfield Canal Trust) and Mr J Nuttall (British Waterways).

2. MINUTES OF THE MEETING HELD ON 9TH OCTOBER 2009

The Minutes were accepted as a true record.

3. MATTERS ARISING FROM THE MINUTES

There were no matters arising which were not covered by the agenda.

4. ELECTION OF ESG CHAIR AND VICE CHAIR

After some discussion it was agreed that Councillor Mrs E Yates of Bassetlaw District Council be elected as temporary Chair of the ESG until a replacement Chair from BDC was appointed. It was also agreed that Councillor Yates be appointed as Vice Chair of the ESG as the elected member from Nottinghamshire County Council. These appointments would be effective for the next twelve months.

5. MARINA DEMAND & LOCATION STUDY BY HYDER CONSULTING

Mr G Webber and Mr P Moss presented the draft results of this study which had been commissioned jointly by Bassetlaw District Council and the Chesterfield Canal Partnership.

The study had been undertaken by a core team of three people and set out to assess the demand for moorings on the Chesterfield Canal should the opportunity to create additional moorings arise. The study recognised that the marina at Shireoaks was operating at its practical capacity and, because of the unique geographical position of the Chesterfield Canal, it had been necessary to investigate national trends and parameters in order to assess the market. There were two types of moorings with different needs and priorities; residential and leisure users. Compared with the overall BW network, the number of existing moorings on the Chesterfield Canal was below the national average.

The study had identified three sites with high potential; the Western Gateway at Worksop, near the junction of the A57 and the Lock Keeper public house, Retford East and the Hop Pole Inn sites, both in Retford. A further two sites with medium potential were identified in Misterton. In terms of a preferred short-term site which could be operational within 5 years, the Hop Pole was the favourite. In the time scale of 5 to 15 years, the Western Gateway and Misterton East offered the best opportunities. Improved town centre moorings at Worksop and Retford also required consideration. The capital cost of a marina capable of accommodating circa 160 boats was estimated between £1.35 and £1.5 million and this would generate an annual local spend of some £400,000.

Hyder Consulting recommended the production of a “Marina Investment Guide” specifically tailored to the Chesterfield Canal as a means of encouraging external investment.

The draft report was submitted to BDC on the 11th March 2010. A discussion meeting with BDC planners would take place shortly and the final report, which would also identify funding options, would be published before the end of the current financial year.

The Chair thanked Hyder Consulting for their excellent presentation.

6. YEAR END REPORT ON THE CCP WORK PROGRAMME 2009-10

GC tabled a report summarising the Work Programme for 2009/10.

GC characterised the year as one of steady but uneven progress; some smaller projects, such as Hollingwood Lock House, had made little visible progress whilst others, such as Phase1 of the Northern Loop Road at Staveley which included bridges over the canal, had been completed. Behind the scenes a great deal of progress had been made on securing design and legal frameworks, for example planning permission had recently been obtained for the Staveley Town Basin and the application for the Chesterfield Waterside Project would shortly go before the Planning Committee at CBC.

A lot of work had been undertaken in order to raise the profile of the Chesterfield Canal and the Canal Trust had made a positive contribution to this. The Inland Waterway Association now recognised that the Chesterfield Canal was among the top 5 canal projects which were "ready for funding". HF reminded the meeting that the line of the canal was in the process of being secured in the LDF of NEDDC.

It was agreed that the delivery of the Work Programme be noted.

7. PROPOSED CCP WORK PROGRAMME 2010-2012

GC tabled a report giving details of the proposed Work Programme for the two-year period from 2010 to 2012.

GC explained that it had now been confirmed by both the Heritage Lottery and Big Lottery Fund that the timetable for funding major projects post the London Olympic Games in 2012 would be as follows:-

- 2011-Projects to be submitted for funding
- 2012-Projects accepted for funding
- 2013-Construction work to begin

The Partnership's Work Programme had been designed to fit in with this timetable.

GC emphasised that land acquisition would be a major issue facing the Partnership and a robust legal framework to deliver the project would be needed both to address the concept of "Risk Management" and to satisfy the requirements of the major funding bodies. In these circumstances, therefore, it would be necessary to resolve the legal framework for the Partnership **before** the submission of funding bids. Education and training programmes were important in order to demonstrate the wider credentials of the Chesterfield Canal and there was an urgent need to increase the level of networking with funding bodies, patrons and other influential organisations. It would be necessary, therefore, for the Partnership to have a critical look at the staffing resources which would be required to formulate significant funding bids. GC said he would present a more detailed action plan at the next ESG.

It was agreed that the proposed Work Programme be formally adopted.

8. CCP BUDGET REPORT

GC tabled the report for the Partnership's budget for 2009/10 which showed an under spend on budgeted expenditure mainly due to ecological surveys which would be undertaken during the next financial year. There had been some misunderstanding, however, on contributions and to balance income and expenditure for 2009/10 would require a draw on the Reserve Fund.

GC then presented the proposed budget for next year and emphasised the point that it would not be possible after March 2011 to make further demands on the Reserve Fund because of the requirement to hold sufficient funds to cover possible redundancy costs for Partnership staff. For the financial year 2011/12, therefore, it would be necessary to further increase contributions or obtain funding from other sources to enable the Partnership to continue operating in its current form. GC suggested that the funding issue be discussed at the next TOG meeting with a view to submitting proposals in due course to the ESG and HL said that local authority representatives needed to confirm the level of contributions for 2010/11 as matter of urgency and to re-enforce the importance of the restoration of the Chesterfield Canal both to local communities and to the overall regeneration of the area.

It was agreed that the Development Manager's recommendations, a-g, be accepted.

9. NEXT NAVIGATION EAST

With the aid of a projector GC presented a verbal report to the meeting on Next Navigation East. He explained that the final restoration project for the Chesterfield Canal had been divided into two sections, east and west, with the western section covering the route from Staveley to Killamarsh and the eastern section from Killamarsh to the eastern portal of the Norwood Tunnel at Kiveton Park.

The Next Navigation East report was presented as a consultation draft. It consisted of some 28 chapters which set out the case for restoration, the community and environmental context, the design of key structures together with indicative designs, a summary of community engagement and the core costing for the project. The report, after undergoing a period of consultation, would form the basis of submissions to major funding bodies such as the Heritage Lottery Fund.

The restoration work would be done in stages over a period of time to ensure that the cost of the individual sections was within the funding scope of the Heritage Lottery Fund. The work would be undertaken by professional civil engineers and approved contractors but there would be some opportunities for volunteers to contribute under the close supervision of qualified engineers. The cost of restoring this section was estimated at £26 million at today's prices but this could be reduced by up to 30%. In GC's opinion, the time frame for a realistic and deliverable restoration programme was 10/15 years.

The consultation draft of the Next Navigation East report was available on a CD ROM which contained all the appendices; other supporting documents were also available. CD ROMs were distributed at the meeting to members of the Partnership and the representative of RMBC was given two copies of the CD ROM, a written copy of Volume 1 of the report, the appendices and written copies of all the appropriate background and supporting reports. GC requested comments, if possible, by 4th June 2010, and confirmed that the final draft of the report would be ready for the Festival in July 2010.

After some discussion it was agreed that a special meeting of the ESG would be held in June 2010 and the Chair would write individually to the Chief Executive of each Local Authority through which the canal passed asking for comments on the report within a 12 week consultation period. In the meantime, GC would approach the individual authorities to decide the most effective way of meeting with Leaders and Chief Executives to discuss the implications of the Next Navigation East report.

10. DEVELOPMENT UPDATE

GC tabled a summary of developments on a number of canal projects based on submissions from members of the Technical Officers Group. AW added that 5 staff had been appointed to the Idle and Trent Valley Landscape Project; the staff would be based with BW at Newark and the value of the project was some £3 million. PS confirmed that work on the Staveley Town Basin would commence in April.

It was agreed that the Development Update report be noted.

11. FUTURE FORM OF THE PARTNERSHIP

GC presented a discussion paper for the ESG to authorise officers to begin to explore what options were available to enable the Partnership to move forward against the background of a potential future expenditure of some £35 million. RS said that the Partnership needed to assess its delivery mechanism because the Heritage Lottery Fund would require assurances on governance before funding was contemplated.

The officer recommendations were accepted and it was agreed that GC would establish a small working party through the Technical Officers Group.

12. CHESTERFIELD CANAL TRUST

RS tabled an update report from the Chesterfield Canal Trust and confirmed that the Trust's membership was now in excess of 1,000. The final draft of the Community Interest Company would be submitted for approval to the Trust's Annual General Meeting on Thursday 18th March 2010.

The meeting noted the report from the CCT and congratulated them on the increasing level of membership.

13. IWAC REPORT ON PARTNERSHIP WORKING

GC informed the Executive that the Inland Waterways Advisory Council's report on "Partnership Working", due to be published in April 2010, would use the Chesterfield Canal Partnership as a model of best practice in the waterways field.

The meeting noted the Development Manager's verbal report.

14. ANY OTHER BUSINESS

RS explained that DCC provided goods and services for Partnership staff in addition to their financial contribution because they acted as the "host" authority in terms of staff employment. DCC, however, had recently held a Single Status job evaluation exercise for all members of staff which had impacted on the salary level of the Partnership's

Development Manager. It was unfortunate that DCC had not consulted with the Partnership on this issue and if the appeal by the Development Manager was successful there would be an impact on the Partnership's budget and on other members.

After some discussion it was agreed that the Chair of the ESG would write to DCC on this matter; AW would liaise between the Chair, other members of the ESG and members of the TOG.

15. DATE OF NEXT MEETING

After some discussion it was agreed that the date of the next two meetings of the ESG would be as follows:-

- **Thursday 10th June 2010 at a DCC venue to be arranged by GC.**
- **Thursday 28th October 2010 at the Retford Enterprise Centre**

It was also agreed that in the future there would be four (4) meetings of the ESG per year in order for members to be able to deal with the increasing work load. Three (3) of these meetings would take place in the mornings and would last for a maximum of 2 hours whilst the fourth meeting, which would take place in the summer months and include a field trip, would last all day.

GC/SR-18/3/2010

TOWNSCAPE HERITAGE INITIATIVE
Monday, 7th June, 2010

Present:- Councillor Smith (in the Chair);

together with:-

Councillor Dave Pickering	Chair, Planning Board
Councillor Barry Dodson	Vice-Chair, Planning Board
John Shepherd	Yorkshire Forward
Charles Hammersley	RMBC Project Officer
Graham Williams	Sheffield Diocese
Peter Hawkridge	Rotherham Civic Society
Andy Robinson	RMBC Architectural Police Liaison Officer

15. INTRODUCTIONS

The Chairman, Councillor Smith, welcomed those present and introductions were made.

16. APOLOGIES

Apologies for absence were received from:-

Canon D. Bliss	Rotherham Minster
Councillor S. Walker	Senior Adviser
Bernadette Rushton	Assistant Town Centre Manager

17. MINUTES OF THE PREVIOUS MEETING HELD ON 15TH DECEMBER, 2009

Consideration was given to the minutes of the previous meeting held on 15th December, 2009.

It was agreed:- That the minutes be received as a correct record.

18. MATTERS ARISING FROM THE PREVIOUS MINUTES

There were no matters arising from the previous minutes.

19. EXCLUSION OF THE PRESS AND PUBLIC

Resolved:- That, under Section 100A(4) of the Local Government Act 1972, the press and public be excluded from the meeting for the following item of business on the grounds that it involves the likely disclosure of exempt information as defined in Paragraph 3 of Part 1 of Schedule 12A to the Local Government Act 1972 (as amended March 2006)

(financial/business affairs).

20. TOWNSCAPE HERITAGE INITIATIVE SCHEME – GRANT APPROVAL FOR NOS. 22–30 HIGH STREET, SNAFU AND UPDATE

Consideration was given to a report, presented by the Project Officer, detailing the application for grant under the Townscape Heritage Initiative Scheme (THI) for Nos. 22-30 High Street.

It was confirmed that planning permission for the building improvements had been granted on 14th December, 2009.

Details of the proposed works, materials to be use, structural repairs etc were set out in the submitted report, together with the proposed elevations.

The Project Officer also outlined progress to date in respect of the following projects;-

- The Three Cranes, Alfonsos and the The George Wright Building
- No. 23 High Street
- No. 20 High Street
- Hamby's block of three properties
- Essoldo Chambers
- Nos. 10 to 12 High Street
- The Minster Yard

Details of the funding elements making up the THI scheme were also set out in the submitted report.

It was agreed (unanimously):- That, this Partnership approves a grant offer under the THI Scheme to The Old Monk Inn Focus Limited and Philip Michael Barker up to a maximum of £288,001 towards repair and restoration works at Nos. 22-30 High Street, SNAFU, as detailed in the report now submitted, subject to Heritage Lottery Fund appraisal and approval.

21. ANY OTHER BUSINESS

There were no other items of business.

22. DATE, TIME AND VENUE OF THE NEXT MEETING

- to be confirmed.

ROTHERHAM BOROUGH COUNCIL – REPORT TO MEMBERS

1.	**Meeting:**	**Economic Development, Planning and Transportation Matters**
2.	**Date:**	**21st June 2010**
3.	**Title:**	**B6098 Bolton Road, Manvers; Ward 19 Wath Proposed New Shared Use Pedestrian / Cycle Footway**
4.	**Directorate:**	**Environment and Development Services**

5. Summary

To inform Cabinet Member of a proposal to provide a new length of pedestrian / cycle footway on the B6098 Bolton Road, Manvers.

6. Recommendations

Cabinet Member is asked to resolve that

1. **The results of the consultation exercise be noted.**
2. **Authority be given for the detailed design to be carried out and for the scheme to be implemented.**
3. **Note that the scheme is to be funded by a neighbouring authority as part of their Community Infrastructure Funding.**

7. Proposals and Details

A report submitted to Cabinet Member on 7th June 2010 (minute No G6 refers) explained a proposal to improve cycling and walking facilities in the Manvers area as part of a package of measures funded by Barnsley MBC as part of their successful bid for Community Infrastructure Funding. This report highlights a further scheme that has been derived as part of this successful bid.

The existing footway on the western side of the B6098 Bolton Road Manvers, terminates approximately 30m into Bolton Road from the Manvers roundabout. At this point pedestrians and cyclists have to cross the carriageway from the existing segregated pedestrian / cycle footway (on the western side of Bolton Road) to either continue down Bolton Road or to circulate the Manvers roundabout. It is our intention to provide a continuation of the footway on the western side of Bolton Road to the point where the public footpath (Footpath No 50) joins onto Bolton Road, (See Appendix A).This will then provide a continuous footpath from the Trans Pennine Trail to Manvers Roundabout.

A further scheme is being derived to convert footpath No 50 to bridleway status which will enable cyclists to use this link. This proposal will be reported within the near future. The proposed footway on Bolton Road will be approximately 2m wide and will be designated as a shared use pedestrian / cycle footway and will provide a useful continuous link between the Dearne towns of Bolton upon Dearne, Goldthorpe etc to areas of employment and education within the Manvers area.

8. Finance

It is estimated that the works will cost approximately £40,000 with funding being available from Barnsley MBC's Community Infrastructure Funding

9. Risks and Uncertainties

The scheme must be implemented before March 2011 to receive full funding from Barnsley MBC. Delays in receiving approvals may result in the scheme not being implemented before this date

10. Policy and Performance Agenda Implications

The proposed scheme is in line with the Councils' main themes of Alive, Safe and Achieving and also accords with the Equalities Policy.

11.Background Papers and Consultation

Consultation with the South Yorkshire Police and Ward Members has been undertaken with regard to the proposal.
No objections to the scheme have been received as a result of any of these consultations.

Contact Name : *Nigel Davey, Engineer, Ext 22380*
nigel.davey@rotherham.gov.uk

Rotherham Metropolitan Borough Council
Environment & Development Services

Strategic Director:
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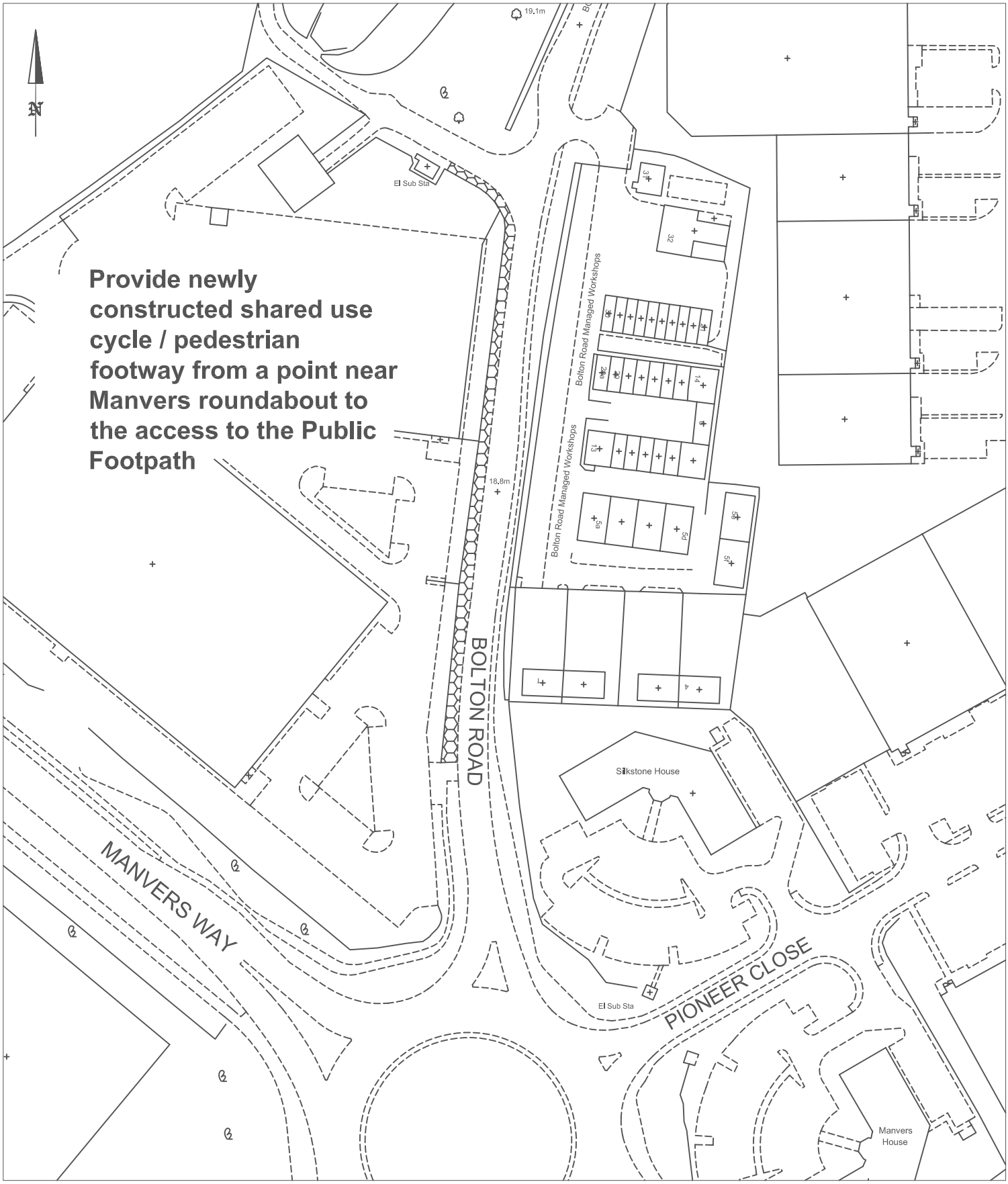

Title: Appendix A - Bolton Road Manvers
Provision of New Footway Incorporating Shared Use Pedestrian / Cycle Facility

Dwg. No.	Scales (If A4)	Drawn	Date	Chd. by
122/B6098/009/1	NTS	N Davey	5/10	

ROTHERHAM BOROUGH COUNCIL – REPORT TO MEMBERS

1.	**Meeting:**	**Economic Development, Planning and Transportation Matters**
2.	**Date:**	**21 June 2010**
3.	**Title:**	**A630 Rotherham to Thrybergh Smart Route Proposed Improvements**
4.	**Programme Area:**	**Economic and Development Services**

5. Summary

To seek Cabinet Member approval to undertake the detailed design and implementation of highway improvements at Mushroom roundabout (the junction of the A630 Fitzwilliam Road/Doncaster Road and A6123 Herringthorpe Valley Road/Aldwarke Lane). The proposals include the introduction of traffic lights to control traffic on the roundabout and facilitate the provision of pedestrian crossings on all arms. It also includes for the infilling of the subway on Fitzwilliam Road approach to the roundabout and extending the existing bus only lane.

6. Recommendations

Cabinet Member resolve that the report prepared by WSP and its recommendations be received and that:

i. detailed design of a traffic light controlled junction with associated highway works be undertaken

ii. a community information giving exercise be carried out in partnership with South Yorkshire Passenger Transport Executive

iii. the proposal be implemented subject to no issues being raised at the information giving stage.

7. Proposals and Details

Background:

As part of the Rotherham Bus Key Routes working group; which is made up of representatives First Group; the primary bus operator, South Yorkshire Passenger Transport Executive (SYPTE) and Rotherham Council (RMBC), the SYPTE commissioned a public consultation exercise in June 2009 to establish public opinion on issues that affected the key route between Rotherham Town Centre and the borough boundary with Doncaster along the A630, identified as the Rotherham to Thrybergh Smart Route.

This exercise attempted to establish the public's perception of this bus route and in particular their views on 4 key locations and potential improvements:

College Road roundabout – improvements in and out of the interchange
Fitzwilliam Road – widening the approach to St. Ann's roundabout
Mushroom roundabout – improvements to traffic flow
Doncaster Road (Whinney Hill) – additional in bound bus only lane

The consultation exercise delivered leaflets to over 10,000 properties along and surrounding the route, there were 30 Community Access Points where leaflets could be picked up and feedback given together with advertisements in the Rotherham Advertiser and Rotherham Record. There was also a specific web site for the consultation which allowed contact via email and all mediums provided a contact telephone number. The respondents identified the following areas of concern:

- Improve traffic flow along the corridor and reduce congestion and delays.
- Improve journey time reliability as a whole and improve punctuality and journey times for public transport. Mushroom roundabout was identified as the most important location for improvements with this junction receiving the most frequent single issue response which was the desire to see traffic lights introduced.

As part of the Dalton and East Herringthorpe Development Framework 'master planning' process for Dalton and East Herringthorpe in the summer of 2008 a workshop was held with members of the local community for Dalton and East Herringthorpe to identify local accessibility issues and barriers to accessing local facilities and services. Mushroom roundabout was seen as a major barrier to movement for pedestrians and cyclists particularly across Aldwarke Lane. Members of the group also highlighted that there were safety concerns with the use of the subway on Fitzwilliam Road, particularly during the evening and that this facility is seen as inconvenient to use.

Additionally Mushroom roundabout is identified as a congestion hotspot in the current Local Transport Plan (LTP 2).

Scheme development and analysis:

With this information in mind the working group identified possible interventions along the corridor to improve journey time and journey time reliability primarily for public transport but taking an holistic approach to the objectives these interventions should address accessibility issues and general traffic congestion. SYPTE then commissioned WSP to evaluate these possible interventions.

WSP worked closely with officers of the Councils' Transportation Unit to carry out the detailed evaluation and jointly developed improvements to the original proposals, a copy of their final report is attached as Appendix A to this report.

To summarise their report they considered the introduction of a number of measures at Mushroom roundabout and the implications these would have on traffic flow, bus movement and pedestrian access. WSP are also considering separately the implications of introducing measures at Whinney Hill and Oldgate Lane but the latter of these will be difficult to deliver due to the presence of statutory undertakers equipment.

A traffic model was developed by WSP to evaluate the effects of introducing these measures along the route as a whole. The options considered at Mushroom roundabout were:

Option 1(a) traffic metering – which involves introducing a set of traffic lights on the A6123 Herringthorpe Valley Road to meter the flow from this arm of the roundabout in order to create gaps on the circulatory carriageway to allow traffic out of A630 Fitzwilliam Road.

Option 1(b) traffic metering with a relocated pedestrian crossing on Herringthorpe Valley Road – this expanded on option 1(a) by relocating the existing crossing but also provided the pedestrian crossing on the desire line.

Option 2 Fitzwilliam Road bus lane extension – this developed further the existing bus lane by extending the bus lane so that the bus exited the bus lane closer to the give way line of the roundabout thereby avoiding more of the queue. This does involve filling in the existing subway and providing an on carriageway crossing.

Option 3 Doncaster Road bus lane extension – discounted due to land issues.

Option 4 Full traffic light control of the roundabout – options were tested both with and without pedestrian crossing facilities.

The analysis of these options undertaken by WSP considered the requirements of public transport for improved journey times but more importantly journey time reliability as journey times can currently fluctuate greatly and have a significant adverse impact on buses running to timetable. As previously mentioned they also considered road safety implications, pedestrian accessibility and general traffic flow and in particular congestion.

The analysis concluded that the full signalisation of the roundabout would give the best return by reducing traffic delay across the modelled network. The 'best return' was determined by giving a financial value to the delay suffered by road users and whilst the full signalisation of the roundabout has a significant cost associated with it (approximately £1.4 million), it does deliver a financial benefit which none of the other proposals are predicted to do.

In light of the significant cost to implement the scheme WSP were asked to evaluate the implications of not extending the bus lane on Fitzwilliam Road and therefore retain the subway and not provide an at grade pedestrian crossing on Fitzwilliam Road. Their report is attached as an addendum to Appendix 'A'. Not including these measures would reduce the overall cost of the scheme but the evaluation undertaken by WSP concluded that the predicted financial benefits from reduced congestion and delay during peak periods would be almost half that of the option to extend. During the peak hour periods the option without extending the bus lane increases the disbenefit to public transport in the morning peak and creates a disbenefit in the evening peak for buses.

The addendum demonstrates that in the first year the financial benefits from implementing the whole scheme are more than double that of the scheme without the extended bus lane across the whole modelled network. It can be seen from the work carried out by WSP that a significant benefit from the scheme is the reduced delays and congestion experienced on the A6123 Aldwarke Lane, the study did not set out to achieve an improvement in delay on this arm of the roundabout but it is an additional benefit of the scheme. It is particularly welcomed when it is considered how key this junction is to traffic movement on the 'northern orbital' route around the town (that section of highway between College Road roundabout and Mushroom roundabout via the A6123 Mangham Road and Great Eastern Way). It provides the potential to direct some traffic towards A6123 Aldwarke Lane rather than via the often congested A633 past Retail World. Not withstanding the overall benefits to traffic from the scheme it also offers the opportunity to replace a subway with an at grade crossing.

WSP also concluded that providing pedestrian facilities on all arms would not impact upon the operation of the roundabout, the design therefore includes for shared pedestrian and cycle crossings on all entry and exit arms of the roundabout a plan of this arrangement is available in their report attached at Appendix 'A'.

The existing crossings on Doncaster Road and Herringthorpe Valley Road would be relocated. The proposed crossing on Herringthorpe Valley Road would be where it is anticipated that the pedestrian desire line would be. Interrogation of our accident data base suggests that an higher than expected number of personal injury accidents occur at the crossing on Doncaster Road; 8 in the last 3 years which may be due in some part to its location, as this is where on the exit from the roundabout 2 lanes reduce to 1. However further analysis would have to be undertaken to determine the causation. The proposal would include for 2 new at grade crossings one on Aldwarke Lane which would assist in pedestrians crossing between the retail outlets on either side and one to replace the subway on Fitzwilliam Road. There is a significant cost associated with the removal of the subway but subways are perceived by the public as being places where anti social behaviour takes place. This is borne out by the comments made at the 'masterplanning' consultation

exercise where members of the public highlighted the subway crossing as a concern. Some highway authorities are actively encouraging the replacement of subways with at grade crossings due to the perceived anti social behaviour that takes place in and around them.

Due to the relocated pedestrian crossing on Herringthorpe Valley Road it is necessary to close the gap from Herringthorpe Valley Road into Doncaster Road as there isn't sufficient carriageway space to accommodate a right turn deceleration lane. Statutory consultation has commenced with bodies such as the emergency services and chamber of commerce regarding this. South Yorkshire Fire and Rescue Service have raised a concern about the closure of this gap and have requested that we consider reopening the central reserve gap on Fitzwilliam Road to allow them easier access to parts of East Dene. This particular gap was originally for buses only to use and the closure process was instigated when it was highlighted that buses no longer use it and that it was now being used by general traffic as a 'rat run'. It should be relatively straightforward to accommodate the request of South Yorkshire Fire and Rescue whilst still discouraging general traffic from using the gap.

All traffic light installations have an electronic controller to control the operation of the signals these usual work on fixed programmes; WSP recommended that this installation should operate utilising a more responsive type of control called 'MOVA' which can react more quickly to changing traffic conditions further optimising the operation of the roundabout. This type of controller is slightly more expensive but the benefits outweigh the initial set up cost.

The full signalisation of the roundabout with pedestrian crossings on all arms therefore provides the following benefits:

- reduced congestion at the roundabout and across the modelled network particularly on the A6123 Aldwarke Lane
- improved bus journey time reliability (very little variation between peak and off peak)
- at grade pedestrian/cycle crossings on all arms of the roundabout
- additional cycle facilities around the roundabout

8. Finance

The proposed improvements at Mushroom roundabout are estimated to cost £1.4million, the scheme has programme entry for the LTP strategic fund programme with £750,000 identified as available this year and £250,000 provisionally available next financial year. Furthermore, South Yorkshire Passenger Transport Executive has also identified £500,000 to spend on this corridor this financial year and they have indicated they would contribute up to the full amount required for this project.

9. Risks and Uncertainties

The funding is identified in the South Yorkshire Local Transport Plan Strategic Fund Programme for this year and next but this money still has to be fully approved from the members of the Finance and Integrated Transport Working Group, but Council support for the scheme and a commitment to start would give the group confidence that the project could be delivered. Although £250,000 has been provisionally

allocated to this scheme in 2011/12 the final LTP settlement will not be known until later this year.

10. Policy and Performance Agenda Implications

The proposals as outlined would assist in improving congestion and thereby improve air quality at this location. It would also improve accessibility and help to encourage a modal shift towards public transport, cycling and walking. Improved pedestrian crossings at the roundabout may also assist in regenerating this particular area of the borough.

11. Background Papers and Consultation

Dalton and East Herringthorpe Draft Development Framework January 2008
A630 Rotherham – Thrybergh Smart Route Consultation update June 2009
A630 Thrybergh Key Route – Mushroom roundabout improvement option analysis May 2010
May 2010 Statutory consultation on the proposed closure of the central reserve gap on the A6123 Herringthorpe Valley Road.

Contact Name : *Andrew Butler, Senior Engineer, Planning and Transportation*
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WSP

A630 Thrybergh Key Route – Mushroom Roundabout Improvement Option Analysis

South Yorkshire Passenger Transport Executive

May 2010

SOUTH YORKSHIRE PASSENGER TRANSPORT EXECUTIVE

Rotherham Metropolitan Borough Council

WSP

QM

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Contents

1 Introduction

1.1 BACKGROUND

1.1.1 WSP UK Ltd (WSP) has been commissioned by South Yorkshire Passenger Transport Executive (SYPTE) to undertake a Study of Mushroom Roundabout on the A630 Key Route in Rotherham.

1.1.2 The Study focuses on improving the flow of traffic to reduce congestion and the subsequent delay currently experienced on the approaches to Mushroom Roundabout, whilst also considering potential improvements to existing pedestrian and cycle movements.

1.1.3 The preferred solution resulting from option analysis of the Mushroom Roundabout Study will contribute to a wider focus of potential improvements on the A630 Thrybergh Corridor, seeking to improve journey time reliability for public transport and reduce overall journey times.

1.1.4 The A630 Thrybergh Corridor is one of over 50 key routes identified in the overall Local Transport Plan strategy as providing important links to support economic and social development.

1.1.5 Mushroom roundabout is one of three key junctions on the A630 Thrybergh Corridor which contribute to journey time delay and reliability issues. The roundabout has been highlighted by bus operators as the main cause of congestion on the key route and by RMBC as the number one hotspot in the congestion reduction plan. The two other junctions are:

- St Ann's Roundabout – junction between A630 and A633; and
- Oldgate Lane junction with A630.

1.1.6 As highlighted in the Client Brief, there are a number of potential future external factors which may impact on Mushroom Roundabout, these are outlined below:

- Potential Parkgate Retail Park extension;
- Development of Corus site; and
- Aspirations for an outer ring road.

1.1.7 Although the above are key factors, given the uncertainty over the timescales and impact on the junction they are excluded from this Study.

1.2 SITE LOCATION

1.2.1 Located approximately 1.5 miles to the east of Rotherham Town Centre, the A630 forms a junction with A6123 at Mushroom Roundabout. The Roundabout is a four arm priority junction providing for all movements between Aldwarke Lane, Doncaster Road, Herringthorpe Valley Road and Fitzwilliam Road. The A630 provides a strategic east-west road route between Sheffield, Rotherham and Doncaster and is a primary route for traffic within Rotherham and beyond.

1.2.2 A site location plan is provided as Figure A1 of Appendix A to this report.

1.2.3 Mushroom Roundabout has been identified by the Local Highway Authority as a site of concern for the accessibility and safe movement of pedestrians and cyclists. It is also considered an area of significant congestion within the local network for all vehicles, particularly public transport. A specific issue is noted of evening peak congestion at the entrance to the outbound Fitzwilliam Road bus lane.

1.2.4 There is a mix of residential, retail and commercial land use surrounding the junction. This results in a high demand for safe pedestrian and cycle facilities, of which there is currently limited provision at the junction.

1.2.5 Toucan Crossings are located approximately 100 metres from the roundabout on both Herringthorpe Valley Road and Doncaster Road, and there is a pedestrian subway under Fitzwilliam Road. Aldwarke Lane currently has no formal pedestrian or cycle crossing facilities.

1.2.6 For bus users arriving from the west to access the Supermarket, the current options available are to alight on Fitzwilliam Road and cross uncontrolled over the Aldwarke Lane arm or use the subway and formal crossing facilities of Herringthorpe Valley Road and Doncaster Road; or to alight on Doncaster Road at the stop located 350m after Mushroom Roundabout and return.

1.3 SOUTH YORKSHIRE POLICY OBJECTIVES

1.3.1 The second Local Transport Plan for South Yorkshire (LTP2) has been produced as a joint plan by the four Councils in South Yorkshire and the Passenger Transport Authority (PTA). The document identifies a new Transport Strategy and Action Plan for the 5 year period (2006/7 – 20010/11) and defines the longer term vision for transport in supporting the aspirations for transformational economic growth in the sub-region.

1.3.2 In 2002 the Government and Local Government Association (LGA) agreed a set of seven Shared Priorities for Local Government that would form the basis for improving public services. There are four Shared Priorities, now considered by Department for Transport (DfT) to have been replaced by DaSTS (Delivering a Sustainable Transport System), for transport that forms the basis of the LTP's transport strategy. The identified priorities are:-

- Congestion;
- Accessibility;
- Road Safety; and
- Air Quality.

1.3.3 The introduction of successful economic policies, particularly arising from the infusion of European Regional Development Fund (ERDF) Objective 1 has led to higher levels of economic activity and car ownership in the region. As traffic volumes have increased, over the same period the dominant public transport mode, the bus, has experienced patronage decline.

1.3.4 In view of the above a South Yorkshire Congestion Strategy was developed in support of the South Yorkshire Vision. The Strategy recognises the need to stem the current level of private car use by addressing the issues of delay and congestion within South Yorkshire, particularly on the Key Route Network.

1.3.5 The Key Route Network is an integral component of the overall LTP2 Strategy, with over 50 routes having been identified that provide important links in supporting economic and social development. The Key Route Network was derived from the main arterial routes of accessibility between the principal urban centres of South Yorkshire. These arterial routes also connect to other centres external to the County.

1.3.6 The primary focus of the Strategy is to reduce congestion by encouraging increased levels of patronage to public transport through improvement of the core services and by enhancing the performance of the existing highway network through introduction of active management techniques, specifically the use of UTMC (Urban Traffic Management and Control) systems.

1.3.7 LTP2 forecasts predict that even with interventions car ownership and use is predicted to rise, resulting in increased congestion on the Key Routes. The Key Routes are integral to the delivery of the South Yorkshire LTP2 Strategy to deliver improvements in each Shared Priority area. Congestion will be addressed as follows:-

- Improved operating conditions for bus operators;
- Tackling delays and unpredictable journey times on Key Routes and improving the balance between competing demands of different road users;
- Achieving modal shift from the private car by promoting public transport services;
- Managing demand and reducing the need to travel through integrated transport, land use and parking policies;
- Provide new infrastructure or facilities to enhance network performance but lock-in the benefits for public transport users; and
- Development of a freight strategy.

1.3.8 It is acknowledged that resources available over the remaining LTP2 period are limited, however, utilising the Key Route Network as a focus for prioritisation will maximise the benefits of further investment.

1.3.9 The targets identified in LTP2 were set on the basis that no additional funding would be made available to South Yorkshire for new major schemes, as directed by DfT. However, SYPTE has significant aspirations to deliver infrastructure and facilities improvements through the major scheme program that will contribute to the targets of LTP2.

1.3.10 This project relates specifically to a review of the existing operation of Mushroom Roundabout and focuses on identifying a solution to provide increased provision for pedestrians and cyclists whilst also delivering journey time reliability and savings for all modes of transport.

1.4 REPORT STRUCTURE

1.4.1 The following Report will be structured as detailed below:

- Micro-Simulation Base Model;
- Initial Option Identification and Modelling
- Option Development
- Final Option Analysis;
- Sensitivity Testing; and
- Recommendations and Way Forward.

2 Micro-Simulation Base Model

2.1 INTRODUCTION

2.1.1 On behalf of SYPTE a Paramics model has previously been developed by WSP to assess the A630 Thrybergh Corridor. The Paramics model was constructed to assess the impact of background traffic growth and scheme proposals on bus journey times.

2.1.2 Agreement was reached from SYPTE and Rotherham MBC (RMBC) in terms of the validity of the previous Paramics model being fit for purpose to assess the proposed improvements at Mushroom Roundabout, as identified in this Study.

2.2 MODEL DESCRIPTION

S-Paramics Micro-Simulation Modelling Software

2.2.1 Paramics is a micro-simulation modelling package that simulates the individual components of traffic flow and congestion, presenting its output as a real time visual display in addition to statistical output.

2.2.2 As well as the physical description of the road network, other driver features such as bus operations, traffic signal settings, driver behaviour characteristics such as aggression, and vehicle kinematics such as acceleration profiles are all represented. Through combination of these factors a model can be produced which gives an accurate representation of the variable circumstances that face drivers on the network.

2.2.3 In addition, the use of statistical distributions enables the user to model and replicate variances in day to day travel and to assess the significance of this variance to assist in decision making.

2.2.4 The Paramics software suite also contains a matrix estimation module, which was used for this corridor model. The trip matrix was constructed from traffic counts and surveys, queue surveys, visual inspection of the network and finally matrix estimation.

2.2.5 The model was calibrated to queue length surveys and validated against turning counts and journey time surveys.

Modelled Network

2.2.6 The Paramics model consists of a number of junctions along the A630 Corridor, from the signalised junction formed between the A630 and the A6021 Centenary Way flyover to the west and the priority junction formed between the A630 and Park Lane to the east.

2.2.7 The area outlined by the Paramics model cordon is illustrated on Figure A2 of Appendix A to this report.

2.2.8 A screenshot of the Paramics model is provided as Figure A3 of Appendix A.

2.2.9 The model was developed to contain morning and evening peak periods. The morning peak period is modelled by the time period 07:00 – 10:00 hrs with 08:00 – 09:00 hrs representing the peak hour. The evening peak period is modelled by time period 16:00 – 19:00 hrs with 17:00 – 18:00 hrs representing the peak hour.

2.3 EXISTING SITUATION

Degree of Congestion

2.3.1 Under its current design Mushroom Roundabout operates reasonably well during the morning peak period. All approaches see maximum queue lengths in the region of 40 – 80 meters throughout the three hour peak period (07:00 – 10:00 hrs).

2.3.2 The evening peak period (16:00 – 19:00 hrs) sees more variation in maximum queue length by approach. Doncaster Road and Herringthorpe Valley Road see queue lengths in the region of 50 – 90 meters and 30 – 70 meters respectively, a similar level to that experienced in the morning peak period.

2.3.3 Fitzwilliam Road sees a maximum queue length of approximately 400 meters between 16:45 and 18:15 hrs. This level of delay impacts significantly on the reliability of buses on the A630 corridor as a queue of 400 meters in length restricts access to the outbound (eastbound) bus lane on the approach to the roundabout.

2.3.4 Aldwarke Lane sees the most significant level of queuing in the evening peak period with a maximum queue length in the region of 500 meters being sustained throughout the modelled period.

2.3.5 A key contributing factor to the delay on both Fitzwilliam Road and Aldwarke Lane is the ability for vehicles to enter the roundabout as a direct result of insufficient gaps being available in the circulating traffic flow.

Existing Bus Services

2.3.6 There are currently three services which operate with a frequency of 15 minutes or better through the junction. These are:

- X78: Doncaster – Sheffield;
- 15: Rotherham – East Herringthorpe Circular; and
- 37: Rotherham – Thrybergh.

2.3.7 Further services operate less frequently. These are:

- 4: Rotherham – Ravenfield; and
- 11: Rotherham – East Dene.

2.3.8 In total there are 19 services per hour passing through the junction during Monday to Friday daytime. All services currently see journey time reliability issues which can partly be attributed to delay experienced approaching Mushroom roundabout.

3 Initial Option Identification and Modelling

3.1 SCOPING OF INITIAL OPTIONS

3.1.1 Following discussions between SYPTE, RMBC and the public transport operators First Group, WSP was issued with a brief outlining eight options to improve the flow of traffic around Mushroom Roundabout requiring modelling. These options were:

- Option 1 (a) – Metering of flow from Herringthorpe Valley Road on to Mushroom Roundabout using traffic signals;
- Option 1 (b) – Closure of the right turn from the Herringthorpe Valley Road exit from the roundabout into Doncaster Road, combined with a Toucan Crossing across Herringthorpe Valley Road;
- Option 2 – Improvements to Fitzwilliam Road including closure of the subway and replacement pedestrian crossings and extension of the bus lane towards Mushroom Roundabout;
- Option 3 – Acquisition of the land to the front of a property on the inbound Doncaster Road approach to Mushroom Roundabout, to allow carriageway widening to benefit the outbound traffic movement;
- Option 4 (a) – Full signalisation of Mushroom Roundabout;
- Option 4 (b) – Full signalisation of Mushroom Roundabout with pedestrian crossing facilities across the centre of the roundabout or should it prove more beneficial, across the arms of the junction;
- Option 5 (a) – Change lane destinations on exit to Doncaster Road to allow nearside lane to be left only into ASDA or a left lane for ASDA and buses; and
- Option 5 (b) – Change lane destinations on exit to Doncaster Road to allow nearside lane to be left only into ASDA or a left lane for ASDA and buses. In addition, change lane markings on eastern circulatory carriageway to allow three lanes.

3.1.2 RMBC supplied WSP with scheme drawings for each of the options listed above to enable option testing models to be developed in Paramics.

3.1.3 On the receipt of the scheme drawings WSP held discussions with SYPTE and RMBC from which it was agreed that Option 3, Option 4 (a) and Option 5 (a) and (b) should to be removed from the brief due to:

- Issues having arisen with respect to the acquisition of land required to implement Option 3;
- The need to provide pedestrian facilities in a full signalisation scheme of Option 4 (a); and
- Options 5 (a) and (b) would imbalance vehicle flows on the Fitzwilliam Road approach to Mushroom Roundabout leading to reduced capacity for the main flow of west to east traffic.

3.1.4 The short length of the internal links means the roundabout is not capable of incorporating pedestrian crossings across the centre of the roundabout without an unacceptable impact on queue space available to accommodate vehicles. Therefore the Option 4 (b) design included pedestrian crossings across the arms of the junction.

3.1.5 Following the alteration to the brief SYPTE requested that WSP model an additional option which would include the best performing option from Option 1 (a) and 1 (b) combined with Option 2.

3.2 LIMITATIONS OF DESIGN & MODELLING

3.2.1 WSP has developed option testing models in Paramics based on the designs supplied by RMBC assuming that they are suitable for use.

3.2.2 No topographical surveys have been supplied with the designs. Therefore all designs have been developed based on Ordinance Survey map bases.

3.2.3 No Lane widths have been measured on site by WSP. RMBC has advised that they are happy with the dimensions of the designs supplied.

3.2.4 RMBC has advised that AutoTrack runs have been undertaken to ensure three circulating lanes are viable on the roundabout within its current dimensions

3.2.5 Only the options agreed between SYPTE and RMBC have been modelled. Further options have been considered but not progressed to modelling stage due to assumptions being made on the suitability.

3.2.6 No statutory undertaker's plans have been supplied to WSP. RMBC have highlighted that one service may be affected at Mushroom Roundabout incurring an approximate cost of £6,000 to divert.

3.3 INITIAL MODELLING

3.3.1 Utilising the scheme drawings supplied by RMBC as overlays, the following option models were developed in Paramics:

- Option 1 (a) – Traffic Metering;
- Option 1 (b) – Toucan Crossing;
- Option 2 – Bus Lane Extension; and
- Option 4 – Full Signalisation with Fixed Time Operation.

3.3.2 Each of the options listed are discussed below in more detail including a summary of the modelled findings.

Option 1 (a) – Traffic Metering

3.3.3 A sketch of this option can be found at Figure B1 of Appendix B.

3.3.4 Option 1 (a) utilises a set of traffic signals located 20 metres from the roundabout giveway line to meter the flow of traffic from Herringthorpe Valley Road on to Mushroom Roundabout.

3.3.5 The location of the stopline for the metering signals is restricted by the junction of Herringthorpe Valley Road and old Doncaster Road. The left turn out of and right turn in to Doncaster Road combined with the need to locate the stopline at a safe distance from the roundabout, fixed the stopline at the location seen in Figure B1.

3.3.6 Modelling of Option 1 (a) indicated that the traffic signals created more suitable gaps in the traffic on the circulatory carriageway to allow vehicles on the Fitzwilliam Road approach to move out on to the roundabout thus reducing the level of queuing seen on the approach. The length of queue can be reduced such that it does not impact

on the operation of the existing bus lane on Fitzwilliam Road therefore minimising the delay experienced by buses.

3.3.7 By metering the flow of traffic on Herringthorpe Valley Road fewer gaps are available in the traffic for vehicles wishing to make the right turn in to old Doncaster Road. The existing length of right turn provision is not sufficient to cope with the queue formed; therefore the queue was seen to extend back on to the roundabout impacting on its operation. This is an intermittent issue which was mainly seen in the morning peak period.

3.3.8 Regardless of the signal timings used at the metering signals there is an increase in the level of queuing on Herringthorpe Valley Road compared to the existing situation. This is something which can not be avoided due to the nature of metering signals; the basic principle being to distribute overall delay to an alternative location to benefit another.

3.3.9 To balance the queues in line with objectives, the signal timings can be varied. We have modelled a balanced situation leading to queues on Fitzwilliam Road just shorter than the bus lane and queues on Herringthorpe Valley Road extending, at worst, slightly beyond Mowbray Street

Option 1 (a) – Conclusions

3.3.10 This option provides an effective solution to reducing the queuing experienced on Fitzwilliam Road. The metering of traffic on Herringthorpe Valley Road creates sufficient gaps in the traffic on the circulatory carriageway for traffic waiting on Fitzwilliam Road to enter the roundabout. The queuing predicted on Fitzwilliam Road could potentially delay buses if general traffic is higher than that modelled, as the queue is almost as long as the bus lane.

3.3.11 The close spacing of the traffic signals and the roundabout giveway leads to a potential safety concern as drivers may incorrectly perceive that the signals also indicate that they can enter the roundabout without giving way to circulating traffic. In general, to mitigate this risk, metering stop lines would be set further from the roundabout and signals would only operate at busy times of day. Due to the proximity of the Doncaster Road junction, there is extremely limited scope to vary the position of the stop line.

3.3.12 If this solution were adopted, we recommend the metering signals should operate in the evening peak period only. This would then deliver the benefits from metering traffic in the evening peak when it is needed to reduce queuing seen on Fitzwilliam Road but it would not cause unnecessary delay to vehicles on Herringthorpe Valley Road at other times. Appropriately targeted part time operation reduces the risk that drivers may believe the signals give them priority to enter the roundabout. This safety issue cannot be replicated in the model and needs careful consideration.

3.3.13 There is the potential to utilise queue detection on Fitzwilliam Road to adjust signal timings to minimise overall delay and manage queues in line with strategic objectives.

Option 1 (b) – Toucan Crossing

3.3.14 A sketch of this option can be found at Figure B2 of Appendix B.

3.3.15 Option 1 (b) utilises the stopline position from Option 1 (a) but further develops the method of control to include a Toucan Crossing facility across the northbound and

southbound carriageway. To accommodate the Toucan Crossing the right turn from Herringthorpe Valley Road in to Doncaster Road must be closed.

3.3.16 The closure of the right turn in to Doncaster Road from Herringthorpe Valley Road requires the re-routing of vehicles wishing to gain access to the Doncaster Road area. It is not a feasible option to send all vehicles down Herringthorpe Valley Road to make a right turn in to Mowbray Street, nor is it sensible to allow U-turns on Herringthorpe Valley Road. Therefore it was considered most suitable to route vehicles along Fitzwilliam Road to make a left turn in to Mowbray Street.

3.3.17 To ensure the Mowbray Street junction with Fitzwilliam Road is suitable for use by all vehicles it will require improvement to accommodate the larger vehicles including buses.

3.3.18 Some initial assumptions were made by RMBC regarding the level of traffic reassignment expected due to the closure of the right turn in to Doncaster Road. Modelling with these assumptions showed an adverse affect on the operation of St Ann's roundabout due to the increase in number of vehicles arriving at the roundabout on Fitzwilliam Road.

3.3.19 The impact modelled at St Ann's prompted RMBC to commission a number plate survey to capture the current level of use and destinations of the vehicles travelling on Doncaster Road. The results of the number plate survey suggested that a high percentage (approximately 70%) of the traffic accessing Doncaster Road has a final destination within the Doncaster Road area and would therefore not reassign to Fitzwilliam Road to make their journey.

3.3.20 Using the findings of the number plate survey Option 1 (b) was remodelled with the impact at St Ann's roundabout being removed, and following the changes queues were observed at a similar level to existing.

3.3.21 The interaction of the Toucan Crossing on Herringthorpe Valley Road and the junction with Doncaster Road caused significant issues in the modelling carried out.

3.3.22 The Toucan Crossing causes delay for vehicles on Herringthorpe Valley Road which queue across the priority junction with Doncaster Road. Due to the vehicles on the main road having priority, the vehicles on Doncaster Road have insufficient gaps to exit the junction. The inability to gain access to Herringthorpe Valley Road results in a excessive queue forming on Doncaster Road extending back to, and through, the roundabout formed at the junction with Mowbray Street.

3.3.23 The queue on Herringthorpe Valley Road is exacerbated by both the operation of the Toucan Crossing and the difficulties in entering Mushroom Roundabout once vehicles are through the crossing.

3.3.24 As mentioned above the closure of the right turn in to Doncaster Road requires the diverting of vehicles along Fitzwilliam Road to Mowbray Street. The resulting queue on Herringthorpe Valley Road caused by the Toucan Crossing restricts the ability for the re-routing vehicles to access the Mowbray Street roundabout. This conflict quickly creates a delay of its own resulting in a queue extending from Mowbray Street on to Fitzwilliam Road.

3.3.25 Alternative signal timings for the Toucan Crossing were tested by varying the green time for the traffic phase. None of the options tested removed the problems highlighted by the modelling.

Option 1 (b) – Conclusions

3.3.26 The modelling undertaken illustrates that this option has no material benefit in terms of the practical performance of Mushroom Roundabout. Congestion is experienced during the peak periods irrespective of signal plans utilised for the Toucan Crossing. However there is scope for the option to be developed to a workable solution by reviewing the lane destinations on the Herringthorpe Valley Road approach to the roundabout as described later in this report.

3.3.27 As with Option 1 (a), the close spacing of the Toucan Crossing and the roundabout giveway leads to a potential safety concern as drivers may incorrectly perceive that the signals also indicate that they can enter the roundabout without giving way to circulating traffic.

3.3.28 In addition to this, if there is insufficient pedestrian demand for the Toucan Crossing, to make it effective as a metering system, then artificial demand would have to be generated.

Option 2 – Fitzwilliam Road Bus Lane Extension

3.3.29 A sketch of this option can be found at Figure B3 of Appendix B.

3.3.30 This option extends the existing bus lane towards Mushroom Roundabout allowing buses to gain a further advantage over queuing traffic. It also includes the removal of the existing subway with the provision of staggered Toucan Crossings across the bus lane and eastbound and westbound carriageways in its place, providing a more attractive facility for pedestrians and cyclists.

3.3.31 To provided greater benefits to buses the stop located within the bus lane has been relocated to maximise the opportunity for earlier detection on the approach to the signals.

Option 2 – Conclusions

3.3.32 This option clearly delivers benefits to pedestrians in terms of increased perception of personal safety through crossing provision. The model also indicates an additional slight benefit to buses due to the extension of the bus lane through a reduction in time for buses to access the roundabout from the bus lane.

3.3.33 However, this option in isolation does little to alleviate the queuing witnessed on Fitzwilliam Road. Hence, as buses are delayed prior to entering the bus lane, the overall benefits to buses are minimal.

Option 4 – Full Signalisation with Fixed Time Control

3.3.34 A sketch of this option can be found at Figure B4 of Appendix B.

3.3.35 In the scheme design supplied by RMBC they have indicated that the current roundabout alignment can accommodate three circulating lanes with minor widening on the north east corner only. Hence the inclusion of three circulating lanes in the scheme designs.

3.3.36 For Option 4 to be viable it requires three circulating lanes on each internal link within the roundabout. RMBC has advised that swept path analysis has been carried out on this layout to confirm the suitability of the scheme. The exact scope of works required to the roundabout would need to be considered if the scheme is progressed to detailed design stage.

3.3.37 Option 4 provides full signalisation of Mushroom roundabout incorporating pedestrian crossings across the entry and exits of the Aldwarke Lane and Herringthorpe Valley Road approaches. To facilitate the pedestrian crossing on Aldwarke Lane Option 4 requires the closure of the right turn from Herringthorpe Valley Road as in Option 1 (b).

3.3.38 Option 4 also includes all aspects of Option 2 detailed and discussed above. This provides pedestrian facilities on three of the four arms of the roundabout with an existing Toucan Crossing located approximately 100m to the east on Doncaster Road.

3.3.39 The full signalisation scheme was initially developed and modelled in Linsig Version 3 collaboratively between RMBC and WSP to gain a suitable set of initial timings for inclusion in the Paramics model.

3.3.40 The Linsig analysis predicted that the scheme should provide adequate capacity, although the junction would be sensitive to small changes in either demand or signal timings due to the short internal links on the roundabout.

3.3.41 The Paramics modelling showed the full signalisation to operate well during the morning peak period with the internal links being cleared of vehicle queues in each cycle.

3.3.42 In the evening peak the interaction between the pedestrian crossing on Doncaster Road and the signalised roundabout creates operational issues. This was due to vehicle behaviour on the exit of the roundabout on to Doncaster Road. Vehicles generally use one lane only to exit the roundabout due to the issues caused by the merge from two lanes to one directly after the pedestrian crossing.

3.3.43 The Linsig model utilised two full lanes on the Doncaster Road exit from the roundabout towards the pedestrian crossing. This however is contradicted by the observations made on existing traffic movements. Due to the merge to one lane which is located directly after the pedestrian crossing on the crest of the road, vehicles exit the roundabout mostly using one lane only so to avoid having to merge further along Doncaster Road.

3.3.44 This effective reduction in lanes to a single lane, replicated in the Paramics model causes queuing traffic blocking back from the crossing, quickly impacting on the operation of the roundabout.

3.3.45 As in Option 1 (b), the closure of the right turn in to old Doncaster Road from Herringthorpe Valley Road requires the re-routing of vehicles wishing to gain access to the Doncaster Road area. To ensure the Mowbray Street junction with Fitzwilliam Road is suitable for use by all vehicles it will require amendment to the existing kerb line to facilitate the movements of large vehicles.

3.3.46 Again, as for Option 1 (b) the same initial assumptions regarding the level of reassignment were made with the same impact of increased queues witnessed at St Ann's roundabout. The findings of the number plate survey were modelled with the impact at St Ann's roundabout being removed, and queuing levels then being observed at a similar level to existing.

Option 4 – Conclusions

3.3.47 When implementing on site observations within the model it became apparent that the pedestrian crossing on Doncaster Road is a substantial constraint to optimum network performance when considering a full signalisation scheme for Mushroom Roundabout.

3.3.48 The additional demand reaching the crossing as a result of the improvement of the roundabout causes the traffic capacity of the crossing to be exceeded. Therefore any scheme to fully signalise Mushroom Roundabout would require further consideration on the location of the existing Toucan Crossing to ensure efficient operation of both the crossing and the roundabout.

3.4 SUMMARY OF INITIAL MODELLING AND AGREED NEXT STEPS

3.4.1 From the initial modelling carried out Option 1 (a) was identified as a viable option in terms of its operational performance and controlling the level of delay experience for vehicles on Fitzwilliam Road.

3.4.2 However, due to the safety concerns surrounding the design of Option 1 (a) for both pedestrians and vehicles it was agreed with SYPTE and RMBC that WSP would further develop Option 1 (b) in a bid to improve its performance as it was perceived as providing improved safety over Option 1 (a).

3.4.3 The full signalisation of Mushroom Roundabout in Option 4 provides a suitable solution in the morning peak but the interaction between the remote Toucan Crossing on Doncaster Road and the signalised roundabout leads to extensive queues to building rapidly in the evening peak.

3.4.4 WSP carried out an additional site visit with RMBC to observe the interaction of the existing Toucan Crossing on Doncaster Road and the uncontrolled Mushroom Roundabout. Following the site visit was agreed that an amended full traffic signal control option, incorporating improved pedestrian facilities would be developed and tested in Linsig and Paramics by WSP. This option is described and discussed in the following chapter.

4 Option Development

4.1 OPTION DEVELOPMENT

Option 1 (b) – Toucan Crossing and reassigned lane destinations on Herringthorpe Valley Road

4.1.1 A sketch of this option can be found as Figure C1 of Appendix C.

4.1.2 Having modelled the initial option and evaluated the reasons for its failure to deliver a viable solution it became apparent that there was scope to further develop Option 1 (b) to ensure it delivered the required benefits for all users.

4.1.3 In the initial option the lane destinations on Herringthorpe Valley Road did not make optimum use of the road space available. The number of left turning vehicles from Herringthorpe Valley Road is low, hence having a dedicated left turn lane is considered inefficient in terms of capacity.

4.1.4 Altering the lane destinations on the approach to the Mushroom Roundabout to promote left and ahead movements from lane one, ahead and right from lane two and right only from lane three increases the capacity of the approach without the need for additional widening of the carriageway.

4.1.5 The alteration of lane destinations on the approach to the roundabout requires the roundabout to be converted to three circulating lanes. As previously discussed for Option 4 it has been demonstrated by RMBC that the roundabout can accommodate three circulating lanes within its existing alignment.

Option 1 (b) – Conclusions

4.1.6 The Paramics modelling indicates that the additional capacity created at the roundabout stopline allows a clear benefit to be given to the queuing on Fitzwilliam Road without adversely affecting vehicles on Herringthorpe Valley Road or Doncaster Road.

4.1.7 In addition to this, the Toucan Crossing is modelled to simulate a demand every cycle so to ensure a ‘worst case’ scenario for Herringthorpe Valley Road is shown.

4.1.8 The level of pedestrian demand will impact on the success of this option in reducing queues on Fitzwilliam Road unless it is decided to incorporate a mechanism for artificially demanding the crossing phase on Herringthorpe Valley Road to create sufficient gaps in the circulatory traffic for vehicles on Fitzwilliam Road to move out in to.

4.1.9 The close proximity of the stop and give way lines and using artificial demand to call the pedestrian phase on the crossing leads to safety concerns. If vehicles are held at a crossing point with no pedestrians crossing the road then there is a risk that drivers will assume the signals control the roundabout entry and therefore fail to give way.

4.1.10 This option does not address the issue of excessive queuing on Aldwarke Lane although it does not exacerbate the existing queuing.

Option 4 – Relocated Toucan Crossing on Doncaster Road and provision of pedestrian crossing at Mushroom roundabout

4.1.11 A sketch of this option can be found as Figure C2 of Appendix C.

4.1.12 Based on the findings from the full signalisation scheme and site observations this option relocates the existing Toucan Crossings on Doncaster Road to a point 120 meters to the east at the site of an existing pedestrian refuge. This location follows the merge from two lanes and therefore ensures more efficient lane usage on the exit of the roundabout.

4.1.13 To ensure sufficient provision for pedestrians there is also a staggered crossing incorporated in to the Doncaster Road arm of the roundabout. Provision of two separate crossings is considered appropriate to meet the pedestrian desire lines observed.

4.1.14 Having modelled both MOVA and fixed cycle control for the crossing it is the recommendation of WSP that the relocated Toucan Crossing be operated on MOVA (Microprocessor Optimised Vehicle Actuation) control. This will deliver the optimum performance for all users by allowing more responsive changes when a pedestrian demand is placed under uncongested conditions, and also extending green time for all traffic when needed to help avoid congestion and prevent any significant and sustained vehicle queues. MOVA control of the crossing is included in the final model, even when the roundabout is modelled with fixed time plans.

4.1.15 The amended design sees a significant reduction in queuing on Fitzwilliam Road compared to the existing situation. In addition to this, the reduced level of queuing that is still observed does not extend back past the start of the bus lane. This delivers an improvement for all traffic compared to the existing situation with buses still receiving a benefit over other vehicles due to the extended bus lane on Fitzwilliam Road, which is the targeted aim during the peak periods.

4.1.16 Herringthorpe Valley Road and Doncaster Road experience no significant adverse affect as a consequence of the signalisation with the added benefit of the provision of pedestrian facilities across identified desire lines.

4.1.17 As a result of fixed time signalisation being focused on prioritising the A630 Corridor, Aldwarke Lane experiences some increased delay in the current evening peak model; this is due to the signal timings used to accommodate the issues caused on the Doncaster Road exit of the roundabout.

4.1.18 There is a need to evaluate the likely level of demand for the Toucan Crossings and optimise the signal operation both at the crossing and the roundabout accordingly.

Option 4 – Conclusions

4.1.19 This amended full signalisation option demonstrates that benefits can be achieved to both traffic and pedestrians, improving journey times on the corridor in the evening peak hour compared with the base situation..

4.1.20 This option does not address the issue of excessive queuing on Aldwarke Lane.

4.2 SUMMARY OF OPTION DEVELOPMENT

4.2.1 The further modelling resulting from the development of Option 1 (b) and Option 4 delivered two potential solutions which require low and high levels of intervention.

4.2.2 These options were presented to the steering group, using video clips from the Paramics models for acceptance and agreement that the options should be progressed for option analysis.

4.2.3 Option 1 (b) will be tested in conjunction with Option 2 in an attempt to improve pedestrian facilities around the roundabout whilst improving the operation of the roundabout for vehicular traffic.

4.2.4 Although Option 4 appears to deliver benefits to general traffic and public transport in the modelled situation, a fixed time solution does not account for daily

variance in demand and traffic arrival patterns and may create delay that could be avoided by a more responsive control strategy.

4.2.5 WSP advised the steering group that it would be beneficial to develop a MOVA solution to allow more responsive control of Mushroom Roundabout and to compare the outputs of the model with fixed time operation.

4.3 FURTHER MODELLING

Option 2 + Option 1 (b) – Toucan Crossing plus Bus Lane Extension

4.3.1 The combination of Option 2 and Option 1 (b) delivers similar traffic benefits as the schemes individually. However, the increased provision of crossing facilities on Fitzwilliam Road and Herringthorpe Valley Road provides a significant benefit to pedestrians and cyclists.

4.3.2 The queue of vehicles on Fitzwilliam Road is managed such that it does not extend back past the start of the bus lane, although traffic is held at the stopline for the Toucan Crossing which allows buses to gain priority over traffic on the approach to the roundabout.

4.3.3 Queues build up on both Herringthorpe Valley Road and Doncaster Road but they clear within two cycles.

4.3.4 This option does not address the issue of excessive queuing on Aldwarke Lane although it does not exacerbate the existing queuing.

Option 4 – Full Signalisation with MOVA Control

4.3.5 Following presentation at a steering group meeting of the fixed time solution for full signalisation it was agreed that WSP would develop an additional MOVA control option to establish the benefits that could be derived.

4.3.6 Development of the MOVA control option focused on the evening peak period due to its current poor performance in the existing base model. For the purpose of the model the same MOVA datasets are used in the morning peak, which is sufficient to avoid any significant queuing or delays. Additional benefits may be derived for the morning peak period though detailed design.

4.3.7 The MOVA strategy was developed based on a two stage operation, which appeared every cycle, with the north – south movement being in Stage 1 and the east – west movement in Stage 2. Phase delays are used to ensure progression through the internal links on normal operation. This minimises the detection requirements on the short internal links and suits the overall geometry and traffic demands at the junction.

4.3.8 A third stage was created to allow bus priority on the Fitzwilliam Road approach. This stage will only operate when MOVA is in Stage 2 and a bus demands the stage change.

4.3.9 To ensure the roundabout could operate effectively a stage which runs all the circulatory links was set up to run as Stage 4, if called by queue detectors on the internal links. This is effectively a clear out stage which operates when there have been a high number of right turns through Stages 1 and 2 to ensure the internal links on the roundabout do not become congested.

4.3.10 Operating under MOVA control Mushroom Roundabout delivers a responsive solution capable of managing the level of queuing and consequently the overall delay on

all approaches. The current model has all pedestrian crossings appearing every cycle and further benefits could be obtained if crossings only appeared when demanded.

4.3.11 Aldwarke Lane sees significant benefits under MOVA control with a large reduction in queue length. This is due to the ability of MOVA to respond to a changing situation and allow appropriate levels of green time to be allocated to alleviate the delay experienced.

4.3.12 As MOVA responds to changing demands, this is achieved without disadvantaging other approaches. This contrasts with the fixed time solution which fails to clear the existing queues on Aldwarke Lane as priority is permanently given to the A630.

4.4 FINAL OPTIONS FOR ANALYSIS

4.4.1 Through the option development process and via stakeholder consultation it was agreed that the following options would be progressed forward for option analysis:

- Option 1 (a) – Traffic Metering;
- Option 2 + Option 1 (b) – Toucan Crossing plus Bus Lane Extension;
- Option 4 – Full Signalisation with Fixed Time Operation; and
- Option 4 – Full Signalisation with MOVA control.

5 Final Option Analysis

5.1 INTRODUCTION

5.1.1 The four schemes progressed for option analysis vary in the level of intervention required to deliver them. It was therefore important to establish the advantages and disadvantages from each of the schemes so to advise on the most appropriate solution to carry forward.

5.1.2 The schemes have been analysed in three ways:

- Queue Length;
- Journey Time; and
- Journey Time Reliability.

5.1.3 In addition to the numeric analysis, account is taken of the un-quantified benefits to pedestrians and cyclists from the provision of new and improved crossing facilities.

5.1.4 A final comparison of the four schemes based on the monetised benefits to be derived was carried out to establish the value for money of each scheme.

5.2 QUEUE LENGTH ANALYSIS

5.2.1 Queue length analysis was carried out for each of the four schemes and then compared to the base situation on each of the four approaches to Mushroom Roundabout in both the morning and evening peak periods.

5.2.2 The following text describes the level of queuing experienced in the option models. Graphs indicating the maximum queue length in five minute intervals through the peak periods can be found as Appendix D.

Morning Peak Period

5.2.3 All of the schemes maintain the level of queued vehicles on Fitzwilliam Road between 40 and 60 metres which is consistent with the existing situation on this approach.

5.2.4 Due to the way in which queue lengths are reported by the model, being measured from the roundabout entry and not from any stopline on the approach, it appears that fixed time operation leads to zero queues. Observation of the simulation shows that the queues are of a similar length in these periods to other within the model.

5.2.5 The two schemes which include full signalisation of Mushroom Roundabout see slightly increased levels of queuing on Aldwarke Lane over both the existing base and partial signalisation schemes. This is due to the addition of signal control creating slight delay where currently the approach is uncontrolled. The partial signal control schemes operate at a similar level to the existing base situation.

5.2.6 The Doncaster Road approach follows a similar pattern to Aldwarke Lane with the full signalisation schemes seeing a minor increase in queue length over the existing base and partial signalisation schemes. The partial signal control schemes operate at a similar level to the existing base situation.

5.2.7 All of the schemes deliver similar levels of queuing on the Herringthorpe Valley Road approach with the queue length fluctuating between 40 and 80 meters.

Evening Peak Period

5.2.8 The base model replicates a clear peak in delay on the Fitzwilliam Road approach. This is caused by the difficultly vehicles have entering the roundabout due to insufficient gaps in traffic on the circulatory carriageway.

5.2.9 Option 1 (b) + 2 delivers the largest reduction in maximum queue length, approximately 150 metres, with a flattening out of the queue profile over the peak period.

5.2.10 Fixed time operation and MOVA control reduce the current level of queuing by approximately 100 metres. MOVA control has the additional benefit over fixed time operation that it can react to variance in traffic demand and arrival patterns, and thus further reduces delay, although queue lengths are not necessarily reduced.

5.2.11 Option 1 (a) improves the situation slightly by reducing the queue by approximately 50 metres. However this option does not address the peak in the queue profile over the peak period.

5.2.12 The existing base situation on Aldwarke Lane sees queuing back to the extents of the modelled network. The only scheme to make a significant impact on the queuing experienced on Aldwarke Lane is MOVA control. MOVA understands there is a queuing issue developing on this approach and takes proactive action before it becomes excessive utilising its ability to vary the length of green time given to each stage.

5.2.13 The three other schemes follow the same queuing pattern on Aldwarke Lane as the existing base situation due to their inability to respond to the queuing issue as it develops.

5.2.14 The full signalisation schemes see a slight increase in queue length on the Doncaster Road approach over the existing base situation and the partial signalisation schemes, as small queues are created on this approach to allow capacity to be given to other approaches enabling larger queues to be reduced.

5.2.15 All of the schemes have similar levels of queuing on Herringthorpe Valley Road compared to the existing base situation with the two full signalisation schemes seeing a slight increase over the partial signalisation options.

5.2.16 A balance between all four approaches would be gained through detailed design to ensure one approach does not suffer significantly to the benefit of another.

5.3 JOURNEY TIME ANALYSIS

5.3.1 Journey time analysis was carried out for each of the four schemes and compared to the base situation on the four approaches to Mushroom Roundabout in both the morning and evening peak periods.

5.3.2 The graphs presented below indicated the average journey time in five minute intervals through the peak periods. Within each peak period, each graph uses the same scale so that it is easier to make fair comparisons between changes in journey time on different routes.

5.3.3 Graphs comparing the journey times across the peak hour and peak period can be found as Appendix E to this report.

Morning Peak Period

5.3.4 Fixed time traffic signal control sees an increase in journey time for non-public transport (Non-PT) vehicles on Fitzwilliam Road over the existing base situation and the three other schemes, with the longest journey time taking three minutes to negotiate the junction.

5.3.5 The other schemes deliver a similar journey time to the existing base situation at around one minute 40 seconds.

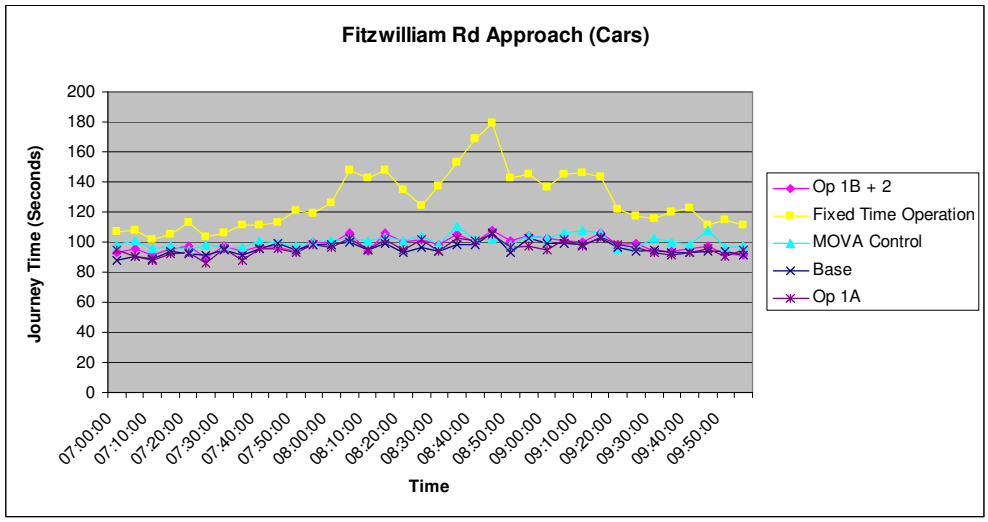


Figure 5.1 – Morning Peak Fitzwilliam Road average journey time (Non PT) by option

5.3.6 For buses on Fitzwilliam Road all schemes other than Option 1 (a) see a slight reduction in journey time of approximately 30 seconds. This is due to the reduction in queue length on Fitzwilliam Road allowing quicker access to the bus lane.

5.3.7 Option 1 (a) has little impact on the journey time for buses over the existing base situation.

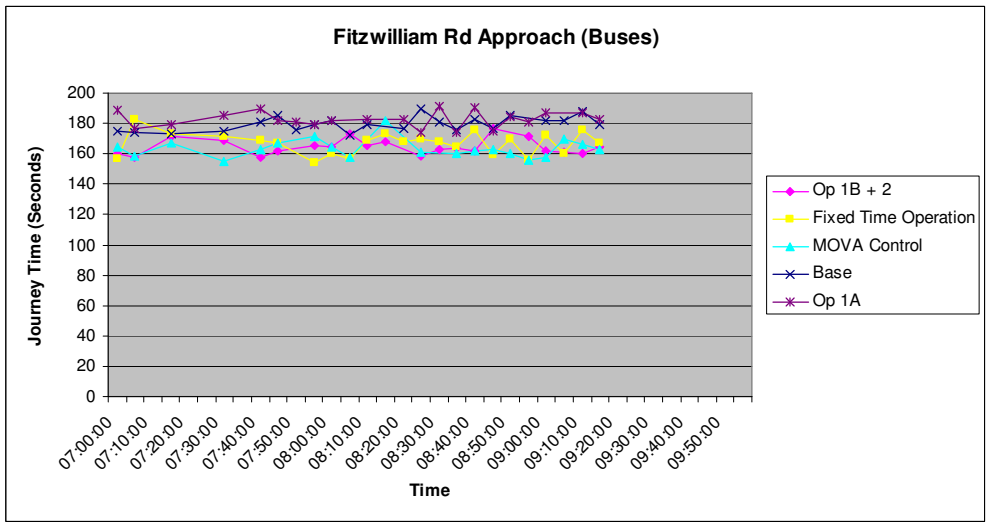


Figure 5.2 – Morning Peak Fitzwilliam Road average journey time (PT) by option

5.3.8 The full signalisation schemes see approximately a 10 – 20 second increase in journey time on Aldwarke Lane over the existing base situation and the partial signalisation schemes. This increase can be attributed to the change in method of control.

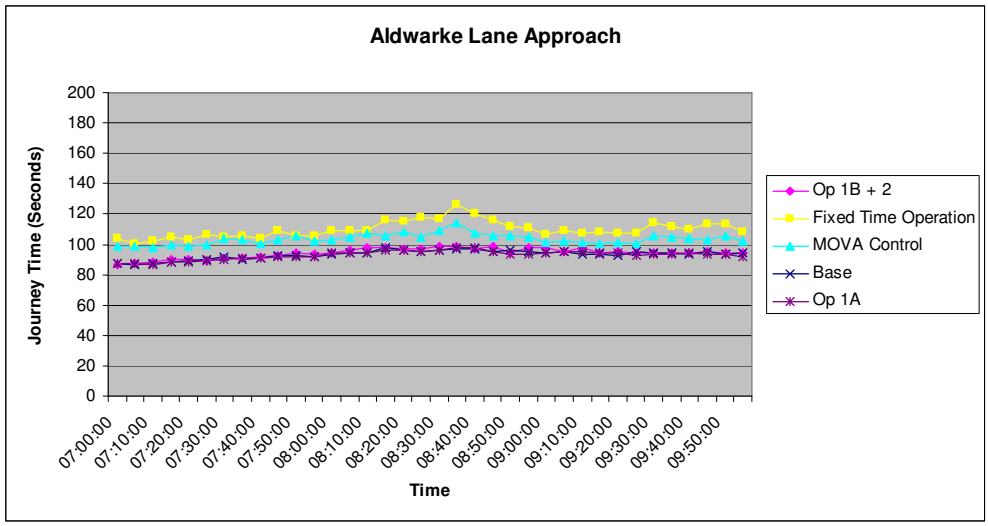


Figure 5.3 –Morning Peak Aldwarke Lane average journey time by option

5.3.9 All of the schemes have a similar journey time of around one minute 20 seconds on the Doncaster Road approach when compared to the existing base situation.

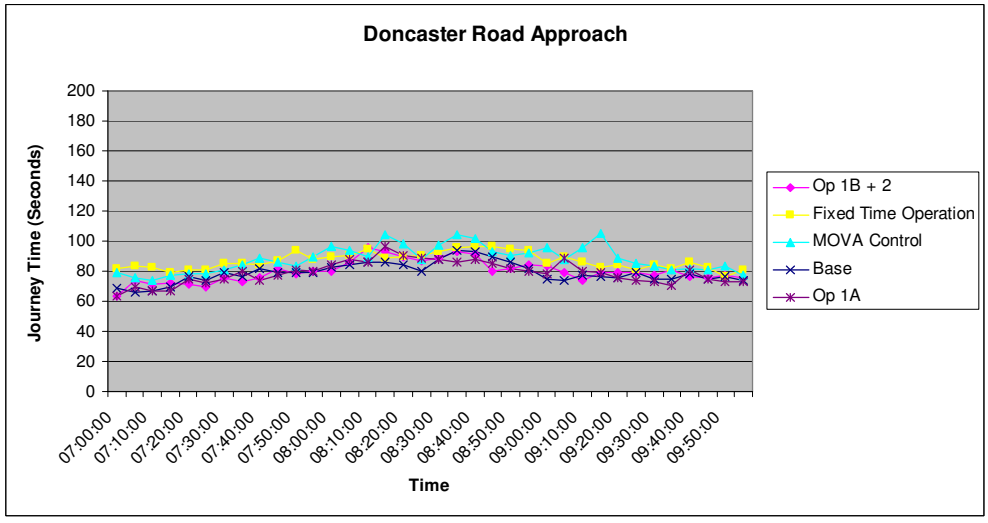


Figure 5.4 – Morning Peak Doncaster Road average journey time by option

5.3.10 Herringthorpe Valley Road sees an increase in delay in all schemes proposed by approximately 10 seconds with Option 1 (a) seeing the largest increase over the existing base situation at approximately 20 seconds increase in delay.

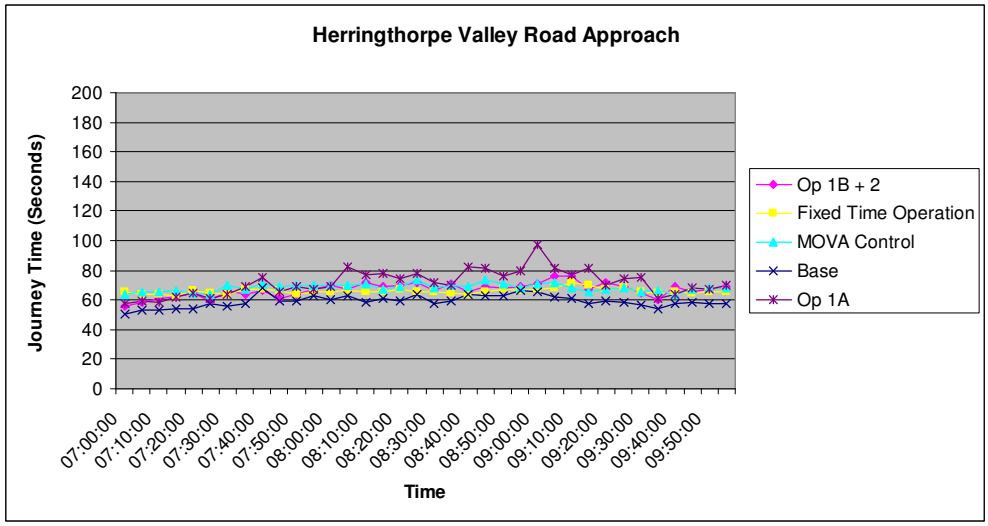


Figure 5.5 –Morning Peak Herringthorpe Valley Road average journey time by option

Evening Peak Period

5.3.11 The existing base situation sees a clear peak in journey time for Non PT vehicles on the Fitzwilliam Road approach from 16:40 to 18:10. This increase is due to the difficulty for vehicles to enter the roundabout.

5.3.12 Option 1 (a) improves the situation for Non PT vehicles slightly by metering traffic on Herringthorpe Valley Road, delivering approximately two minutes and 30 seconds reduction in journey time.

5.3.13 The three other options see a much flatter journey time profile throughout the peak period with approximately five minutes reduction for the worst journey time. This equates to a journey time of approximately three minutes and 20 seconds.

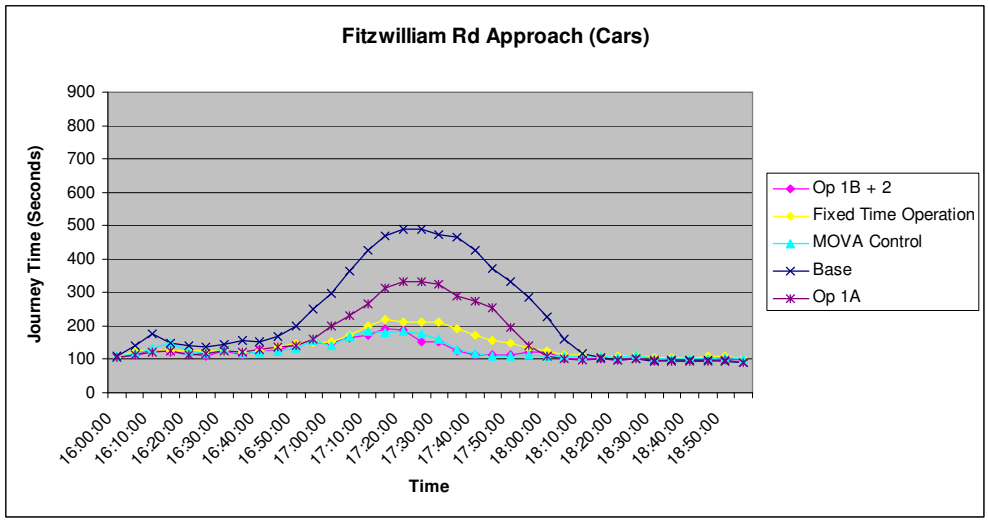


Figure 5.6 – Evening Peak Fitzwilliam Road average journey time (Non PT) by option

5.3.14 As for Non PT vehicles on the Fitzwilliam Road, buses also see a clear peak in journey time in the existing base situation. Although there is significant provision of bus lane currently in place on Fitzwilliam Road buses experience delay accessing the bus lane due to queuing traffic blocking the entry point as a result of vehicles being unable to gain access on to Mushroom Roundabout due to insufficient gaps in circulatory traffic.

5.3.15 All of the schemes remove the peak in journey time for buses by reducing the level of queuing on Fitzwilliam Road to a length which has minimal impact on the operation of the bus lane.

5.3.16 MOVA control, fixed time operation and Option 1 (b) + 2 deliver the most significant benefits by reducing the journey time below three minutes and 20 seconds.

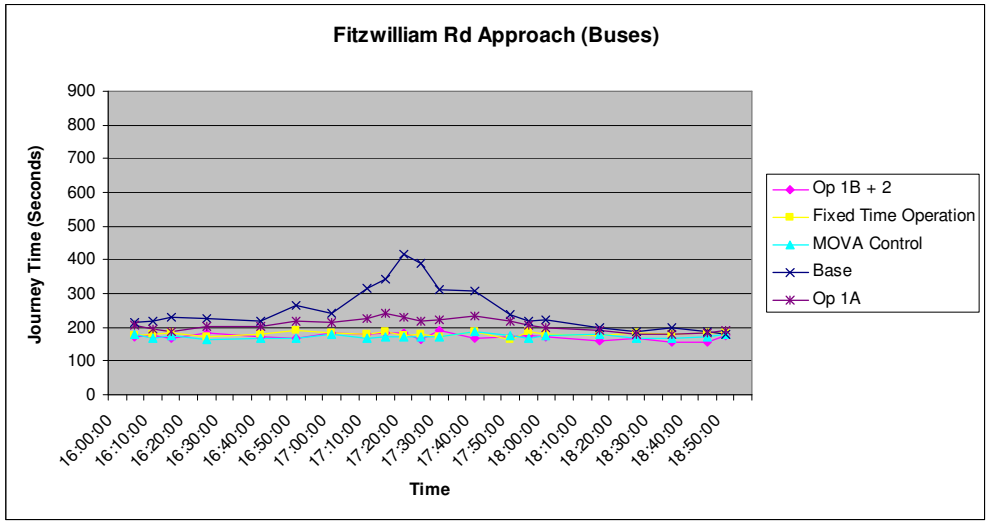


Figure 5.7 – Evening Peak Fitzwilliam Road average journey time (PT) by option

5.3.17 The existing base situation and all scheme options other than MOVA control see an excessively high journey time on the Aldwarke Lane approach to the roundabout.

5.3.18 Fixed time operation achieves a constant journey time throughout the peak period which is higher than the existing base journey time.

5.3.19 Option 1 (b) + 2 sees a reduction in journey time about 30 minutes earlier in the peak period than the base situation.

5.3.20 MOVA control of the roundabout manages the delay before it becomes excessive and sees a significant reduction in journey time over the existing base situation and the three other schemes.

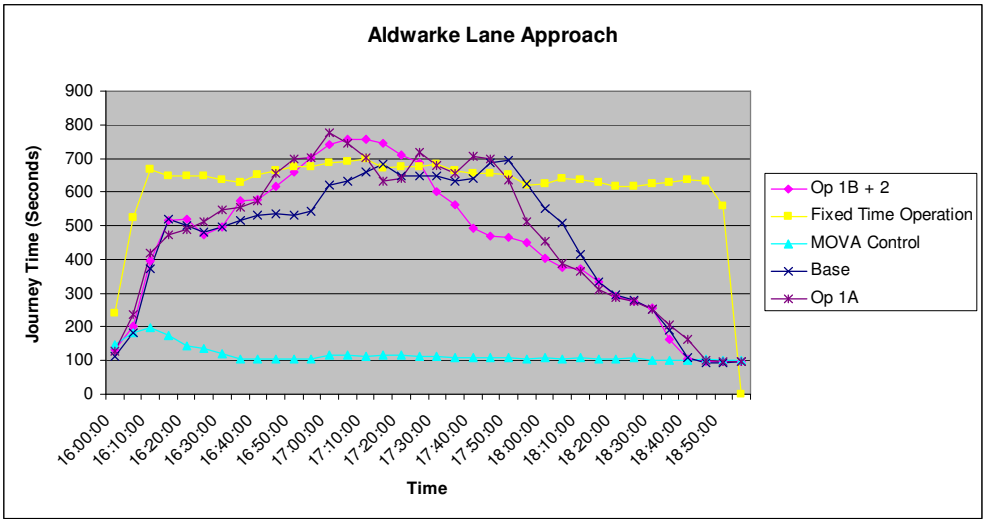


Figure 5.8 – Evening Peak Aldwarke Lane average journey time by option

5.3.21 All of the proposed schemes deliver a very similar journey time on the Doncaster Road approach with no major increases or decreases in journey time over the existing base situation.

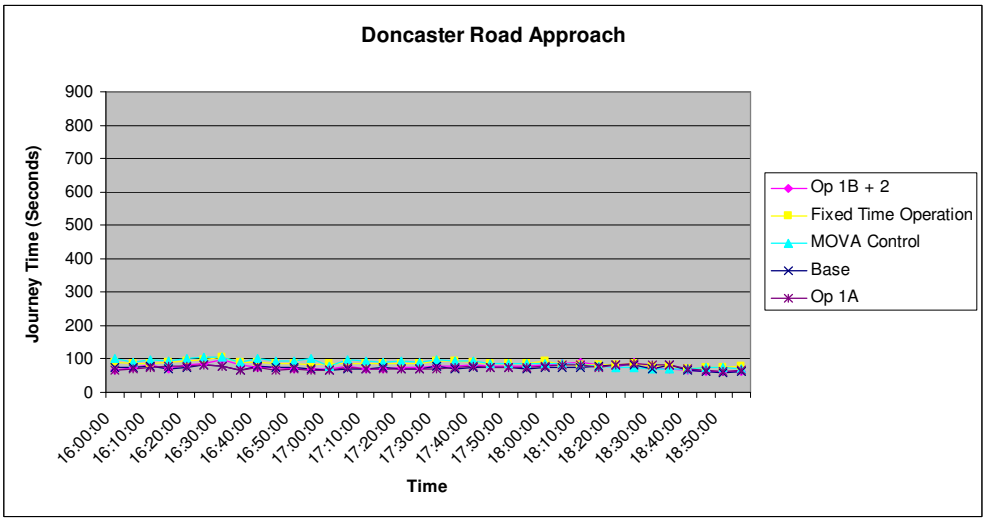


Figure 5.9 – Evening Peak Doncaster Road average journey time by option

5.3.22 Herringthorpe Valley Road currently experiences a fairly constant journey time throughout the peak period. None of the proposed schemes deliver significant changes in journey time over the existing situation.

5.3.23 Option 1 (a) sees a slight increase in journey time of approximately 40 seconds over the existing situation.

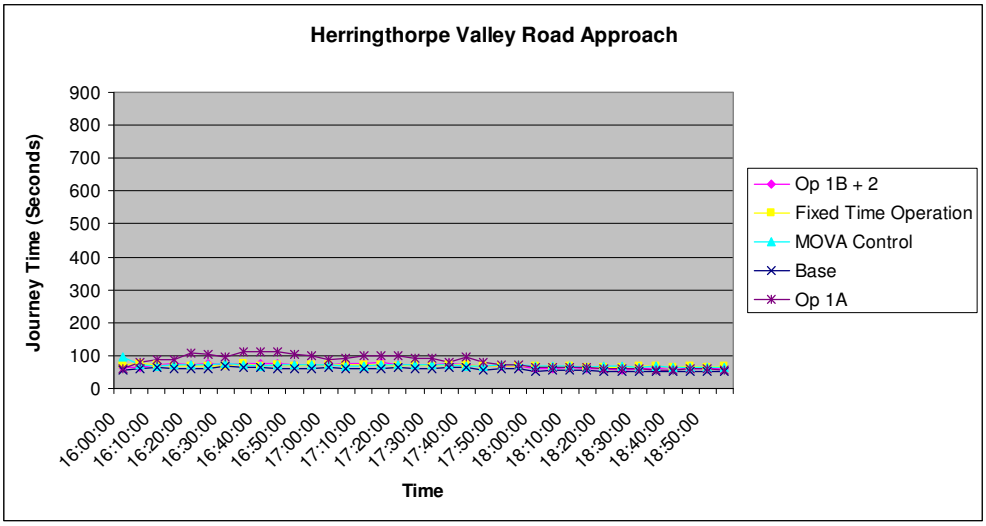


Figure 5.10 – Evening Peak Herringthorpe Valley Road average journey time by option

5.3.24 In summary, considering all routes, full signalisation of the roundabout with MOVA control provides the greatest overall journey time benefit.

5.4 JOURNEY TIME RELIABILITY

5.4.1 Journey time reliability has been assessed on the X78 northbound service for all option models. The X78 is considered representative of the bus services on the corridor.

5.4.2 Bus journey time reliability has been assessed using the journey time for the whole route in the modelled network rather than segmenting the route to assess bus journey times specifically through Mushroom Roundabout.

5.4.3 This method allows a view to be taken on the impact of the intervention at Mushroom roundabout, and the journey time through the junction, and also how the rest of the network impacts on the journey time. Thus, indicating that not all reliability issues for buses are caused at the roundabout.

5.4.4 Option 4 with MOVA control delivers the most significant journey time benefits on the approaches and through the roundabout and is therefore presented below. Figures indicating the journey time reliability for all the option can be found as Appendix F of this report.

5.4.5 Figure 5.11 below indicates the existing journey time variability in the evening peak period for the X78 service on the A630 corridor, compared to full signalisation with MOVA control.

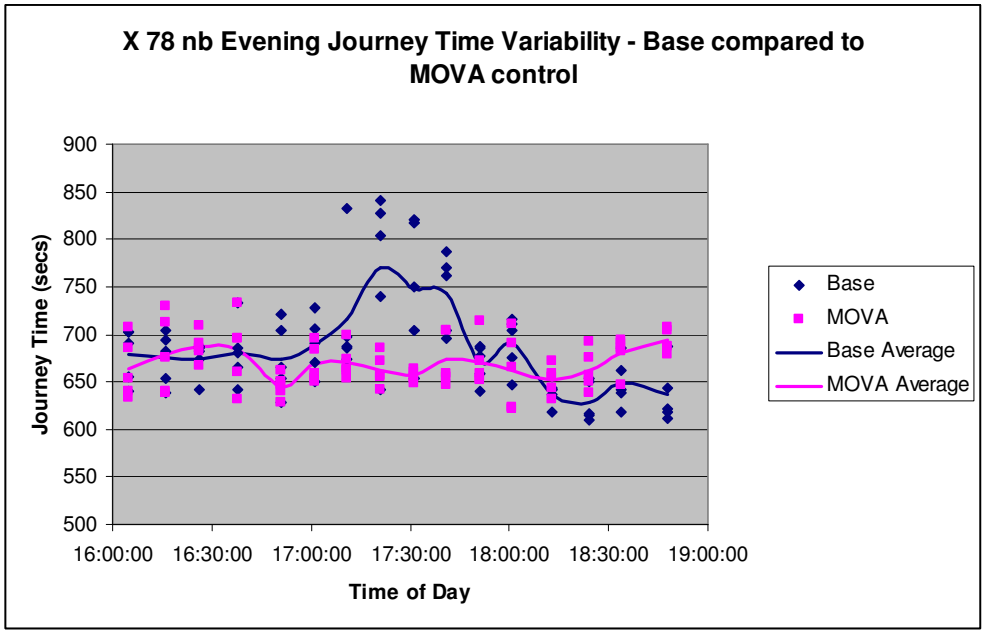


Figure 5.11 – X78 northbound service reliability impact

5.4.6 The graph indicates that under MOVA control Mushroom Roundabout contributes to a significant reduction in journey time variability particularly between 17:00 and 18:00 hrs where there is currently higher journey times with greater variability.

5.4.7 MOVA control sees the profile of bus journey times flattened considerably compared to the existing situation. This is a benefit to bus operators as it allows them to have more confidence in the service timetable; consequently it becomes a more attractive option for potential bus users.

5.5 MONETISED BENEFITS OF SCHEMES

5.5.1 Following Webtag Unit 3.5.6 Values of Time and Operating Costs, a resource value of time figure of £4.29 for all vehicle occupants was used to undertake a simple value for money exercise on the four proposed schemes.

5.5.2 Taking the total vehicle hours from the modelled outputs and converting them to person hours, using the figures presented in Table 5.1 below, the monetised benefits of each scheme compared to the existing situation have been derived.

Table 5.1 – Vehicle occupancy per trip

Trip	Weekday Average Occupancy
Work Car	1.21
PSV	12.20

5.5.3 The results of the value for money exercise have been presented in two ways:

- Whole network impact indicated by benefits to all vehicles on all trips made within each modelled time period; and
- Whole network impact indicated by benefits to public transport (PT) and non-public transport (Non-PT) vehicles within the peak hour within each modelled time period.

Whole Network Impact within Peak Periods

5.5.4 The figures in Table 5.2 below indicate that over the first year Option 4 with MOVA control would deliver £568,307 of benefits over the existing situation.

Table 5.2 – Whole network benefits for peak periods (annualised)

Scheme	AM	PM	Total
Op 1 (a)	**£ 5,297.82**	- £ 89,760.59	- £ 84,462.77
Op 2 + 1 (b)	- £ 66,938.02	**£ 31,087.56**	- £ 35,850.46
Option 4 – Fixed Time	- £ 131,769.74	- £ 482,110.78	- £ 613,880.53
Option 4 - MOVA	- £ 110,213.37	**£ 678,521.07**	**£ 568,307.70**

5.5.5 Of the four schemes analysed Option 4 with MOVA control is the only scheme to deliver a positive monetary benefit to the whole network.

5.5.6 The morning peak period is currently indicating a dis-benefit under MOVA control, although smaller than predicted with fixed time control. This can be attributed to a number of factors:

- The existing uncontrolled base situation sees minimal delay in the morning peak; and
- The MOVA model incorporates Toucan Crossings called every cycle, which would not realistically be the case; and
- The MOVA design has currently been developed to specifically suit the evening peak.

5.5.7 Whilst fixed time signal control of the roundabout addresses the delay to buses in the key route, it incurs unnecessary delay to other vehicles.

5.5.8 The net benefit of MOVA control over fixed time operation exceeds £1million annually.

Whole Network Impact within Peak Hours

5.5.9 Table 5.3 indicates that all the schemes deliver benefits to Non–PT vehicles in the evening peak hour. With Option 1 (a) and Option 4 with MOVA control also delivering benefits to Public Transport (PT).

Table 5.3 – Whole network benefits for peak hour (annualised)

Scheme	AM Peak Hour (08:00 – 09:00)		PM Peak Hour (17:00 – 18:00)		Total
	Non – PT	PT	Non – PT	PT	
Op 1 (a)	- £ 1237.49	**£ 172.14**	**£ 2,424.06**	**£ 114.02**	**£ 2,472.73**
Op 2 + 1 (b)	- £ 11,955.82	- £ 989.44	**£ 4,251.80**	- £ 1,154.22	- £ 9,847.68
Option 4 – Fixed Time	- £ 26,285.43	- £ 3,419.99	**£ 5,643.24**	- £ 390.62	- £ 24,452.81
Option 4 – MOVA	- £ 24,596.31	- £ 1,190.46	**£ 240,330.78**	**£ 592.93**	**£ 214,416.93**

5.5.10 The morning peak hour sees disadvantages for Non–PT vehicles in all the proposed schemes. This arises from the increase in level of control over the existing situation. All of the schemes introduce some new signal control on at least one approach to Mushroom Roundabout.

5.5.11 Mushroom Roundabout currently operates reasonably well in the morning peak period with out any major points of delay. The evening peak currently sees high levels of delay on at least two approaches which impacts on all vehicle users.

5.5.12 To alleviate the evening peak delay some form of signal control is required, hence the increase in delay experienced in the morning peak period.

5.5.13 Option 1 (a) offers the opportunity to operate metering traffic signals on a part time basis (i.e. evening peak period only), but it does not deliver the increase safety and pedestrian provision of the three other options. Traffic signals must operate at all times where controlled pedestrian facilities are provided.

5.6 OPTION ANALYSIS SUMMARY

5.6.1 Based on queue length reduction, journey time savings and journey time reliability Option 4 with MOVA control has been identified as the preferred solution, providing the greatest overall benefits, when buses, general traffic, pedestrians and cyclists are considered across both peak periods.

5.6.2 To support this, the monetised benefits indicate only full signalisation with MOVA control, of the options tested, would deliver positive benefits in terms of value for money across the peak periods.

6 Sensitivity Testing

6.1 OPTION 4 – MOVA CONTROL

6.1.1 Due to the significant benefits derived from MOVA control for Aldwarke Lane, specifically in the evening peak, a sensitivity test was carried out to establish if Mushroom roundabout could cope with an increased level of demand on Aldwarke Lane.

6.1.2 There are concerns over the potential for suppressed demand on the Aldwarke Lane approach to Mushroom roundabout due to the existing high levels of delay. An increase in the level of demand for the left turn from Aldwarke Lane to Doncaster Road could potentially cause operational issues due to the interaction of traffic with the pedestrian crossing on the Doncaster Road exit.

6.1.3 The following sensitivity tests were carried out on the evening peak period in the Paramics model:

- Increased left turn demand by 150 vehicles (5%) in the peak;
- Increased left turn demand by 300 vehicles (11%) in the peak; and
- Increased left turn demand by 450 vehicles (16%) in the peak.

6.1.4 The following text describes the findings of each of the sensitivity tests.

6.2 SENSITIVITY TESTING CONCLUSIONS

6.2.1 Under all scenarios tested MOVA manages to control the roundabout in such a way that the internal links do not suffer. However, dependant on the level of increase in demand the impact on the approaches varies.

6.2.2 With 150 vehicles added there is minimal change over the initial demand modelled. With 300 vehicles added in the peak period Fitzwilliam Road does see a slight increase in the level of queuing. However this does not extend to the bus lane entrance. Therefore it will not impact on bus journey time or reliability.

6.2.3 With 450 vehicles added to the demand on Aldwarke Lane the queue on Fitzwilliam Road extends past the bus lane entrance. This has an impact on bus journey time and reliability by limiting access in to the bus lane. There are also occasional issues of blocking back on the roundabout internals due to the two pedestrian crossings on the Doncaster Road exit. These issues are infrequent and MOVA controls the flow of vehicles on to the roundabout to allow the internal links to clear.

6.2.4 To combat the queuing issue experienced on Fitzwilliam Road the setup of MOVA could be altered so to give additional priority to the A630 corridor movements over Aldwarke Lane, although this is unlikely to be necessary as increases in demand of this scale are not expected.

7 Recommendations and Way Forward

7.1 RECOMMENDATIONS

7.1.1 Following option analysis and via consultation with SYPTE, RMBC and First Group, WSP recommend that Option 4 – Full Signalisation with MOVA control is taken forward as the preferred option for improvements at Mushroom Roundabout.

7.1.2 Although the preferred scheme requires the highest level capital investment of all the options considered, it delivers journey time improvements and reliability improvements for all vehicles, whilst also providing facilities for pedestrians and cyclists on all arms of the junction.

7.1.3 The marginal additional expenditure required to provide MOVA control over fixed time operation, for the full signalisation scheme, delivers significant benefits by providing a method of control capable of substantially reducing queuing and delay overall.

7.1.4 Options 1 (a) and 1 (b) + 2, the metering options, requiring a lower level of expenditure but show dis-benefits that are significant compared with the expected benefit. They also raise safety concerns on a number of levels, thus rendering the options unsuitable.

7.2 WAY FORWARD

7.2.1 A prioritisation appraisal tool should be utilised to consider the findings of this report and other identified corridor wide interventions. This will ensure that any investment in either a single scheme or combination of schemes is targeted at achieving maximum benefit and therefore overall value for money.

7.2.2 Should the above identify signalisation of mushroom to be the preferred scheme funding should be sought by SYPTE and RMBC to progress the scheme, taking account of cost estimates being prepared by RMBC.

7.2.3 The scheme should be progressed through detailed design, taking account of the conceptual design of both the physical and operational aspects, and the findings of the modelling carried out to date by WSP,

7.2.4 Consideration should be given to the wider corridor and potential interventions to further improve the situation for all vehicles and journey time reliability for buses, with particular attention paid to St Ann’s Roundabout and Oldgate Lane.

Appendices, Figures & Tables

Appendix A Figures

Appendix B Initial Option Sketches

Appendix C Developed Option Sketches

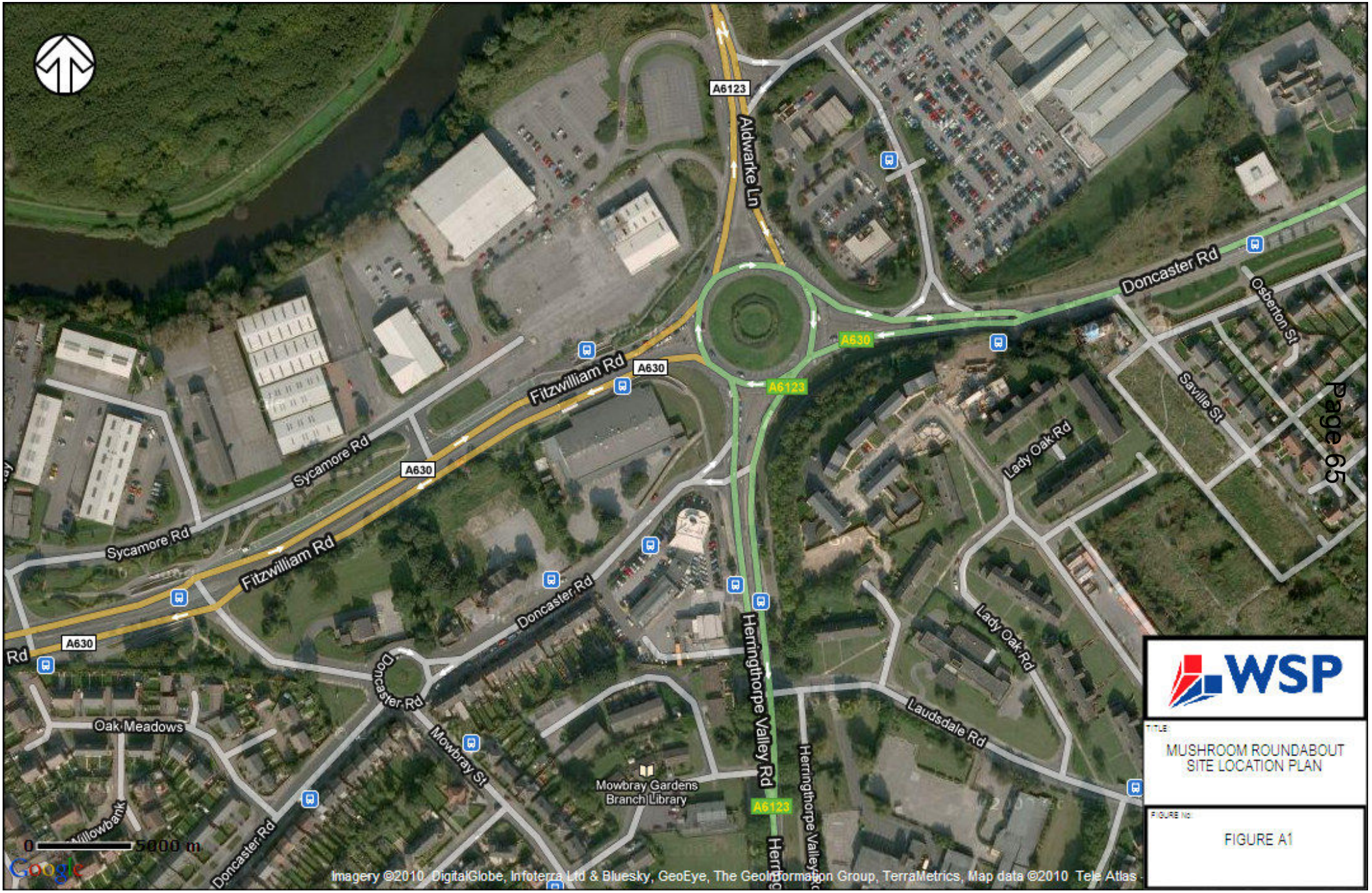
Appendix D Queue Length Graphs

Appendix E Journey Time Graphs

Appendix F Journey Time Reliability Graphs

Appendices, Figures & Tables

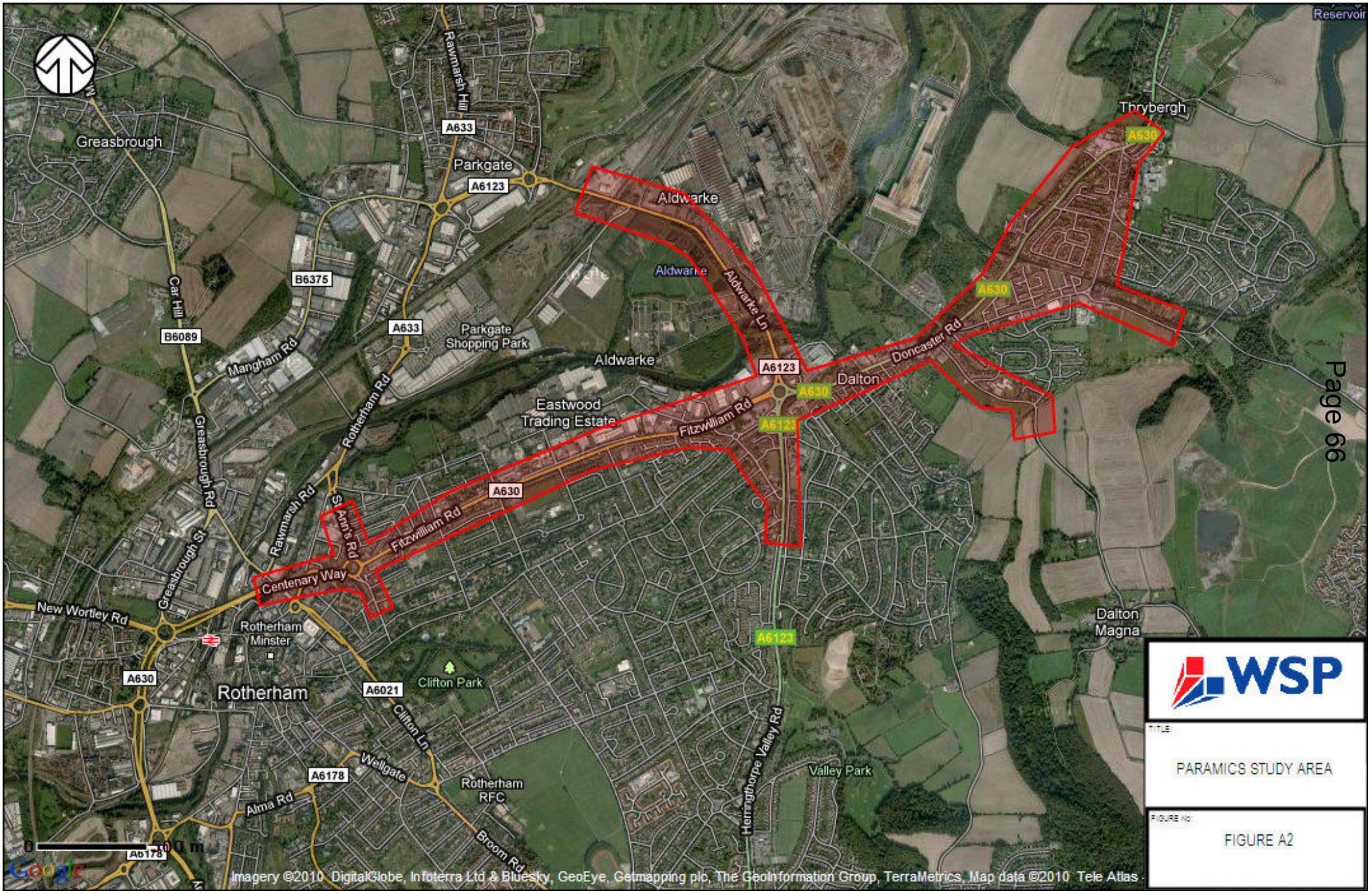
Appendix A Figures



WSP

TITLE:
MUSHROOM ROUNDABOUT
SITE LOCATION PLAN

FIGURE No:
FIGURE A1


Greasbrough
Rawmarsh Hill
A633
Parkgate
A6123
Aldwarke
Aldwarke Ln
Thrybergh
Reservoir
A630
B6375
Car Hill
B6089
Mangham Rd
Parkgate Shopping Park
Doncaster Rd
Dalton
Eastwood Trading Estate
Fitzwilliam Rd
Rotherham Rd
Greasbrough Rd
Rawmarsh Rd
St Ann's Rd
Centenary Way
Greasbrough St
New Wortley Rd
Rotherham Minster
Rotherham
A6021
Clifton Park
Clifton Ln
Wellgate
A6178
Alma Rd
Rotherham RFC
Broom Rd
Herringthorpe Valley Rd
Valley Park
Dalton Magna
0
200 m
Google
Imagery ©2010 DigitalGlobe, Infoterra Ltd & Bluesky, GeoEye, Getmapping plc, The GeoInformation Group, TerraMetrics, Map data ©2010 Tele Atlas
WSP
TITLE
PARAMICS STUDY AREA
FIGURE No
FIGURE A2

WSP

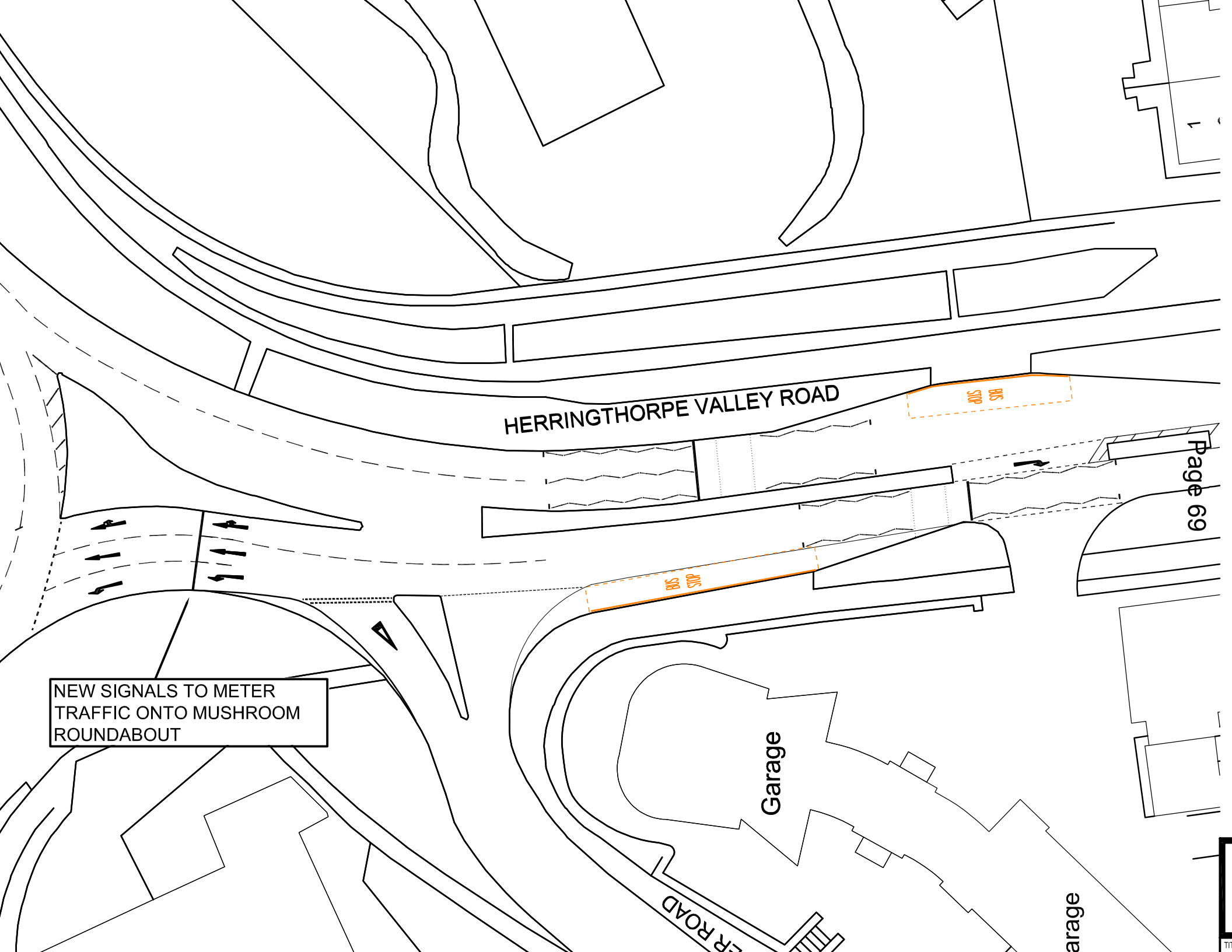
TITLE:

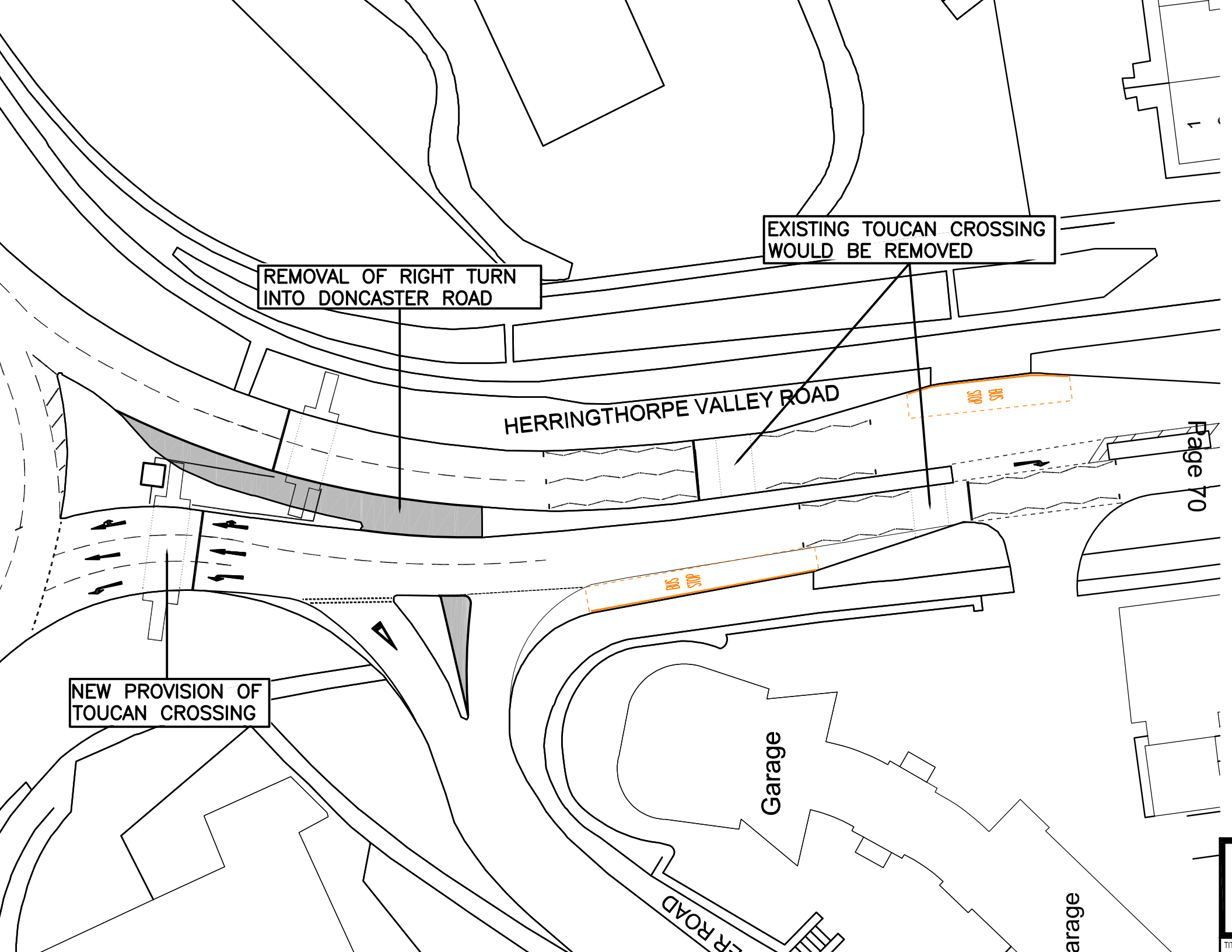
Paramics Modelled Network

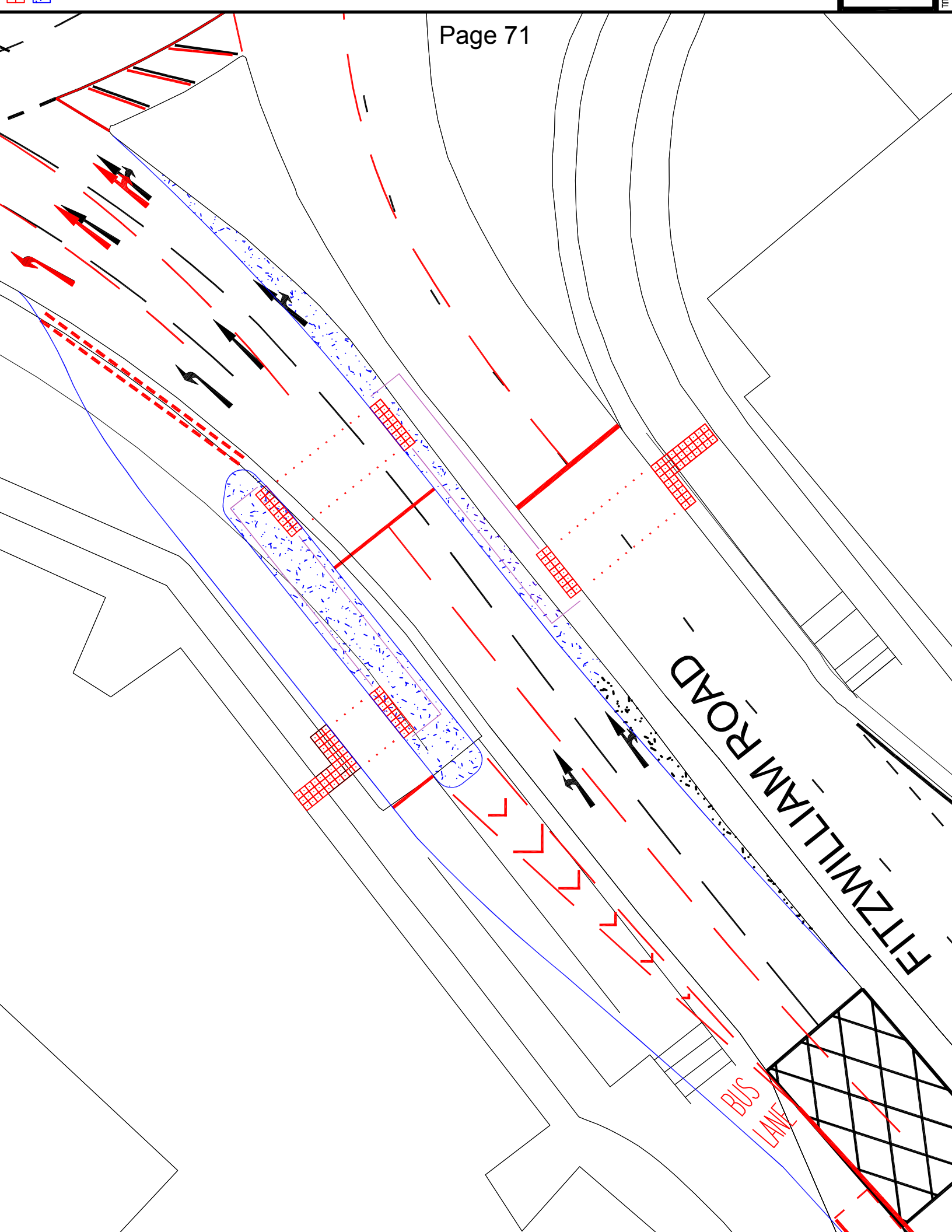
FIGURE No:

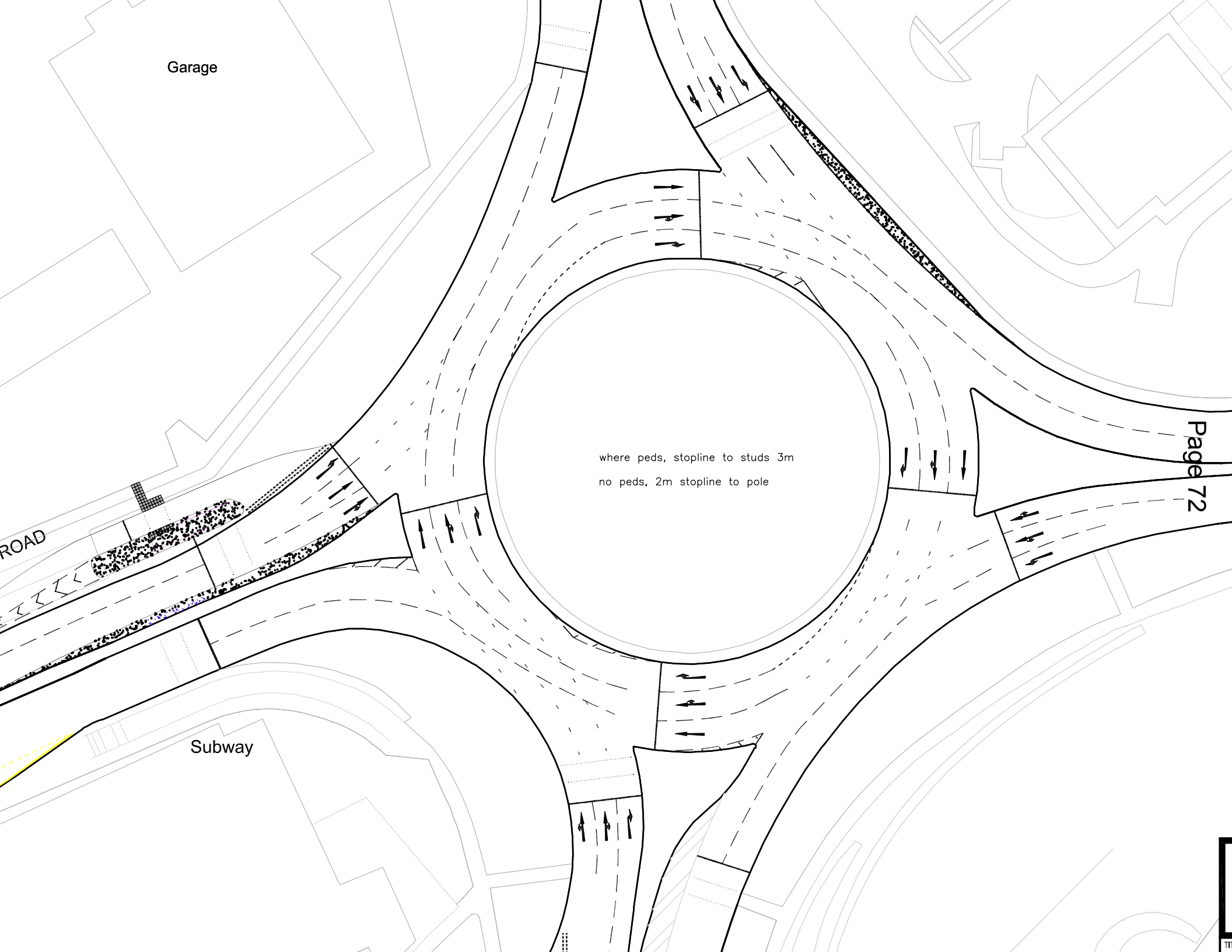
Figure A3

Appendix B Initial Option Sketches

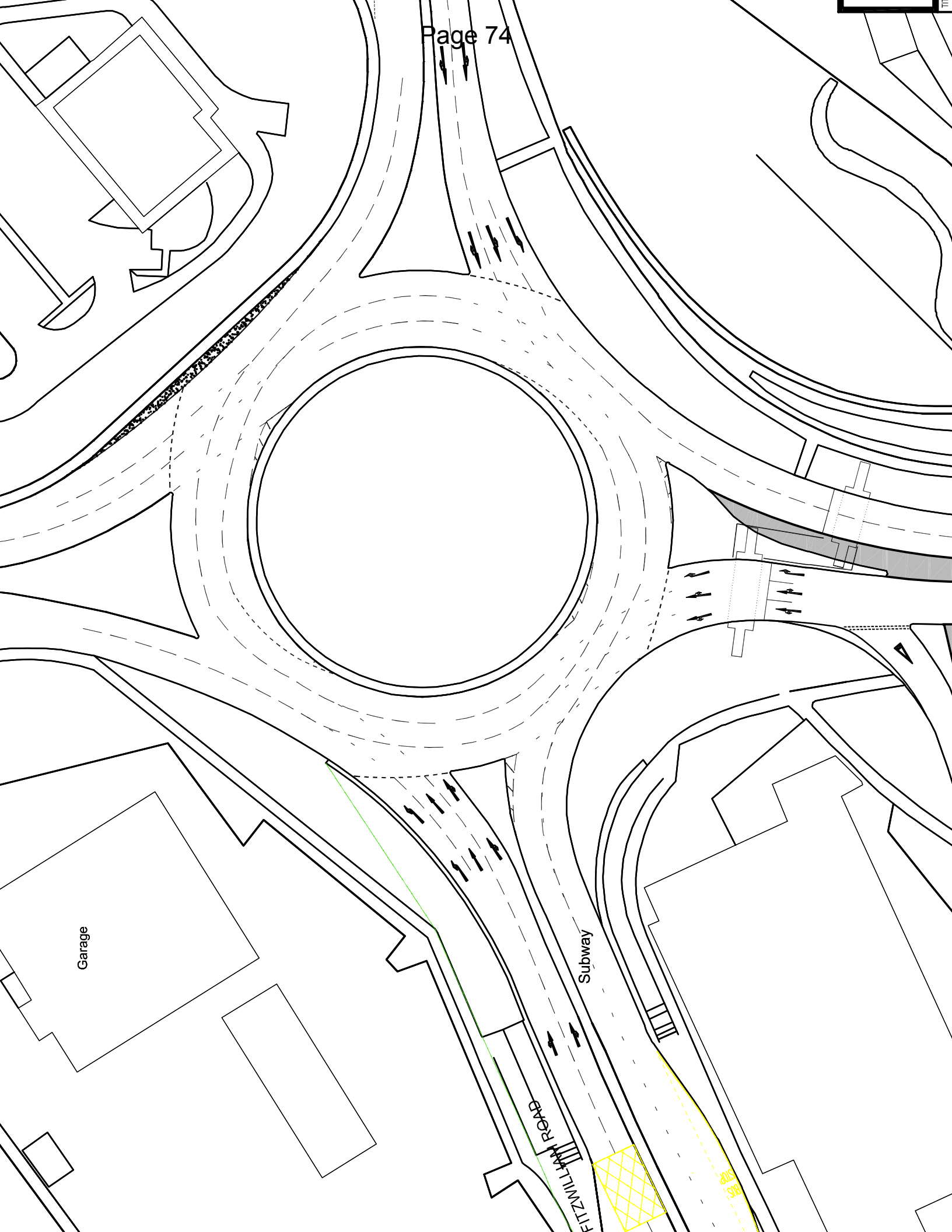

HERRINGTHORPE VALLEY ROAD
BUS STOP
BUS STOP
NEW SIGNALS TO METER TRAFFIC ONTO MUSHROOM ROUNDABOUT
Garage
Garage

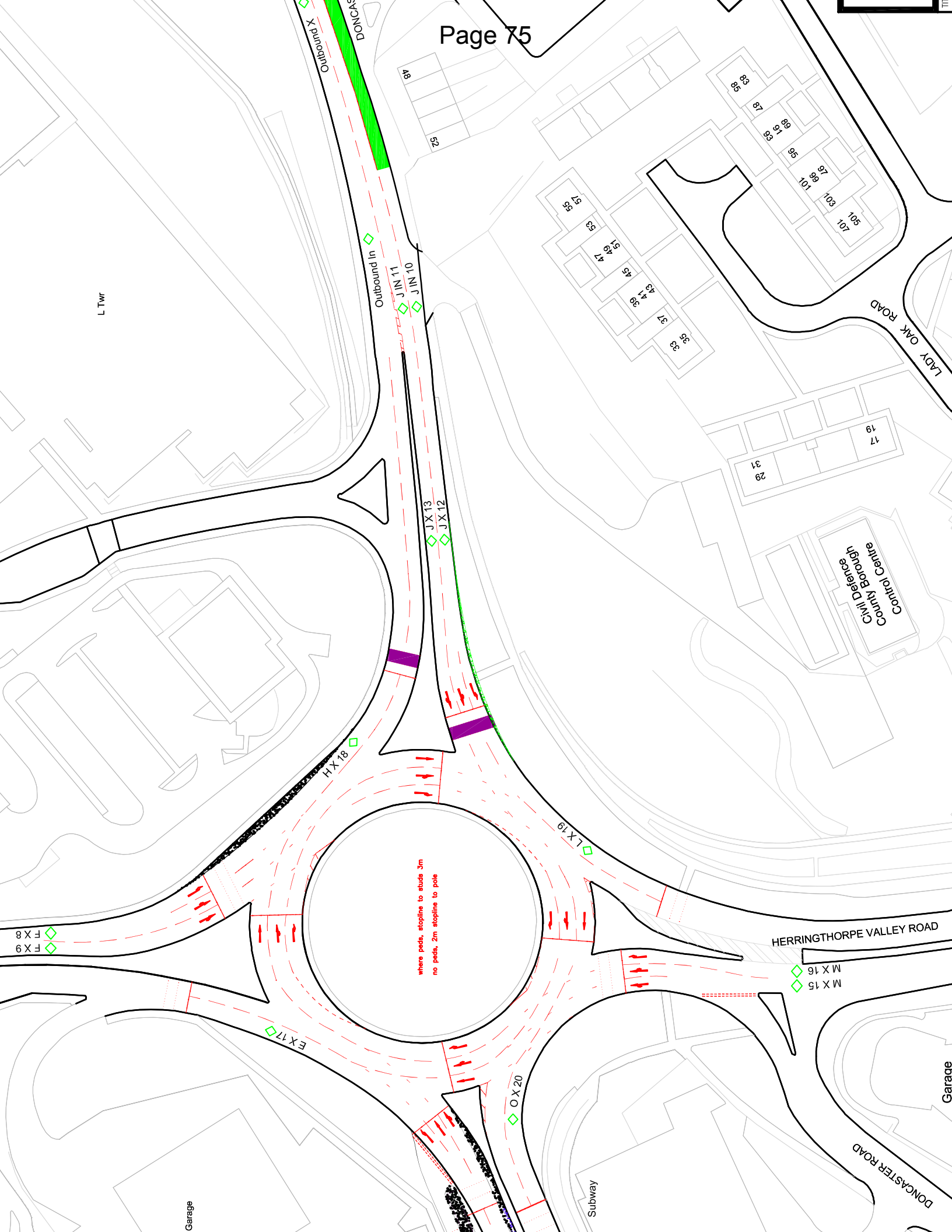

REMOVAL OF RIGHT TURN INTO DONCASTER ROAD
EXISTING TOUCAN CROSSING WOULD BE REMOVED
HERRINGTHORPE VALLEY ROAD
BUS STOP
BUS STOP
NEW PROVISION OF TOUCAN CROSSING
Garage
Page 40


FITZWILLIAM ROAD
BUS
LANE


Garage
where peds, stopline to studs 3m
no peds, 2m stopline to pole
ROAD
Subway

Appendix C Developed Option Sketches

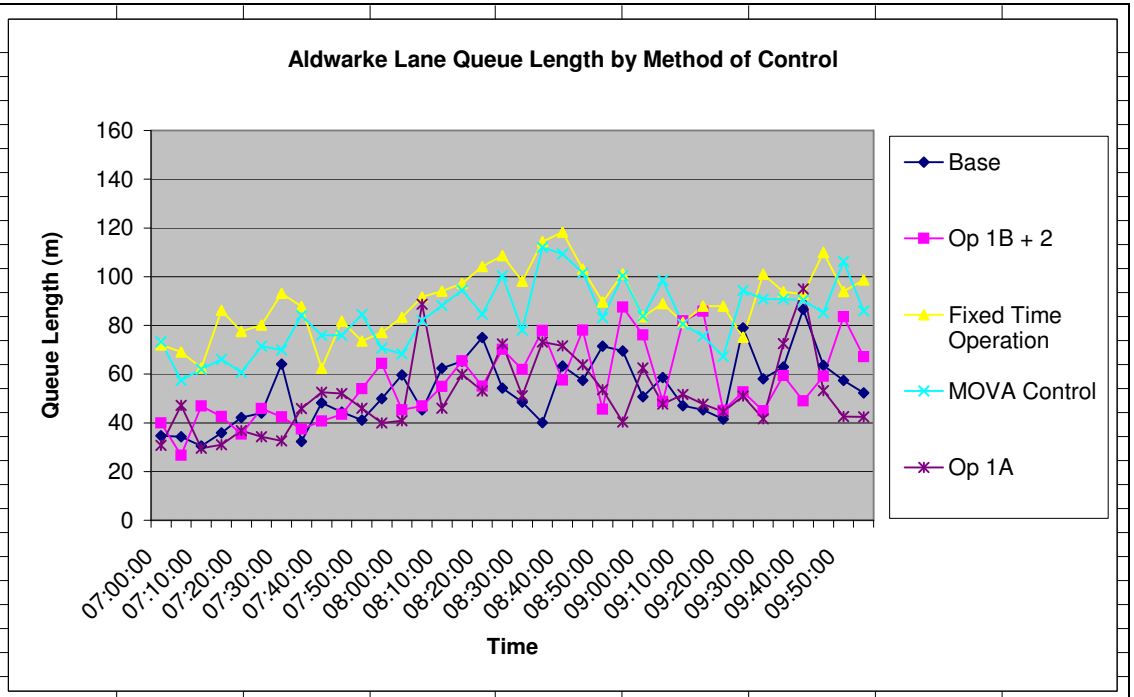

Garage
Subway
FITZWILLIAM ROAD


Outbound In
J IN 11
J IN 10
J X 13
J X 12
H X 18
L X 19
E X 17
O X 20
F X 8
F X 9
M X 15
M X 16
where peds, stopline to stude 3m
no peds, 2m stopline to pole
HERRINGTHORPE VALLEY ROAD
LADY OAK ROAD
DONCASTER ROAD
County Borough
Civil Defence
Control Centre
Subway
Garage
Garage
L Twr

Appendix D Queue Length Graphs

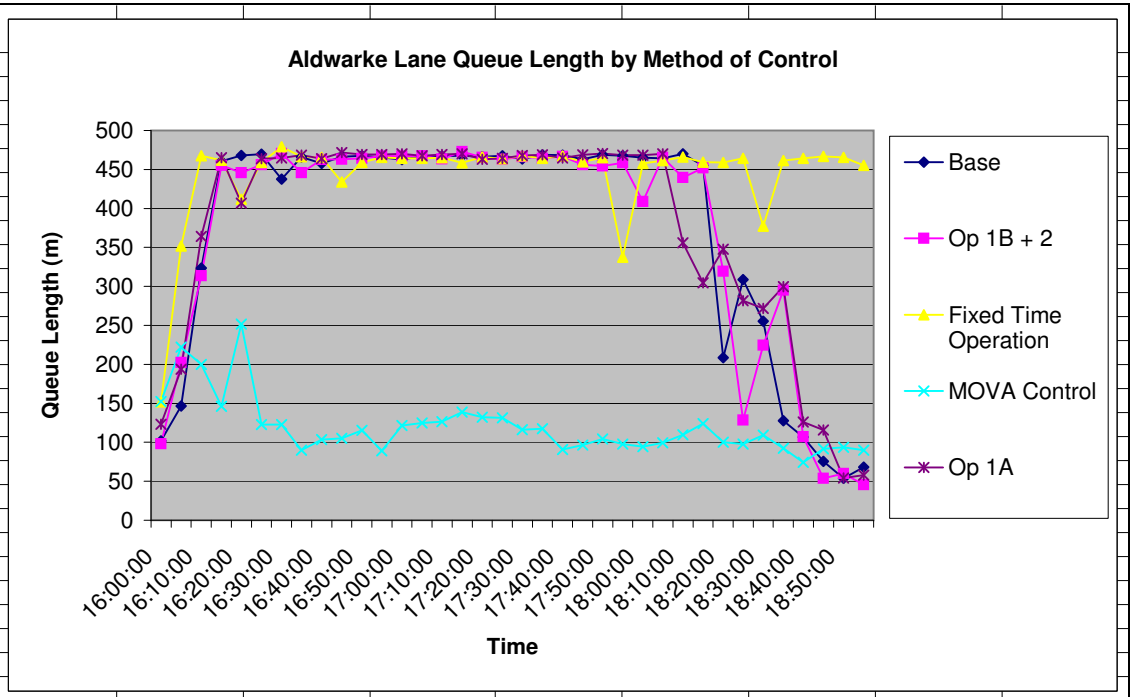
Queue Length Comparison by Approach - Morning Peak

	Base	Op 1A	Op 1B + 2	Fixed Time Operation	MOVA Control
07:00:00	34.7299	30.7823	39.9048	71.94775	73.2494
07:05:00	34.3342	47.1957	26.61285	69.1614	57.4018
07:10:00	30.4472	29.6154	46.8802	62.5572	61.9698
07:15:00	35.9044	30.9533	42.54965	86.17265	66.1034
07:20:00	42.1247	36.8237	35.3626	77.51625	60.73825
07:25:00	43.9599	34.2598	45.85435	80.1122	71.51265
07:30:00	64.124	32.5246	42.4025	93.099	69.92725
07:35:00	32.2591	45.8871	37.3826	87.80365	84.0608
07:40:00	48.2011	52.551	40.7242	62.34805	75.98925
07:45:00	44.3923	52.0503	43.4381	81.67275	75.93285
07:50:00	41.1396	45.9647	54.042	73.59335	84.46015
07:55:00	49.8972	39.9961	64.3605	77.16525	70.68655
08:00:00	59.5791	40.9117	45.3756	83.32755	68.26025
08:05:00	45.34335	88.6673	46.9291	91.72995	81.9325
08:10:00	62.4404	46.02495	54.9382	94.04535	88.17215
08:15:00	65.3365	59.8886	65.4074	97.2546	94.50125
08:20:00	74.9604	53.078	55.0578	104.1744	84.58365
08:25:00	54.23595	72.3385	70.188	108.674	100.40765
08:30:00	48.4643	51.0952	61.92965	98.18246667	77.974
08:35:00	40.113	73.16455	77.95875	114.3858	112.0588
08:40:00	63.32925	71.6549	57.5226	118.20205	109.3019
08:45:00	57.4097	63.801	78.0063	103.0717	101.59355
08:50:00	71.4424	53.6116	45.5876	89.60695	83.17255
08:55:00	69.5265	40.3473	87.4776	101.1072	100.3693
09:00:00	50.753	62.4674	76.0507	83.51095	83.81705
09:05:00	58.56135	47.73455	48.76875	88.89015	98.4983
09:10:00	47.0557	51.68925	81.864	81.1227	80.4983
09:15:00	45.3198	47.74585	85.72055	87.88585	75.5841
09:20:00	41.52965	44.49795	45.00985	87.9222	67.2719
09:25:00	78.89975	50.9368	52.65515	75.13965	94.38325
09:30:00	58.0087	41.64345	44.942	101.05855	90.7787
09:35:00	62.91825	72.4804	59.3399	93.8289	90.72185
09:40:00	86.60155	94.9286	49.0009	92.77775	90.41755
09:45:00	63.5384	53.1435	59.09135	109.92365	85.0752
09:50:00	57.3786	42.5298	83.5384	93.9309	106.2885
09:55:00	52.2272	42.3687	67.0756	98.618	85.9457



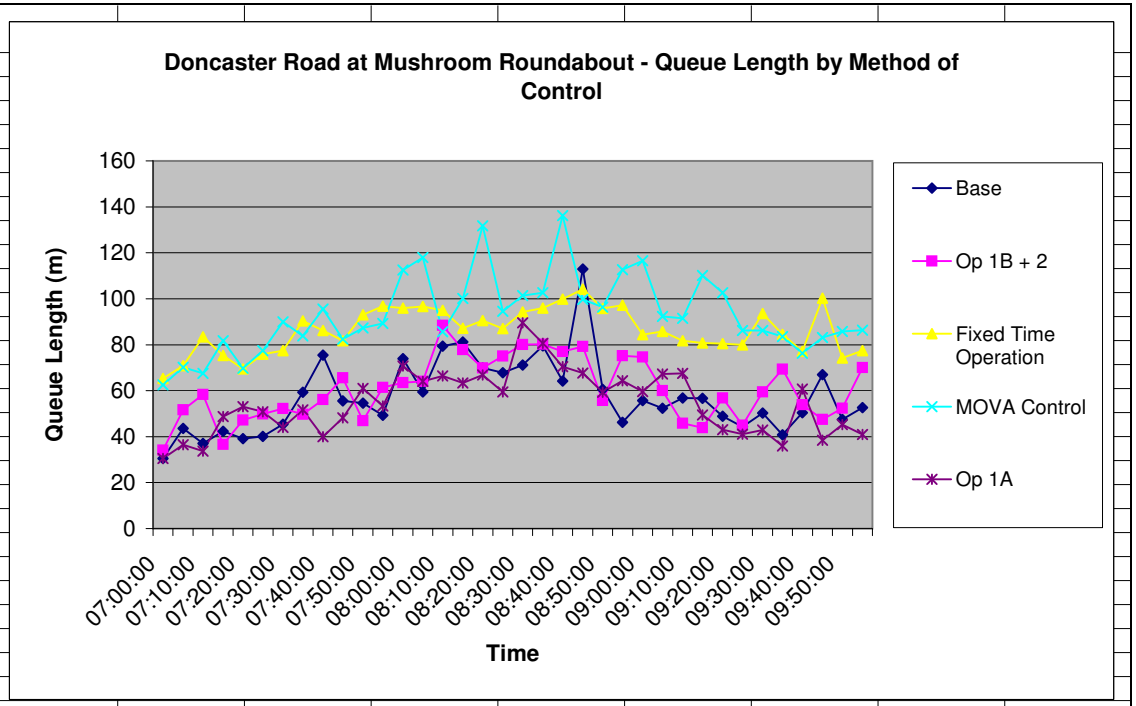
Queue Length Comparison by Approach - Evening Peak

	Base	Op 1A	Op 1B + 2	Fixed Time Operation	MOVA Control
16:00:00	101.739	123.11945	98.3147	151.8079333	152.3968
16:05:00	146.5335667	193.6319667	202.5601	351.7636	222.2802333
16:10:00	323.3829667	364.0232667	313.7320667	467.4285	199.8258333
16:15:00	460.4699	465.2817	455.3403333	461.7334667	146.0526667
16:20:00	468.1172333	406.6782667	445.7076667	411.5813	251.5000333
16:25:00	469.8127667	464.0217667	455.9020667	458.9305667	122.9132
16:30:00	437.428	464.7268333	470.5780333	479.1964667	122.6104
16:35:00	465.8855667	468.3654333	446.0010667	466.1692	89.76765
16:40:00	457.8741667	463.8009667	462.5995	465.5228	103.37455
16:45:00	466.1792667	471.7270667	463.1845333	433.7792667	104.9433
16:50:00	467.5752333	469.0537333	464.1692	459.0717	115.26845
16:55:00	465.5068667	469.071	467.2739667	465.6633667	89.25226667
17:00:00	462.8219667	469.9924667	467.0563667	464.1564667	121.628
17:05:00	467.3135	467.4335333	467.4289	464.1911667	124.644
17:10:00	467.1530667	469.0730667	463.4598333	465.2930333	126.5001
17:15:00	467.419	470.1584667	472.9700333	458.7312667	138.6847
17:20:00	466.3083667	463.2213333	465.5020333	466.0788	132.0594
17:25:00	467.4443667	464.1414667	463.2521	463.8629	131.423
17:30:00	463.5695	467.8156	466.2182333	467.4252	116.26375
17:35:00	468.6209667	468.6751333	464.2708	464.2827	117.32675
17:40:00	468.3476333	464.8015	466.8167667	467.2176	90.6975
17:45:00	463.1810667	468.8572667	456.1864667	459.6199	96.5897
17:50:00	468.9418	470.5255	454.5863	465.0361	104.2374
17:55:00	467.5226667	468.4631	458.6847	337.4709667	97.78265
18:00:00	464.9518667	468.4568	408.9196	457.7193333	94.45825
18:05:00	464.2452667	469.9574667	465.3828333	461.617	99.32205
18:10:00	469.9174	355.9070333	439.8376667	466.0944333	109.4619
18:15:00	454.7366667	304.4214	451.9576333	459.5014	123.91685
18:20:00	208.3434667	347.8980333	319.2961	459.1033333	100.19595
18:25:00	308.8084667	281.7494333	128.3156333	464.2309	97.85735
18:30:00	255.3701667	271.6968	224.7181	377.1938	109.1098
18:35:00	127.7461	299.8059	295.0185	461.5200667	92.41445
18:40:00	106.84095	126.0749	106.94385	464.4156	74.48786667
18:45:00	75.35675	115.6670333	53.8175	466.8179667	91.5666
18:50:00	53.79775	54.348	59.7709	465.6472	93.5184
18:55:00	68.0675	57.91855	45.6507	455.2918667	89.9285



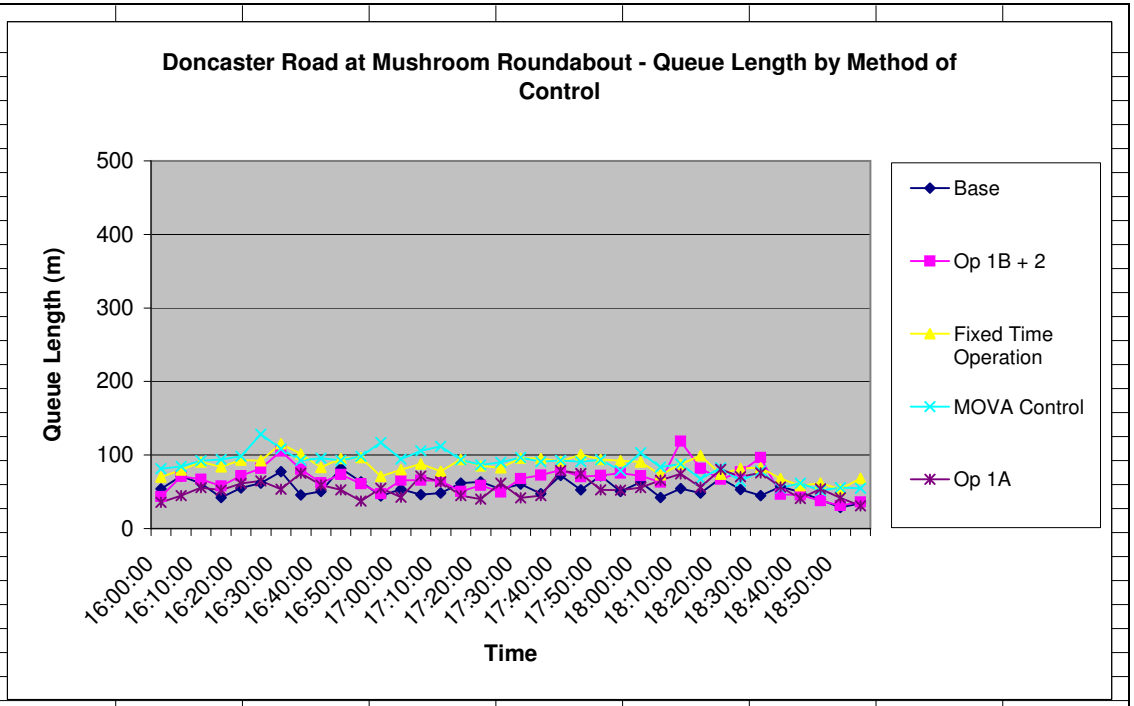
Queue Length Comparison by Approach - Morning Peak

	Base	Op 1A	Op 1B + 2	Fixed Time Operation	MOVA Control
07:00:00	30.4837	30.5278	34.1811	65.28533333	62.54653333
07:05:00	43.64676667	36.53015	51.6321	70.86636667	70.23343333
07:10:00	37.0722	33.7131	58.4041	83.41393333	67.5219
07:15:00	42.3552	48.75136667	36.63356667	75.3174	81.78976667
07:20:00	39.1504	53.1115	47.1693	69.52423333	69.74286667
07:25:00	40.0503	50.80046667	49.8898	75.9206	77.4928
07:30:00	45.331	44.0627	52.22045	77.44	89.90076667
07:35:00	59.32803333	51.72706667	49.7417	90.438	83.7755
07:40:00	75.5175	39.98995	56.1762	86.20733333	95.5123
07:45:00	55.50243333	48.2379	65.5328	81.68266667	82.39213333
07:50:00	54.56913333	61.02086667	46.91555	93.00343333	87.3555
07:55:00	49.35576667	53.38123333	61.3764	96.79286667	89.2429
08:00:00	73.94923333	70.7762	63.47176667	95.98183333	112.5435333
08:05:00	59.4171	64.0093	64.1155	96.68216667	117.9849667
08:10:00	79.3057	66.3552	88.42626667	95.01656667	85.6405
08:15:00	81.1848	63.3327	77.80263333	87.18316667	100.1325667
08:20:00	69.94315	66.8697	69.861	90.5001	131.7045333
08:25:00	67.85903333	59.4712	75.00726667	86.9636	94.53376667
08:30:00	71.09596667	89.60226667	80.05813333	94.2693	101.3245333
08:35:00	79.5596	80.61026667	80.19586667	95.87673333	102.6689
08:40:00	64.25783333	70.4414	77.07446667	99.85486667	136.1791
08:45:00	112.9159	67.7279	79.2459	104.1947	99.6988
08:50:00	60.55	59.28193333	55.76033333	95.74156667	96.34646667
08:55:00	46.19363333	64.3196	75.19656667	97.26673333	112.6697667
09:00:00	55.70296667	59.55666667	74.59173333	84.3816	116.5007667
09:05:00	52.40086667	67.21506667	60.03743333	85.76316667	92.37986667
09:10:00	56.86603333	67.4982	45.814	81.7174	91.43653333
09:15:00	56.74426667	49.37016667	43.84566667	80.78766667	110.1624
09:20:00	48.9226	43.0431	56.75755	80.48633333	102.5652333
09:25:00	44.34246667	41.07906667	44.917	79.92966667	86.1804
09:30:00	50.3269	42.92775	59.5036	93.51283333	86.17426667
09:35:00	40.75553333	35.96356667	69.34445	84.5585	83.58123333
09:40:00	50.43486667	60.67116667	53.90735	77.09566667	76.32946667
09:45:00	67.00446667	38.48183333	47.43125	100.2551667	83.15293333
09:50:00	47.45846667	45.27415	52.29376667	74.15903333	85.77253333
09:55:00	52.57745	40.95076667	70.08766667	77.4462	86.33106667



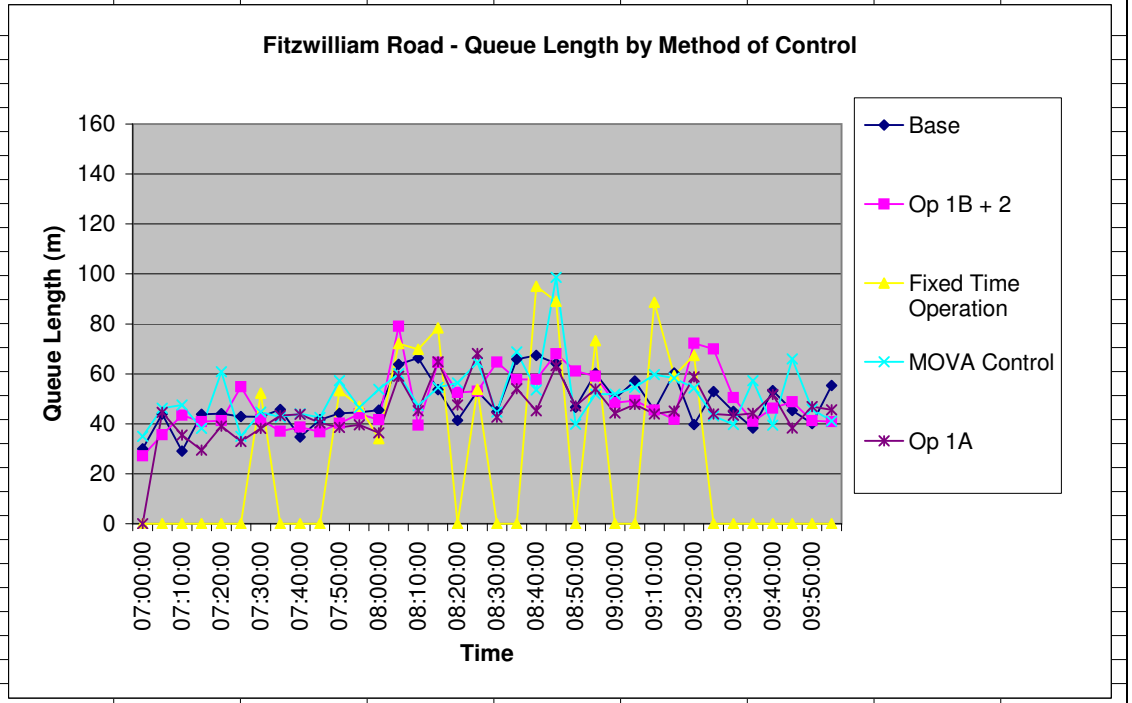
Queue Length Comparison by Approach - Evening Peak

	Base	Op 1A	Op 1B + 2	Fixed Time Operation	MOVA Control
16:00:00	54.14703333	35.6792	43.38845	70.1663	81.24576667
16:05:00	71.26996667	44.81013333	70.88303333	79.60046667	84.35656667
16:10:00	61.3187	55.88036667	67.1435	90.57653333	92.19503333
16:15:00	42.27653333	52.28063333	57.894	84.0905	93.98383333
16:20:00	55.37656667	61.32103333	71.81015	92.9884	98.5502
16:25:00	61.813	64.8114	81.955	92.44723333	128.2802667
16:30:00	77.31843333	53.55766667	105.2000667	115.3369333	108.5035
16:35:00	45.79506667	75.46126667	80.49023333	101.5629667	92.65643333
16:40:00	50.56783333	59.28186667	62.18533333	82.93236667	95.52196667
16:45:00	81.96223333	52.66953333	73.61826667	95.4627	92.80386667
16:50:00	63.5905	37.33723333	61.10386667	96.70346667	98.13323333
16:55:00	44.4933	54.692	47.43386667	70.81686667	117.0739333
17:00:00	53.46275	42.7217	65.88926667	80.03153333	94.5798
17:05:00	46.1151	71.21486667	65.83973333	87.87453333	105.5927667
17:10:00	48.35613333	63.4458	64.93943333	77.90706667	111.8063333
17:15:00	61.94026667	44.6954	50.3814	94.10833333	93.714
17:20:00	63.70226667	40.20143333	58.91573333	85.4974	86.7972
17:25:00	53.4008	61.95946667	49.65703333	82.8134	90.11516667
17:30:00	60.44896667	41.79193333	67.9454	95.82616667	96.41983333
17:35:00	47.41176667	44.69396667	72.78683333	95.4367	90.9145
17:40:00	72.03466667	78.92796667	79.51223333	91.37783333	92.78926667
17:45:00	52.6894	75.06373333	70.64776667	100.5563667	91.03023333
17:50:00	71.66743333	52.46736667	72.19663333	93.85733333	93.68986667
17:55:00	50.53183333	52.0335	75.3725	92.46773333	78.54956667
18:00:00	63.13446667	55.67423333	71.8426	90.55036667	103.2286667
18:05:00	42.08073333	65.85486667	63.30933333	73.12003333	83.67413333
18:10:00	54.5376	74.30066667	118.5931333	87.62386667	87.96166667
18:15:00	48.30293333	56.09843333	81.9467	99.0767	67.36416667
18:20:00	68.2564	80.69836667	66.9783	74.0923	82.85963333
18:25:00	53.18783333	70.69983333	77.22283333	81.82796667	64.30506667
18:30:00	44.9513	75.60353333	96.42153333	82.804	78.49696667
18:35:00	57.16133333	56.63206667	46.69555	67.9588	55.43886667
18:40:00	49.44733333	40.9831	45.86406667	58.17823333	61.98683333
18:45:00	39.3552	53.8607	38.0478	61.6884	51.60883333
18:50:00	28.8697	41.9755	31.30173333	53.41066667	55.64706667
18:55:00	34.59465	30.9391	36.2889	68.50723333	54.61516667



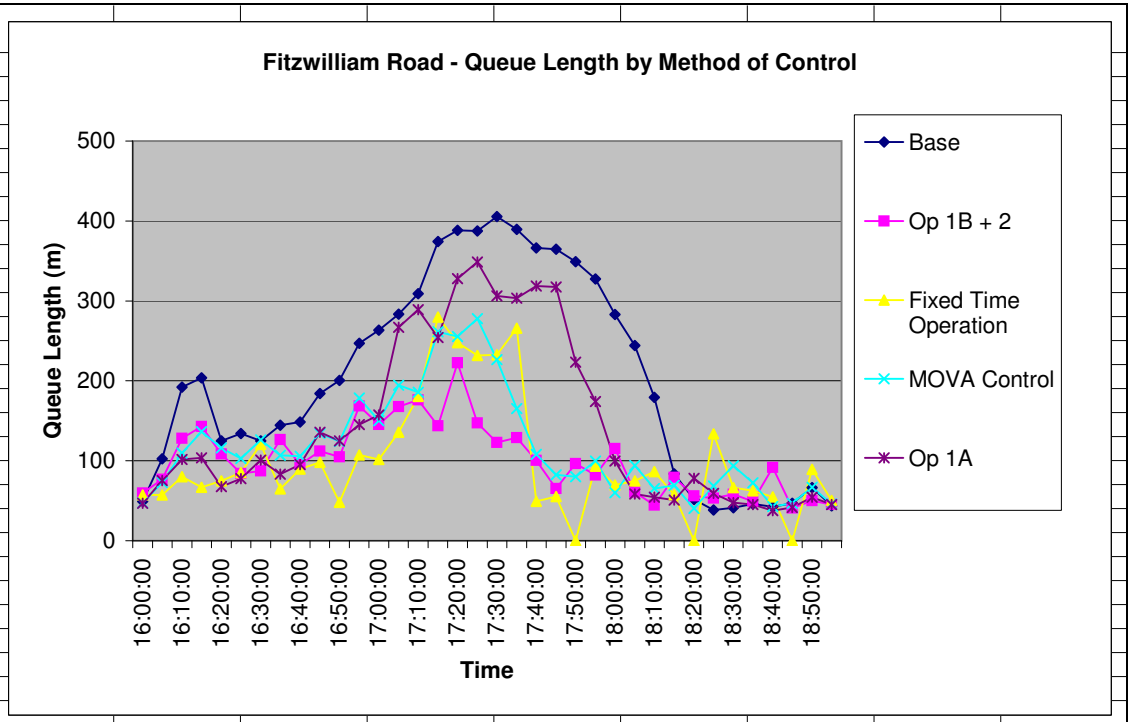
Queue Length Comparison by Approach - Morning Peak

	Base	Op 1A	Op 1B + 2	Fixed Time Operation	MOVA Control
07:00:00	29.9631	0	27.2137	0	34.9497
07:05:00	43.961	44.6204	35.6208	0	46.201
07:10:00	29.06885	35.54075	43.4153	0	47.5649
07:15:00	43.86755	29.5271	40.88565	0	38.15035
07:20:00	44.0872	39.07105	41.2777	0	60.81835
07:25:00	42.9694	32.869	54.8092	0	34.92775
07:30:00	42.83435	38.16175	41.736	52.2821	44.7401
07:35:00	45.6768	43.2839	36.9896	0	42.60605
07:40:00	34.68815	43.75525	38.6381	0	44.05433333
07:45:00	41.64135	40.38005	36.8282	0	42.5331
07:50:00	44.2177	38.54985	40.28173333	53.3434	57.2179
07:55:00	44.61605	39.63445	43.8939	47.0689	46.5528
08:00:00	45.50495	36.4046	41.58425	34.03103333	53.7653
08:05:00	63.75725	59.03765	79.0522	72.08925	60.09956667
08:10:00	66.4073	45.1997	39.4821	69.8218	47.323
08:15:00	53.7297	64.78025	64.5827	78.44	54.6028
08:20:00	41.32965	47.51565	52.4984	0	56.34845
08:25:00	53.0585	68.1629	53.05713333	53.84595	64.50166667
08:30:00	44.79725	42.6177	64.6888	0	44.69005
08:35:00	65.82775	54.0834	57.83003333	0	68.7479
08:40:00	67.3945	45.2268	57.7516	95.03385	53.50255
08:45:00	64.18405	63.24375	68.0774	89.006	98.61965
08:50:00	46.66095	47.17146667	61.05475	0	39.8013
08:55:00	60.2466	53.9215	59.09033333	73.2642	51.86503333
09:00:00	50.1	44.32195	48.4408	0	51.87485
09:05:00	57.1414	47.75555	49.29563333	0	54.50936667
09:10:00	45.45876667	43.95255	45.5233	88.6108	59.7362
09:15:00	60.39675	45.0586	41.7755	59.291	58.32296667
09:20:00	39.6881	58.7929	72.303	67.4447	54.30976667
09:25:00	52.8518	43.88585	69.9643	0	43.12466667
09:30:00	44.9688	43.4164	50.42265	0	39.74415
09:35:00	38.34583333	44.16645	40.9443	0	57.31025
09:40:00	53.277	51.73715	46.20695	0	39.4307
09:45:00	45.34935	38.3275	48.82775	0	65.9101
09:50:00	40.06485	46.9216	41.3077	0	45.8006
09:55:00	55.27955	45.5491	40.84545	0	41.1313



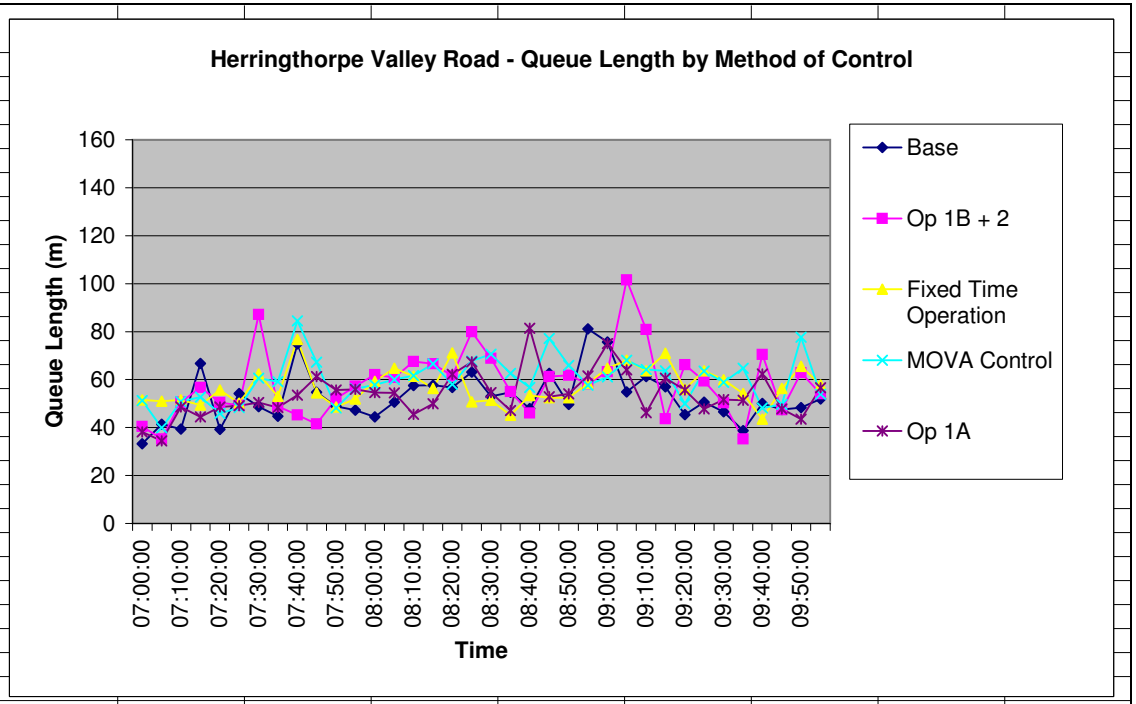
Queue Length Comparison by Approach - Evening Peak

	Base	Op 1A	Op 1B + 2	Fixed Time Operation	MOVA Control
16:00:00	49.24415	46.9156	59.6735	57.44085	47.1834
16:05:00	102.64865	75.33745	76.67296667	57.1924	72.70285
16:10:00	192.07455	101.78695	128.2093	80.17	109.80185
16:15:00	203.87285	103.56295	142.8854	66.6895	136.45995
16:20:00	124.71335	67.6615	108.67185	74.6975	116.109
16:25:00	134.2592	77.8337	83.90496667	85.3348	102.9208
16:30:00	124.77225	101.0254	87.39586667	120.36845	126.0386
16:35:00	144.6469	83.10866667	126.56425	64.74415	106.74685
16:40:00	148.5001	95.15245	95.1408	89.7389	105.5658
16:45:00	184.04705	135.66775	111.9257	98.0833	133.9925
16:50:00	200.5231	124.75215	104.9179	48.20885	123.9925
16:55:00	247.0266	145.25315	168.33635	107.3139	178.5018
17:00:00	263.43585	157.3423667	145.4954	101.7026	149.95715
17:05:00	283.22865	267.1478	167.8905	135.67945	194.52395
17:10:00	309.0610667	288.982	176.1793	180.4385	185.7695667
17:15:00	374.4221667	254.29935	143.79855	279.8945	261.30555
17:20:00	388.2566	327.9939	222.57175	247.94035	255.49375
17:25:00	387.5234333	348.56265	147.2859667	231.77925	277.6533
17:30:00	405.6604	306.1109	122.9242	232.43825	226.64435
17:35:00	389.6042333	303.35775	128.84045	265.6278	165.3132
17:40:00	366.3519	318.49865	100.4751	49.2929	108.1857
17:45:00	364.7996333	317.31525	65.2245	55.40535	82.66115
17:50:00	349.1561333	223.4733667	96.2867	0	80.26175
17:55:00	327.27565	174.2275	82.2604	93.159	99.7984
18:00:00	283.13035	99.7366	115.34005	69.7408	60.0574
18:05:00	244.1124	58.47225	60.7245	74.713	94.0472
18:10:00	179.3307	54.59605	44.53165	86.5269	65.1285
18:15:00	83.635	50.7078	79.3871	57.60505	69.4483
18:20:00	51.7041	77.9525	55.8757	0	40.53106667
18:25:00	38.5181	59.35805	53.22445	133.8321	68.3204
18:30:00	41.0596	47.75565	58.2068	66.29205	93.7001
18:35:00	46.2107	45.05665	49.1265	62.5485	72.45795
18:40:00	42.4871	37.45545	91.80225	54.85555	42.83315
18:45:00	46.92595	41.6895	40.7186	0	46.69525
18:50:00	66.60785	54.4977	50.21086667	89.0953	66.7885
18:55:00	43.6839	45.23165	45.27425	50.31305	45.92505



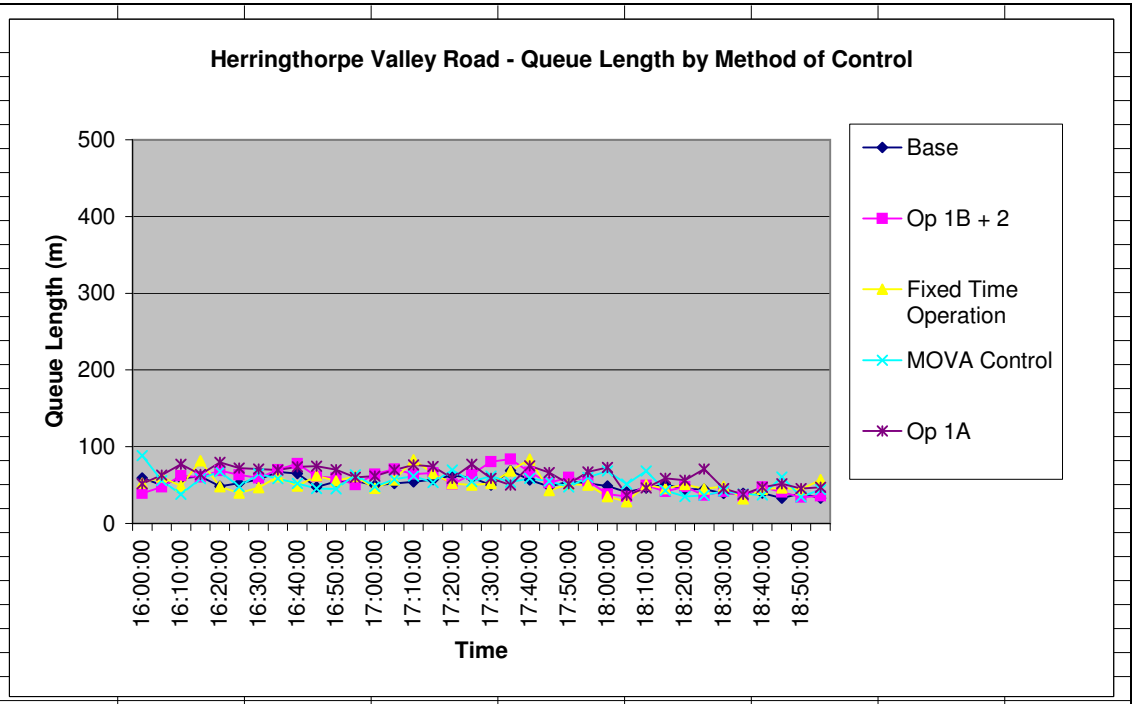
Queue Length Comparison by Approach - Morning Peak

	Base	Op 1A	Op 1B + 2	Fixed Time Operation	MOVA Control
07:00:00	33.1791	38.1883	40.4548	51.52975	51.20273333
07:05:00	41.34	34.49505	35.2187	50.96345	39.96213333
07:10:00	39.34	48.5268	50.52625	51.53075	50.84433333
07:15:00	66.7711	44.3992	56.70113333	49.38296667	52.76823333
07:20:00	39.2143	48.51315	50.3815	55.6791	45.92036667
07:25:00	54.178	49.13896667	49.2601	50.1632	48.2616
07:30:00	48.72855	50.41195	87.0844	62.3584	60.62013333
07:35:00	44.668	48.2644	48.8821	52.95343333	59.1001
07:40:00	74.88775	53.49336667	45.2963	76.67183333	84.47905
07:45:00	54.6708	61.2033	41.56045	54.4357	67.2367
07:50:00	48.84675	55.6311	52.03016667	48.59573333	48.21565
07:55:00	47.18045	55.93275	57.22355	51.96953333	56.17273333
08:00:00	44.4995	54.5236	62.04635	59.24393333	57.75616667
08:05:00	50.5706	54.47576667	60.78565	64.68216667	59.99036667
08:10:00	57.57385	45.50085	67.5033	61.33863333	61.602
08:15:00	57.6964	49.9453	66.6485	56.32366667	66.579
08:20:00	56.7032	62.1403	61.4611	71.1322	57.99496667
08:25:00	63.17005	67.3352	79.9948	50.69783333	67.8274
08:30:00	52.99285	54.62075	68.801	51.3733	70.55573333
08:35:00	54.7268	47.1105	54.94533333	45.1307	62.5677
08:40:00	47.9468	81.4124	46.05583333	53.31506667	56.75793333
08:45:00	62.5736	52.90386667	61.18456667	52.50823333	77.1617
08:50:00	49.7069	54.09903333	61.74256667	52.38426667	65.9742
08:55:00	81.07155	61.52373333	58.20333333	58.4686	57.69673333
09:00:00	75.69875	74.94973333	63.28796667	64.72073333	61.1197
09:05:00	54.7986	63.98686667	101.5831	68.0941	68.04256667
09:10:00	61.31	46.20426667	80.8307	63.71223333	64.15143333
09:15:00	56.95995	60.64183333	43.58583333	70.95476667	63.61236667
09:20:00	45.3295	55.6593	66.19753333	56.03366667	49.88723333
09:25:00	50.6344	47.70686667	59.344	63.70773333	63.5279
09:30:00	46.5264	51.7052	50.3405	59.8579	58.80956667
09:35:00	38.6554	51.3468	35.18015	54.15216667	64.70513333
09:40:00	49.98025	62.2611	70.41895	43.56525	48.21313333
09:45:00	47.5268	47.7442	47.3867	56.2912	49.65273333
09:50:00	48.33265	43.472	62.89793333	65.51036667	77.61133333
09:55:00	51.8849	56.63633333	54.0438	57.83863333	53.88356667



Queue Length Comparison by Approach - Evening Peak

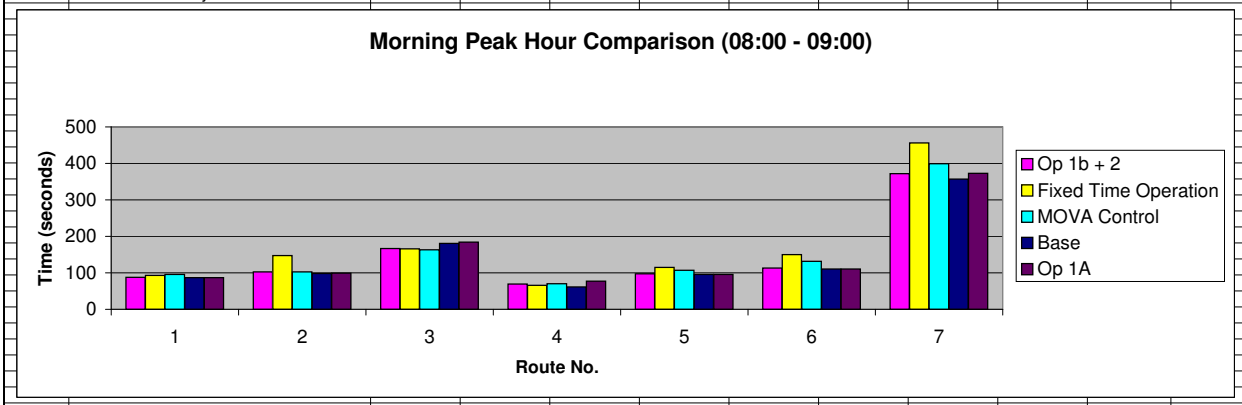
	Base	Op 1A	Op 1B + 2	Fixed Time Operation	MOVA Control
16:00:00	59.202	51.8879	39.1088	52.4123	88.5256
16:05:00	49.88633333	63.07296667	47.5227	60.37973333	55.8977
16:10:00	58.96215	77.34653333	62.1179	48.67493333	37.74943333
16:15:00	61.34515	63.84873333	60.36606667	81.6916	58.5803
16:20:00	48.5009	79.5768	68.90063333	47.7744	67.68965
16:25:00	52.3684	72.0464	63.3435	39.43246667	47.85103333
16:30:00	56.97055	70.85216667	59.342	46.7579	64.57126667
16:35:00	67.0659	69.75983333	69.93185	60.68486667	58.57226667
16:40:00	64.9903	74.00233333	78.09475	48.96206667	52.29816667
16:45:00	47.46765	74.45136667	61.34585	62.24393333	45.3691
16:50:00	54.4772	69.94346667	59.08565	55.46996667	45.17896667
16:55:00	55.30865	60.11893333	50.5097	61.4876	63.19163333
17:00:00	49.63636667	61.87023333	64.02903333	46.0407	47.92753333
17:05:00	51.93725	69.80876667	70.87476667	56.5399	57.48536667
17:10:00	54.21375	76.51703333	64.17203333	82.94233333	61.70186667
17:15:00	57.0974	74.1808	66.07556667	64.88803333	53.2624
17:20:00	62.42165	58.60393333	51.20666667	52.16825	69.5422
17:25:00	59.437	77.0488	63.7305	49.89336667	54.6001
17:30:00	50.09235	58.93786667	80.46435	52.24743333	61.72615
17:35:00	68.9817	50.08	83.70355	68.52265	53.73163333
17:40:00	56.71485	75.039	66.51585	83.73505	58.79553333
17:45:00	48.16325	66.5042	52.7789	42.90926667	55.1312
17:50:00	54.79225	51.80393333	60.2461	51.2853	47.37076667
17:55:00	52.16965	66.958	55.5308	49.9067	60.10983333
18:00:00	48.7817	73.1741	38.17106667	35.0638	68.257
18:05:00	40.69275	36.65513333	35.1716	28.19753333	51.2261
18:10:00	46.21955	46.2225	49.44905	50.4115	68.45665
18:15:00	50.9826	58.8298	41.624	45.47863333	42.79083333
18:20:00	44.8158	56.4079	47.9782	50.9396	35.1477
18:25:00	44.4605	70.8603	36.62165	45.0273	36.6872
18:30:00	39.2701	45.509	41.87693333	48.2691	42.0636
18:35:00	39.34	37.822	36.071	32.0387	38.5629
18:40:00	39.6372	47.2958	47.52555	44.6672	37.0215
18:45:00	32.949	51.5629	40.7046	46.2984	60.64215
18:50:00	39.1587	45.51666667	34.2381	44.28656667	34.48315
18:55:00	32.81495	47.1778	35.6891	57.30113333	44.05256667

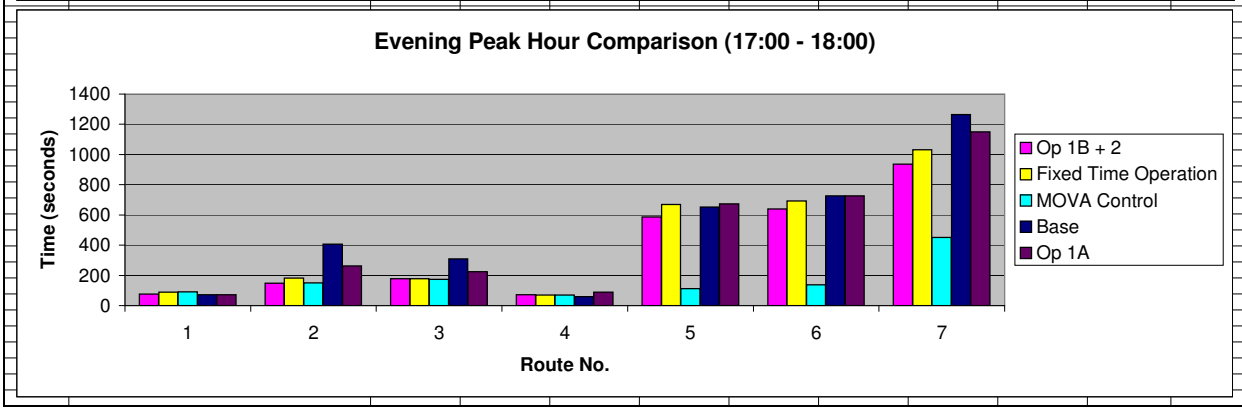


Appendix E Journey Time Graphs

Journey Time Comparison at Mushroom Roundabout

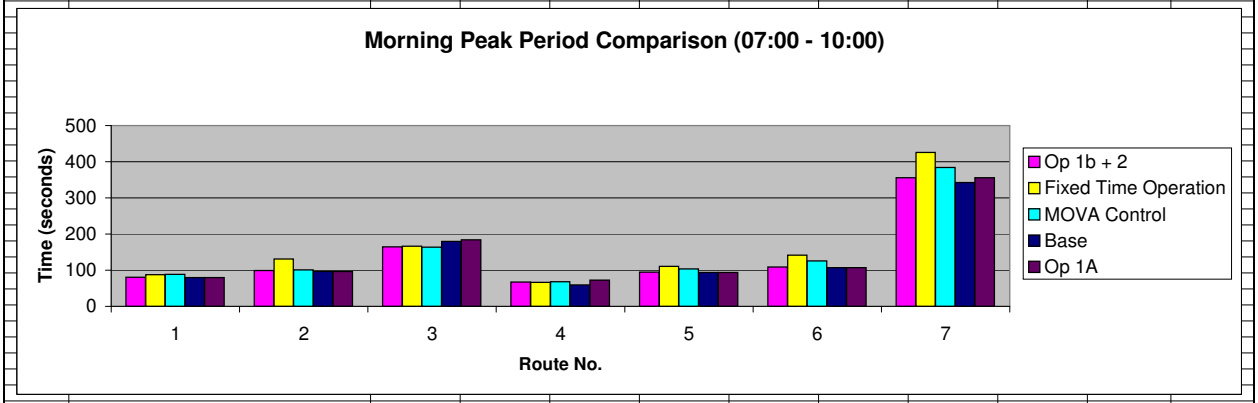
		Base		Op 1A		Op 1B + 2		Fixed Time Operation		MOVA Control	
Route	**Journey Path**	**08:00 - 09:00**	**17:00 - 18:00**	**08:00 - 09:00**	**17:00 - 18:00**	**08:00 - 09:00**	**17:00 - 18:00**	**08:00 - 09:00**	**17:00 - 18:00**	**08:00 - 09:00**	**17:00 - 18:00**
1	Magna Lane to Mushroom Rbt	86.4313	71.9021	86.9386	72.0341	87.6488	76.1532	92.9213	88.1187	95.913	91.3147
2	Cranworth Road to Mushroom Rbt Cars	97.954	405.914	99.1263	262.707	102.215	148.311	147.425	182.326	102.446	150.544
3	Cranworth Road to Mushroom Rbt Buses	181	309.267	184.4	223.578	166.725	177.156	165.575	178.756	163.3	173.533
4	Herringthorpe Valley Road to Doncaster Road EB	61.521	60.3467	76.8074	88.1076	69.1226	72.2672	65.7563	69.9171	69.9962	70.8214
5	Aldwarke Lane to Doncaster Road EB	95.7319	651.328	95.5229	674.577	97.1668	586.69	115.055	669.273	106.746	112.072
6	Aldwarke Lane to Doncaster Road WB	110.763	726.467	110.169	726.696	113.186	638.9	149.944	691.85	131.175	137.519
7	**Total Junction Journey Time**	**356.6693**	**1264.6298**	**373.0413**	**1149.5447**	**372.1724**	**935.6314**	**456.0466**	**1032.2118**	**399.5302**	**450.1991**

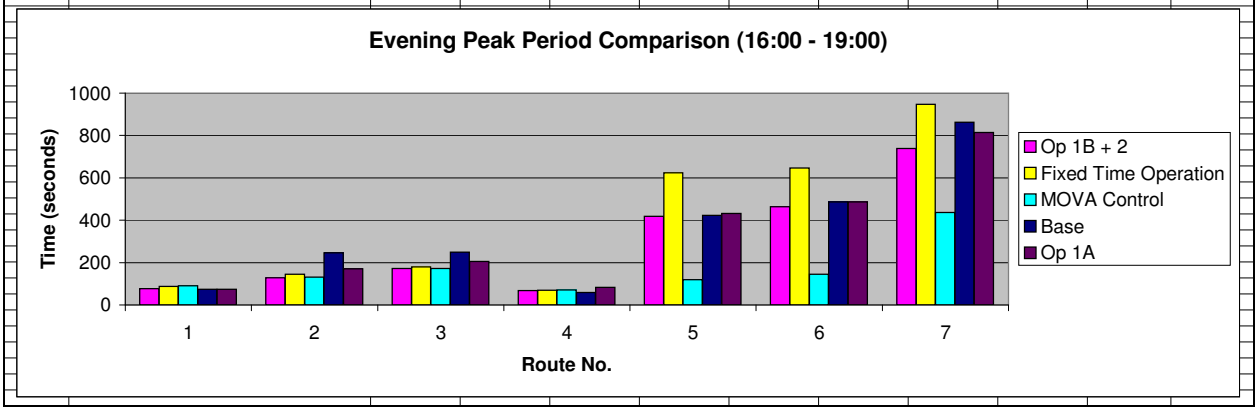




Journey Time Comparison at Mushroom Roundabout

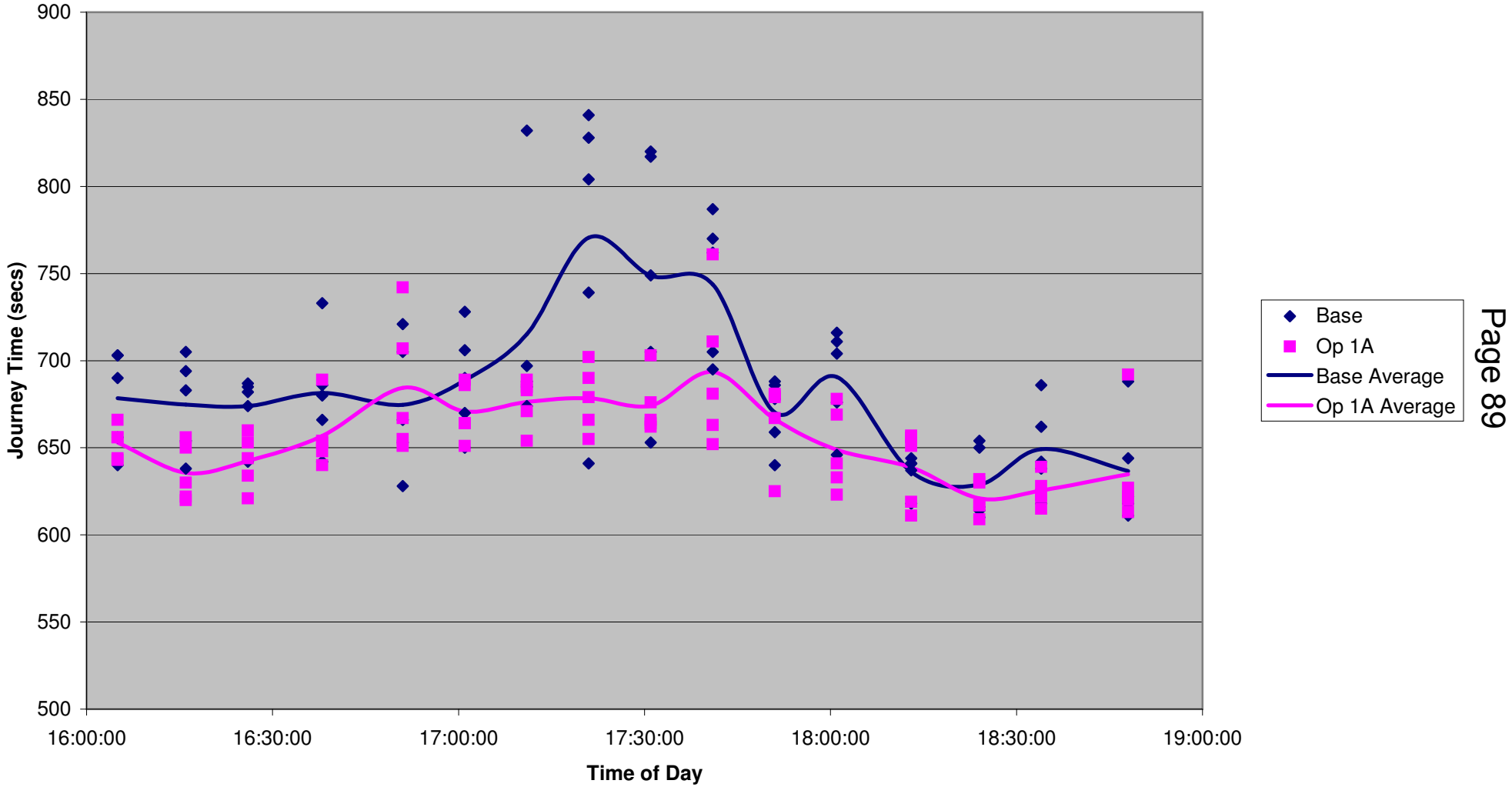
		Base		Op 1A		Op 1B + 2		Fixed Time Operation		MOVA Control	
Route	**Journey Path**	**07:00 - 10:00**	**16:00 - 19:00**	**07:00 - 10:00**	**16:00 - 19:00**	**07:00 - 10:00**	**16:00 - 19:00**	**07:00 - 10:00**	**16:00 - 19:00**	**07:00 - 10:00**	**16:00 - 19:00**
1	Magna Lane to Mushroom Rbt	79.5754	73.3327	79.8288	73.9191	80.5201	77.5809	87.3152	87.0596	88.8651	90.1495
2	Cranworth Road to Mushroom Rbt Cars	96.2376	245.527	96.4415	171.367	98.9954	128.281	131.029	144.864	101.089	131.553
3	Cranworth Road to Mushroom Rbt Buses	179.844	249.652	184.144	205.835	164.589	171.896	166.789	179.861	163.844	171.835
4	Herringthorpe Valley Road to Doncaster Road EB	59.2932	58.6717	72.2836	83.0659	67.2882	68.5911	66.0353	69.2512	68.4107	70.2874
5	Aldwarke Lane to Doncaster Road EB	93.6547	422.524	93.3821	431.687	94.6632	418.37	110.493	623.956	103.833	120.028
6	Aldwarke Lane to Doncaster Road WB	107.463	485.75	106.838	486.408	109.133	463.782	141.723	645.939	126.023	144.783
7	**Total Junction Journey Time**	**342.5692**	**863.2814**	**355.3919**	**814.76**	**355.9367**	**738.235**	**426.1025**	**947.1138**	**384.3878**	**436.7729**



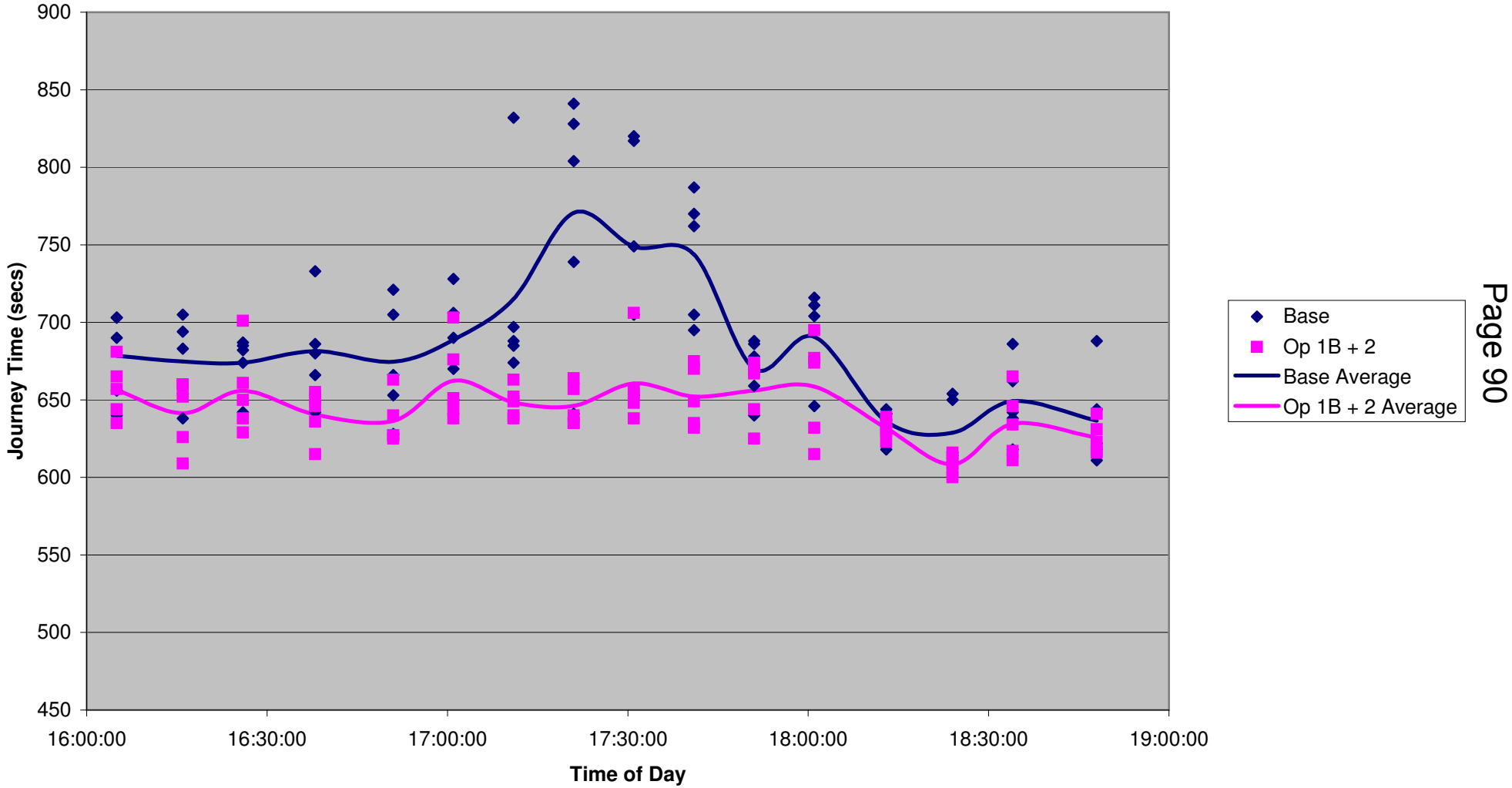


Appendix F Journey Time Reliability Graphs

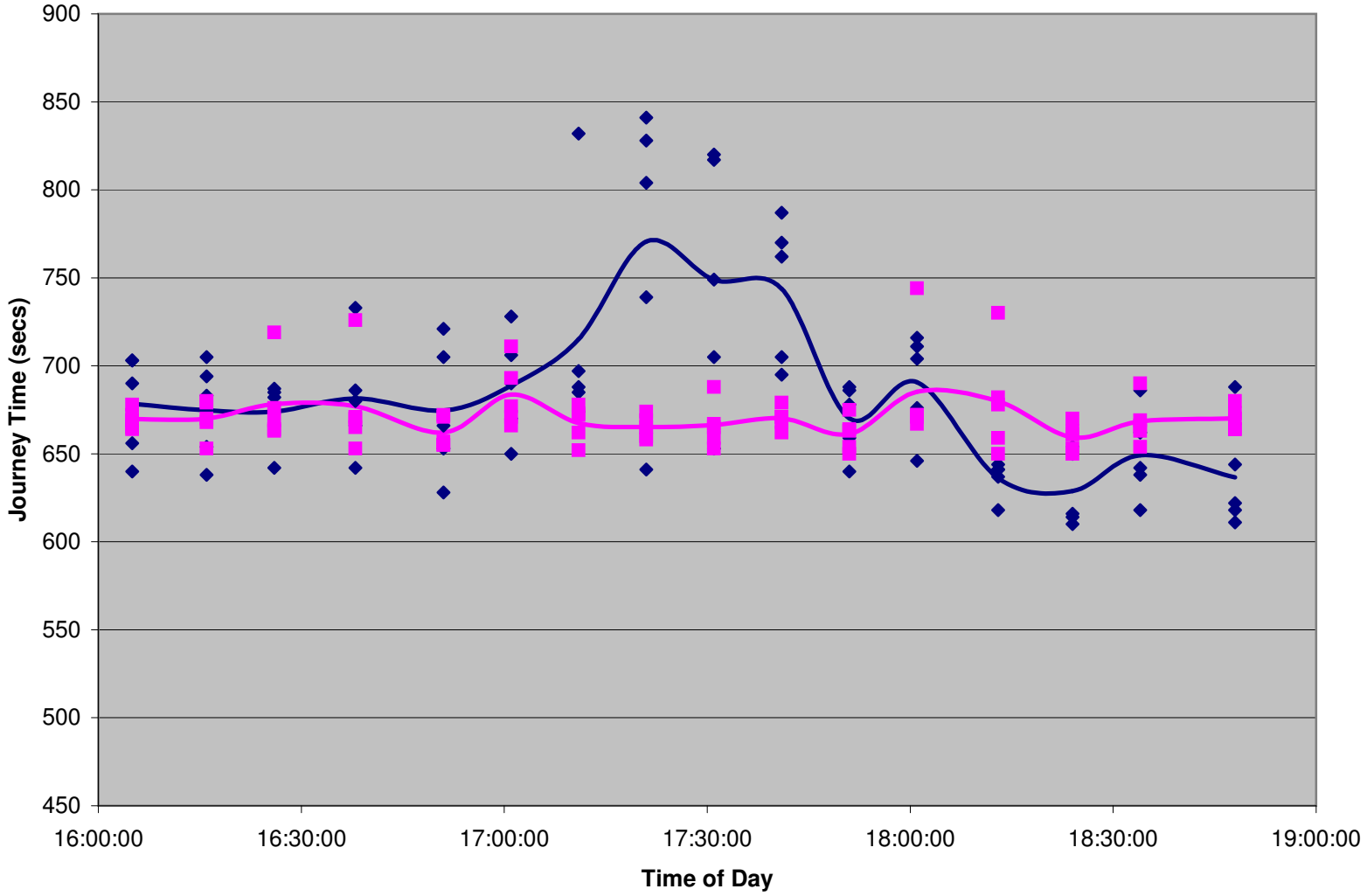
X 78 nb Evening Journey Time Variability - Base compared to Op 1A



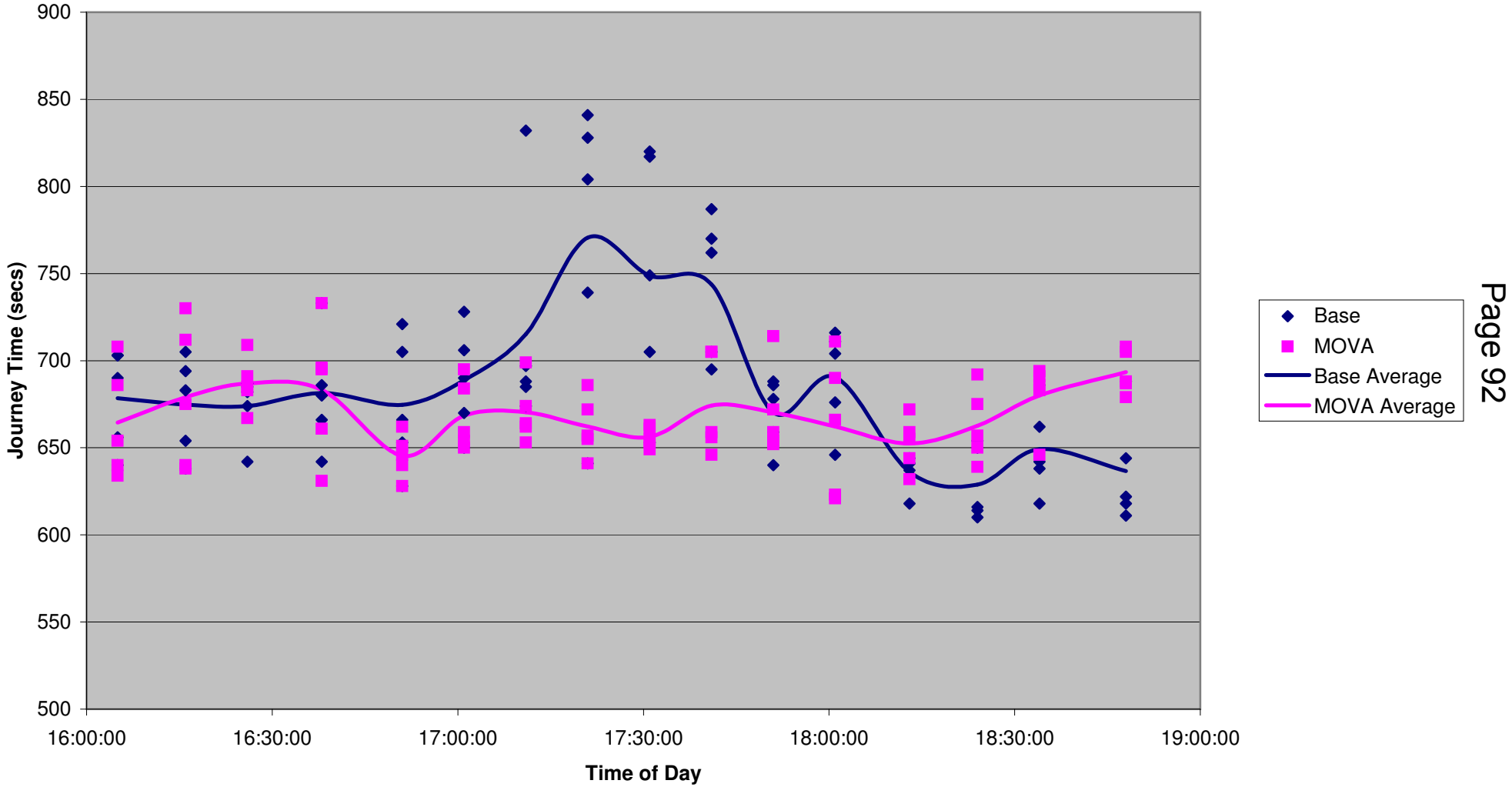
X 78 nb Evening Journey Time Variability - Base compared to Op 1B + 2



X 78 nb Evening Journey Time Variability - Base compared to Fixed Time



X 78 nb Evening Journey Time Variability - Base compared to MOVA control



UNITED BY OUR DIFFERENCE

WSP

A630 Thrybergh Key Route – Mushroom Roundabout Improvement Option Analysis Addendum 1: Additional Option Testing

South Yorkshire Passenger Transport Executive

June 2010

SOUTH YORKSHIRE PASSENGER TRANSPORT EXECUTIVE

Rotherham Metropolitan Borough Council

WSP

QM

Issue/revision	Issue 1	Revision 1	Revision 2	Revision 3
Remarks	Draft Issue	.		
Date	June 2010			
Prepared by	Ashley Russell			
Signature	Ashley Russell			
Checked by	Andy Poole			
Signature	Andy Poole			
Authorised by	Adrian Kemp			
Signature	Adrian Kemp			
Project number	11650126 – TF1			
File reference	Mushroom Roundabout Addendum.doc			

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Contents

1 Additional Option Testing

1.1 INTRODUCTION

1.1.1 WSP UK Ltd (WSP) has been commissioned by South Yorkshire Passenger Transport Executive (SYPTE) to undertake a Study of Mushroom Roundabout on the A630 Key Route in Rotherham. The study report "A630 Thrybergh Key Route – Mushroom Roundabout Improvement Option Analysis" was issued in May 2010.

1.1.2 Following a meeting between WSP, SYPTE and RMBC on Thursday 20th May 2010, at which results of previous option testing were presented and discussed, WSP was commissioned to undertake additional option testing to evaluate the impact of removing the bus lane extension from the Option 4 with MOVA control scheme.

1.1.3 It was identified at the meeting that Option 4 with MOVA control was the preferred option. However, due to the high cost of including the bus lane extension on Fitzwilliam Road requiring the infill of the existing subway, SYPTE and RMBC wished to evaluate a scheme with reduced capital costs whilst keeping the roundabout under MOVA control.

1.1.4 This addendum provides the results of that additional option testing; full details of the overall study are included in the study report. This document details the refinements made to the existing Option 4 (with MOVA control) model along with the changes made to allow testing to be carried out on the model with the bus lane removed.

1.2 OPTION 4 – MOVA REVISED

1.2.1 Improvements to the MOVA operation were identified during the presentation of the model.

1.2.2 The following minor improvements were incorporated in the Option 4 – MOVA revised model:

- Improved coordination between the bus priority on Fitzwilliam Road and the roundabout;
- Improved coordination between the roundabout and the pedestrian crossings on the roundabout exits; and
- Improved operation of Stage 4 to clear out the build up of traffic on the roundabout internals.

1.2.3 Traffic held at the bus priority signals on Fitzwilliam Road was previously held at the roundabout stop line for approximately two seconds. Following the changes, vehicles now leave the bus priority signals and receive a green signal on arrival at the roundabout.

1.2.4 The linking between the pedestrian crossings on the roundabout exits and the roundabout itself was improved to ensure the exit crossings can only come in when the left turn from the previous approach is running in to them.

1.2.5 Phase delays were added to the end of Stage 4 to match those set up for Stage 2. This ensures efficient use of the "flush out / clearance" stage. The introduction of phase delays on the end of Stage 4 reduces the number of times the stage is called, therefore improving the efficiency of the junction as a whole.

1.3 OPTION 4 – MOVA CONTROL WITHOUT BUS LANE EXTENSION

1.3.1 The phase delays added to the end of Stage 4 in the Option 4 - MOVA revised model were also incorporated in to the model with the bus lane removed.

1.3.2 The extended bus lane and incorporated pedestrian crossing facility on Fitzwilliam Road was removed from the model with the bus priority signals relocated to the current on street position.

1.3.3 The existing bus priority signals are located 100 meters to the west of the signalised roundabout and are incorporated in to the MOVA control of the roundabout to ensure delay is minimised on the Fitzwilliam Road approach for all vehicles.

1.3.4 Including the bus priority signals at their existing location required the extension of phase delays to ensure that the platoons released from bus priority signals can clear through the roundabout stop line on the Fitzwilliam Road approach. This reduces the overall flexibility of MOVA operation.

1.3.5 Initial observations resulting from the above changes to the model included:

- Due to the extended effective duration of Stage 2, to allow clearance from the bus priority signals through the roundabout, traffic was held for longer periods of time on Aldwarke Lane and Herringthorpe Valley Road. This resulted in longer queues forming on these approaches.
- The extended queues on the above approaches demand a larger amount of green time to clear the queue. However, due to the small size of the roundabout the internal links could not cope with the increased queues of right turning traffic; and the queues failed to clear from the internal links at the end of each stage.

1.3.6 To ensure the roundabout internals continued to operate efficiently changes to the MOVA setup were made:

- The extension time associated with the queue loop on Doncaster Road eastbound was reduced to stop Stage 1 being held on for too long
- The TOTALG parameter controlling maximum total green time available in each cycle was reduced. This ensures that MOVA constrained stage lengths to appropriate values that minimise the formation of excess queues.

1.3.7 With these changes incorporated, it was considered that the model provided a suitable representation of the MOVA operation of the modified layout for analysis.

1.4 JOURNEY TIME ANALYSIS

1.4.1 The modelled journey times on all approaches for the additional scenario were compared with the journey times for all previously modelled options.

1.4.2 In general, the performance of the revised MOVA model showed marginal improvements compared with the previous MOVA model.

1.4.3 The performance of the MOVA control without bus lane extension can be compared against the option of MOVA control including the bus lane extension.

1.4.4 In comparing these two options, the most significant journey time changes are seen on Aldwarke Lane in the evening peak period. All other approaches see minimal changes due to the removal of the bus lane extension.

1.4.5 Graphs comparing the journey times across the peak hour and peak period can be found as Appendix A to this addendum.

1.4.6 The morning peak sees increases of approximately 30 seconds in journey time on Aldwarke Lane and Herringthorpe Valley Road.

1.4.7 Figure 7.1 below shows journey times on Aldwarke Lane in the modelled scenarios. The full MOVA scheme including the bus lane extension shows the shortest journey times. Modelled journey times on Aldwarke Lane are approximately 5 minutes longer if the bus lane extension is not included in the scheme.

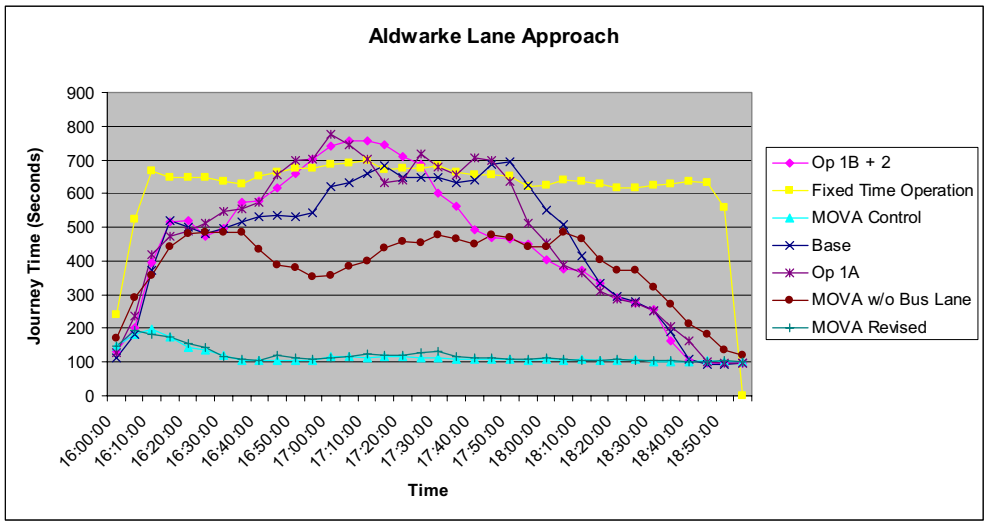


Figure 7.1 – Evening Peak Aldwarke Lane average journey time by option

1.4.8 Queue length graphs detailed by approach can be found as Appendix B to this addendum.

1.5 MONETISED BENEFITS OF SCHEMES

1.5.1 As in Section 5 of the study report, the monetised benefits presented below have been produced using Webtag Unit 3.5.6 Values of Time and Operating Costs based on the outputs produced from the Paramics modelling.

Whole Network Impact within Peak Periods

1.5.2 The figures in Table 1.1 below indicate that over the first year the revised Option 4 with MOVA control model generates the largest benefits over the existing base situation.

Table 1.1 – Whole network benefits for peak periods (annualised)

Scheme	AM	PM	Total
Option 1 (a)	£ 5,297.82	- £ 89,760.59	- £ 84,462.77
Option 2 + 1 (b)	- £ 66,938.02	£ 31,087.56	- £ 35,850.46
Option 4 – Fixed Time	- £ 131,769.74	- £ 482,110.78	- £ 613,880.53
Option 4 - MOVA	- £ 110,213.37	£ 678,521.07	£ 568,307.70
Option 4 – MOVA Revised	- £ 111,378.85	£682,194.40	£ 570,815.56
Option 4 – MOVA w/o Bus Lane	- £ 78,518.06	£355,858.63	£ 277,340.58

1.5.3 Removing the bus lane extension from the model leads to an overall reduction in the benefits that can be derived from the scheme. Although there is a reduction in dis-benefit in the morning peak period there is a significant reduction, almost halving, of benefits in the evening peak period. This can mostly be attributed to the increase in journey time and queuing seen on Aldwarke Lane compared with the MOVA option.

Whole Network Impact within Peak Hours

1.5.4 Table 1.2 below indicates that removing the bus lane increases the dis-benefit for buses in the morning peak hour and creates a dis-benefit for buses in the evening peak hour. It also sees a reduction in benefits for Non-PT vehicles in the evening peak hour.

Table 1.2 – Whole network benefits for peak hour (annualised)

Scheme	AM Peak Hour (08:00 – 09:00)		PM Peak Hour (17:00 – 18:00)		Total
	Non – PT	PT	Non – PT	PT	
Op 1 (a)	- £ 1237.49	£ 172.14	£ 2,424.06	£ 114.02	£ 2,472.73
Op 2 + 1 (b)	- £ 11,955.82	- £ 989.44	£ 4,251.80	- £ 1,154.22	- £ 9,847.68
Option 4 – Fixed Time	- £ 26,285.43	- £ 3,419.99	£ 5,643.24	- £ 390.62	- £ 24,452.81
Option 4 – MOVA	- £ 24,596.31	- £ 1,190.46	£ 240,330.78	£ 592.93	£ 214,416.93
Option 4 – MOVA Revised	- £ 26,185.11	- £ 1,012.98	£ 249,072.89	£ 637.06	£ 222,511.87
Option 4 – MOVA w/o Bus Lane	- £ 24,484.83	- £ 3,669.37	£ 140,876.71	- £ 173.61	£ 112,548.90

1.5.5 Over the first year the revised Option 4 with MOVA control model generates the largest benefits over the existing base situation.

1.6 ADDITIONAL OPTION TESTING SUMMARY

1.6.1 Based on the additional option testing undertaken the slightly revised Option 4 with MOVA control model is the preferred option. It generates further queue length reduction, journey time savings and journey time reliability over the previous Option 4 with MOVA control model and the overall benefits are much greater than any other option tested.

1.6.2 The removal of the bus lane extension almost halves the benefit to all vehicles in the evening peak and creates a dis-benefit to buses. The main increase in delay comes on Aldwarke Lane with approximately a 5 minute journey time increase. This is due to the restriction on available green time to allow coordination of the remote bus priority on Fitzwilliam Road.

2 Recommendations and Way Forward

2.1 RECOMMENDATIONS

2.1.1 Following option analysis and via consultation with SYPTE, RMBC and First Group, WSP recommend that Option 4 – Full Signalisation with MOVA control is taken forward as the preferred option for improvements at Mushroom Roundabout.

2.1.2 Although the preferred scheme requires the highest level capital investment of all the options considered, it delivers journey time improvements and reliability improvements for all vehicles, whilst also providing facilities for pedestrians and cyclists on all arms of the junction.

2.1.3 The marginal additional expenditure required to provide MOVA control over fixed time operation, for the full signalisation scheme, delivers significant benefits by providing a method of control capable of substantially reducing queuing and delay overall.

2.1.4 Options 1 (a) and 1 (b) + 2, the metering options, requiring a lower level of expenditure but show dis-benefits that are significant compared with the expected benefit. They also raise safety concerns on a number of levels, thus rendering the options unsuitable.

2.1.5 Following the additional option testing undertaken, Option 4 with MOVA control without the proposed bus lane extension is a viable alternative to the full Option 4 scheme at a lower cost but therefore delivering lower benefits. There is potential for the lower cost scheme to be upgraded to the full scheme at a later date but this would incur higher costs than if the scheme was implemented together.

2.2 WAY FORWARD

2.2.1 A prioritisation appraisal tool should be utilised to consider the findings of this Addendum and other identified corridor wide interventions. This will ensure that any investment in either a single scheme or combination of schemes is targeted at achieving maximum benefit and therefore overall value for money.

2.2.2 Should the above identify signalisation of mushroom to be the preferred scheme funding should be sought by SYPTE and RMBC to progress the scheme, taking account of cost estimates being prepared by RMBC.

2.2.3 The scheme should be progressed through detailed design, taking account of the conceptual design of both the physical and operational aspects, and the findings of the modelling carried out to date by WSP,

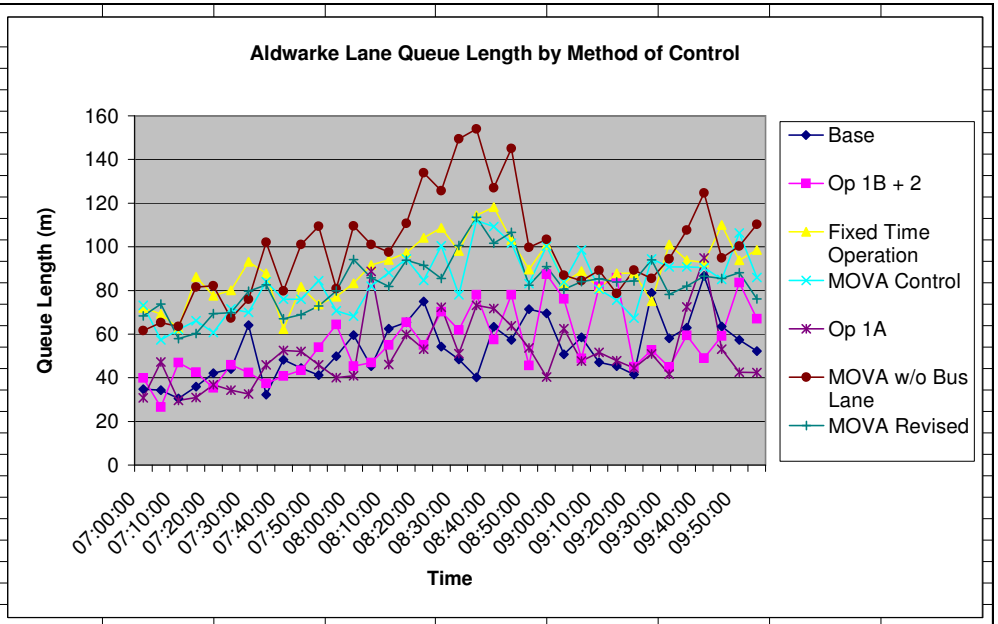
2.2.4 Consideration should be given to the wider corridor and potential interventions to further improve the situation for all vehicles and journey time reliability for buses, with particular attention paid to St Ann's Roundabout and Oldgate Lane.

Appendices, Figures & Tables

Appendix A Additional Option Testing - Queue Length Graphs

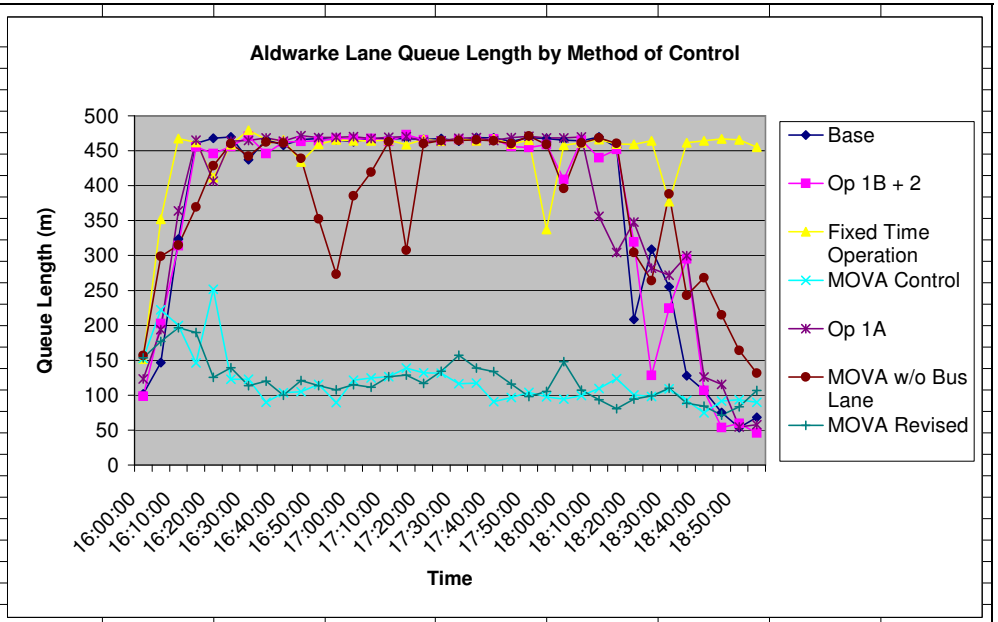
Queue Length Comparison by Approach - Morning Peak

	Base	Op 1A	Op 1B + 2	Fixed Time Operation	MOVA Control	MOVA w/o Bus Lane	MOVA Revised
07:00:00	34.7299	30.7823	39.9048	71.94775	73.2494	61.6098	68.34735
07:05:00	34.3342	47.1957	26.61285	69.1614	57.4018	65.2336	73.7517
07:10:00	30.4472	29.6154	46.8802	62.5572	61.9698	63.45935	57.9138
07:15:00	35.9044	30.9533	42.54965	86.17265	66.1034	81.57305	60.2659
07:20:00	42.1247	36.8237	35.3626	77.51625	60.73825	82.1784	69.302
07:25:00	43.9599	34.2598	45.85435	80.1122	71.51265	67.29735	69.814
07:30:00	64.124	32.5246	42.4025	93.099	69.92725	75.98685	79.5827
07:35:00	32.2591	45.8871	37.3826	87.80365	84.0608	102.08455	82.51425
07:40:00	48.2011	52.551	40.7242	62.34805	75.98925	79.77725	67.0684
07:45:00	44.3923	52.0503	43.4381	81.67275	75.93285	101.0249	68.8963
07:50:00	41.1396	45.9647	54.042	73.59335	84.46015	109.3725	72.8575
07:55:00	49.8972	39.9961	64.3605	77.16525	70.68655	80.8723	79.74485
08:00:00	59.5791	40.9117	45.3756	83.32755	68.26025	109.48225	94.20775
08:05:00	45.34335	88.6673	46.9291	91.72995	81.9325	101.01635	85.8325
08:10:00	62.4404	46.02495	54.9382	94.04535	88.17215	97.50285	81.79815
08:15:00	65.3365	59.8886	65.4074	97.2546	94.50125	110.7575	93.9019
08:20:00	74.9604	53.078	55.0578	104.1744	84.58365	133.8479	91.5494
08:25:00	54.23595	72.3385	70.188	108.674	100.40765	125.66975	85.4981
08:30:00	48.4643	51.0952	61.92965	98.18246667	77.974	149.471	100.614
08:35:00	40.113	73.16455	77.95875	114.3858	112.0588	154.05075	113.48605
08:40:00	63.32925	71.6549	57.5226	118.20205	109.3019	127.0025	101.61055
08:45:00	57.4097	63.801	78.0063	103.0717	101.59355	145.0556	106.56375
08:50:00	71.4424	53.6116	45.5876	89.60695	83.17255	99.6769	82.43155
08:55:00	69.5265	40.3473	87.4776	101.1072	100.3693	103.42785	90.87965
09:00:00	50.753	62.4674	76.0507	83.51095	83.81705	86.92565	80.56755
09:05:00	58.56135	47.73455	48.76875	88.89015	98.4983	84.4486	83.97775
09:10:00	47.0557	51.68925	81.864	81.1227	80.4983	89.17715	85.41065
09:15:00	45.3198	47.74585	85.72055	87.88585	75.5841	78.604	83.913
09:20:00	41.52965	44.49795	45.00985	87.9222	67.2719	89.3237	84.386
09:25:00	78.89975	50.9368	52.65515	75.13965	94.38325	85.49845	94.07025
09:30:00	58.0087	41.64345	44.942	101.05855	90.7787	94.41865	78.21145
09:35:00	62.91825	72.4804	59.3399	93.8289	90.72185	107.6842	82.01625
09:40:00	86.60155	94.9286	49.0009	92.77775	90.41755	124.70945	86.52405
09:45:00	63.5384	53.1435	59.09135	109.92365	85.0752	94.88125	85.44965
09:50:00	57.3786	42.5298	83.5384	93.9309	106.2885	100.2649	88.1554
09:55:00	52.2272	42.3687	67.0756	98.618	85.9457	110.33375	76.07305



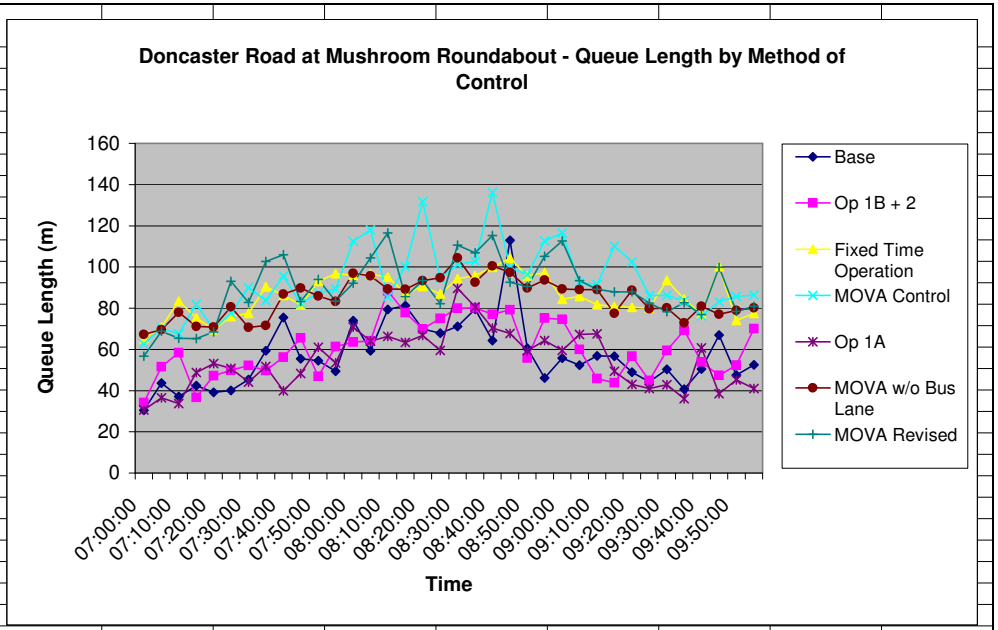
Queue Length Comparison by Approach - Evening Peak

	Base	Op 1A	Op 1B + 2	Fixed Time Operation	MOVA Control	MOVA w/o Bus Lane	MOVA Revised
16:00:00	101.739	123.11945	98.3147	151.8079333	152.3968	156.8511	153.49945
16:05:00	146.5335667	193.6319667	202.5601	351.7636	222.2802333	298.9429333	176.8481667
16:10:00	323.3829667	364.0232667	313.7320667	467.4285	199.8258333	314.7859667	196.4345333
16:15:00	460.4699	465.2817	455.3403333	461.7334667	146.0526667	369.5616333	189.9404
16:20:00	468.1172333	406.6782667	445.7076667	411.5813	251.5000333	428.5043667	125.6657
16:25:00	469.8127667	464.0217667	455.9020667	458.9305667	122.9132	460.1688333	139.096
16:30:00	437.428	464.7268333	470.5780333	479.1964667	122.6104	442.1137667	113.538
16:35:00	465.8855667	468.3654333	446.0010667	466.1692	89.76765	462.4784667	120.0556
16:40:00	457.8741667	463.8009667	462.5995	465.5228	103.37455	460.8603	99.68
16:45:00	466.1792667	471.7270667	463.1845333	433.7792667	104.9433	438.8862667	120.8486333
16:50:00	467.5752333	469.0537333	464.1692	459.0717	115.26845	352.6276	113.5246
16:55:00	465.5068667	469.071	467.2739667	465.6633667	89.25226667	273.0863667	107.6219
17:00:00	462.8219667	469.9924667	467.0563667	464.1564667	121.628	385.5294667	115.23525
17:05:00	467.3135	467.4335333	467.4289	464.1911667	124.644	419.3390667	111.2198
17:10:00	467.1530667	469.0730667	463.4598333	465.2930333	126.5001	462.9625667	126.65425
17:15:00	467.419	470.1584667	472.9700333	458.7312667	138.6847	307.473	128.8375
17:20:00	466.3083667	463.2213333	465.5020333	466.0788	132.0594	459.9635333	116.9790667
17:25:00	467.4443667	464.1414667	463.2521	463.8629	131.423	464.7871	134.1339
17:30:00	463.5695	467.8156	466.2182333	467.4252	116.26375	464.7060333	156.97385
17:35:00	468.6209667	468.6751333	464.2708	464.2827	117.32675	465.6192667	138.66845
17:40:00	468.3476333	464.8015	466.8167667	467.2176	90.6975	464.1200667	133.9108
17:45:00	463.1810667	468.8572667	456.1864667	459.6199	96.5897	460.257	116.1207
17:50:00	468.9418	470.5255	454.5863	465.0361	104.2374	471.0344667	97.9987
17:55:00	467.5226667	468.4631	458.6847	337.4709667	97.78265	458.8002333	105.5193
18:00:00	464.9518667	468.4568	408.9196	457.7193333	94.45825	395.9486333	147.8598
18:05:00	464.2452667	469.9574667	465.3828333	461.617	99.32205	461.0126333	107.2439
18:10:00	469.9174	355.9070333	439.8376667	466.0944333	109.4619	468.3401333	93.52525
18:15:00	454.7366667	304.4214	451.9576333	459.5014	123.91685	460.707	80.88865
18:20:00	208.3434667	347.8980333	319.2961	459.1033333	100.19595	304.4081333	94.31625
18:25:00	308.8084667	281.7494333	128.3156333	464.2309	97.85735	263.9784333	99.18015
18:30:00	255.3701667	271.6968	224.7181	377.1938	109.1098	388.1930667	110.1488
18:35:00	127.7461	299.8059	295.0185	461.5200667	92.41445	243.0564667	88.3738
18:40:00	106.84095	126.0749	106.94385	464.4156	74.48786667	268.1202	84.51315
18:45:00	75.35675	115.6670333	53.8175	466.8179667	91.5666	214.9045	71.33705
18:50:00	53.79775	54.348	59.7709	465.6472	93.5184	163.9005667	83.29315
18:55:00	68.0675	57.91855	45.6507	455.2918667	89.9285	131.5860667	106.73355



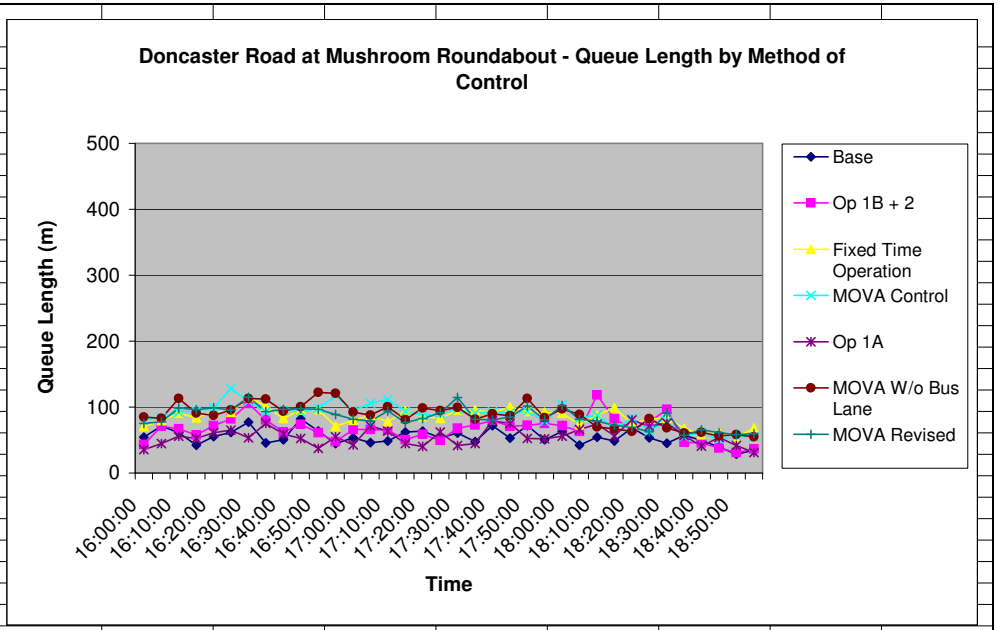
Queue Length Comparison by Approach - Morning Peak

	Base	Op 1A	Op 1B + 2	Fixed Time Operation	MOVA Control	MOVA w/o Bus Lane	MOVA Revised
07:00:00	30.4837	30.5278	34.1811	65.28533333	62.54653333	67.3019	56.73796667
07:05:00	43.64676667	36.53015	51.6321	70.86636667	70.23343333	69.56356667	68.7468
07:10:00	37.0722	33.7131	58.4041	83.41393333	67.5219	77.9093	65.4212
07:15:00	42.3552	48.75136667	36.63356667	75.3174	81.78976667	71.17686667	65.25323333
07:20:00	39.1504	53.1115	47.1693	69.52423333	69.74286667	70.77473333	68.49363333
07:25:00	40.0503	50.80046667	49.8898	75.9206	77.4928	80.54546667	93.00853333
07:30:00	45.331	44.0627	52.22045	77.44	89.90076667	70.6698	82.78276667
07:35:00	59.32803333	51.72706667	49.7417	90.438	83.7755	71.60303333	102.7490333
07:40:00	75.5175	39.98995	56.1762	86.20733333	95.5123	86.85253333	105.9892333
07:45:00	55.50243333	48.2379	65.5328	81.68266667	82.39213333	89.8126	83.338
07:50:00	54.56913333	61.02086667	46.91555	93.00343333	87.3555	85.89486667	94.0465
07:55:00	49.35576667	53.38123333	61.3764	96.79286667	89.2429	83.19493333	83.42813333
08:00:00	73.94923333	70.7762	63.47176667	95.98183333	112.5435333	96.86863333	92.17373333
08:05:00	59.4171	64.0093	64.1155	96.68216667	117.9849667	95.74296667	104.3435
08:10:00	79.3057	66.3552	88.42626667	95.01656667	85.6405	89.30433333	116.5711333
08:15:00	81.1848	63.3327	77.80263333	87.18316667	100.1325667	89.24226667	85.5758
08:20:00	69.94315	66.8697	69.861	90.5001	131.7045333	93.3889	93.32503333
08:25:00	67.85903333	59.4712	75.00726667	86.9636	94.53376667	94.78046667	82.10566667
08:30:00	71.09596667	89.60226667	80.05813333	94.2693	101.3245333	104.3123	110.6528
08:35:00	79.5596	80.61026667	80.19586667	95.87673333	102.6689	92.59913333	106.8345333
08:40:00	64.25783333	70.4414	77.07446667	99.85486667	136.1791	100.5606	115.2498333
08:45:00	112.9159	67.7279	79.2459	104.1947	99.6988	97.41013333	92.5482
08:50:00	60.55	59.28193333	55.76033333	95.74156667	96.34646667	89.77086667	90.55476667
08:55:00	46.19363333	64.3196	75.19656667	97.26673333	112.6697667	93.673	105.1970667
09:00:00	55.70296667	59.55666667	74.59173333	84.3816	116.5007667	89.2494	112.6582
09:05:00	52.40086667	67.21506667	60.03743333	85.76316667	92.37986667	89.00613333	93.3264
09:10:00	56.86603333	67.4982	45.814	81.7174	91.43653333	88.9403	89.11096667
09:15:00	56.74426667	49.37016667	43.84566667	80.78766667	110.1624	77.57496667	87.9888
09:20:00	48.9226	43.0431	56.75755	80.48633333	102.5652333	88.7372	87.92446667
09:25:00	44.34246667	41.07906667	44.917	79.92966667	86.1804	79.65153333	82.52283333
09:30:00	50.3269	42.92775	59.5036	93.51283333	86.17426667	80.11793333	78.30366667
09:35:00	40.75553333	35.96356667	69.34445	84.5585	83.58123333	72.9227	82.69706667
09:40:00	50.43486667	60.67116667	53.90735	77.09566667	76.32946667	80.9383	76.83256667
09:45:00	67.00446667	38.48183333	47.43125	100.2551667	83.15293333	77.03463333	99.91066667
09:50:00	47.45846667	45.27415	52.29376667	74.15903333	85.77253333	78.86686667	78.43613333
09:55:00	52.57745	40.95076667	70.08766667	77.4462	86.33106667	80.21956667	80.93053333



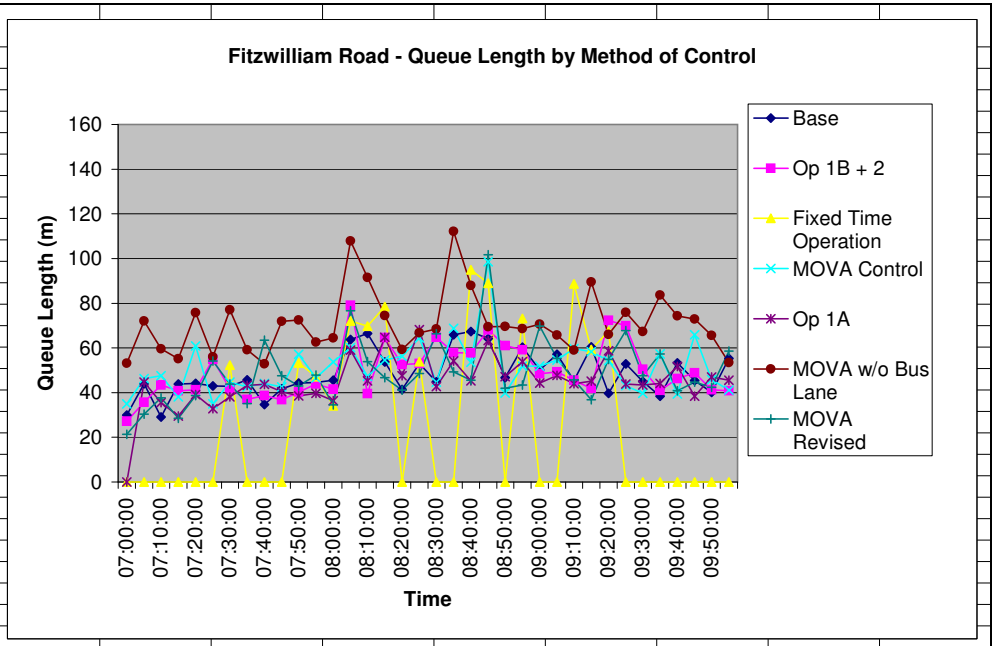
Queue Length Comparison by Approach - Evening Peak

	Base	Op 1A	Op 1B + 2	Fixed Time Operation	MOVA Control	MOVA w/o Bus Lane	MOVA Revised
16:00:00	54.14703333	35.6792	43.38845	70.1663	81.24576667	85.13553333	75.33956667
16:05:00	71.26996667	44.81013333	70.88303333	79.60046667	84.35656667	82.77686667	77.45873333
16:10:00	61.3187	55.88036667	67.1435	90.57653333	92.19503333	113.1608	98.40633333
16:15:00	42.27653333	52.28063333	57.894	84.0905	93.98383333	90.5938	96.0991
16:20:00	55.37656667	61.32103333	71.81015	92.9884	98.5502	87.17966667	99.05023333
16:25:00	61.813	64.8114	81.955	92.44723333	128.2802667	95.3986	95.44866667
16:30:00	77.31843333	53.55766667	105.2000667	115.3369333	108.5035	112.9756	114.9481
16:35:00	45.79506667	75.46126667	80.49023333	101.5629667	92.65643333	112.1029	93.4219
16:40:00	50.56783333	59.28186667	62.18533333	82.93236667	95.52196667	93.53863333	96.68433333
16:45:00	81.96223333	52.66953333	73.61826667	95.4627	92.80386667	100.5713333	97.3985
16:50:00	63.5905	37.33723333	61.10386667	96.70346667	98.13323333	122.2224333	96.70543333
16:55:00	44.4933	54.692	47.43386667	70.81686667	117.0739333	121.0246333	88.97166667
17:00:00	53.46275	42.7217	65.88926667	80.03153333	94.5798	92.23283333	81.37496667
17:05:00	46.1151	71.21486667	65.83973333	87.87453333	105.5927667	87.73193333	78.47803333
17:10:00	48.35613333	63.4458	64.93943333	77.90706667	111.8063333	100.3649667	94.3379
17:15:00	61.94026667	44.6954	50.3814	94.10833333	93.714	80.96476667	76.48996667
17:20:00	63.70226667	40.20143333	58.91573333	85.4974	86.7972	98.36456667	82.59383333
17:25:00	53.4008	61.95946667	49.65703333	82.8134	90.11516667	94.57173333	91.50036667
17:30:00	60.44896667	41.79193333	67.9454	95.82616667	96.41983333	99.36796667	114.492
17:35:00	47.41176667	44.69396667	72.78683333	95.4367	90.9145	81.74106667	81.3331
17:40:00	72.03466667	78.92796667	79.51223333	91.37783333	92.78926667	89.8839	80.7152
17:45:00	52.6894	75.06373333	70.64776667	100.5563667	91.03023333	87.02856667	84.9668
17:50:00	71.66743333	52.46736667	72.19663333	93.85733333	93.68986667	113.3349667	101.239
17:55:00	50.53183333	52.0335	75.3725	92.46773333	78.54956667	83.74013333	80.63586667
18:00:00	63.13446667	55.67423333	71.8426	90.55036667	103.2286667	96.90703333	102.5903667
18:05:00	42.08073333	65.85486667	63.30933333	73.12003333	83.67413333	88.81376667	81.68206667
18:10:00	54.5376	74.30066667	118.5931333	87.62386667	87.96166667	70.07783333	78.83473333
18:15:00	48.30293333	56.09843333	81.9467	99.0767	67.36416667	66.8858	72.56203333
18:20:00	68.2564	80.69836667	66.9783	74.0923	82.85963333	63.19346667	69.36416667
18:25:00	53.18783333	70.69983333	77.22283333	81.82796667	64.30506667	82.62896667	62.73753333
18:30:00	44.9513	75.60353333	96.42153333	82.804	78.49696667	68.68466667	90.66603333
18:35:00	57.16133333	56.63206667	46.69555	67.9588	55.43886667	60.8611	57.2332
18:40:00	49.44733333	40.9831	45.86406667	58.17823333	61.98683333	61.59243333	65.6874
18:45:00	39.3552	53.8607	38.0478	61.6884	51.60883333	56.15683333	61.10913333
18:50:00	28.8697	41.9755	31.30173333	53.41066667	55.64706667	58.3076	58.0938
18:55:00	34.59465	30.9391	36.2889	68.50723333	54.61516667	54.66526667	59.7792



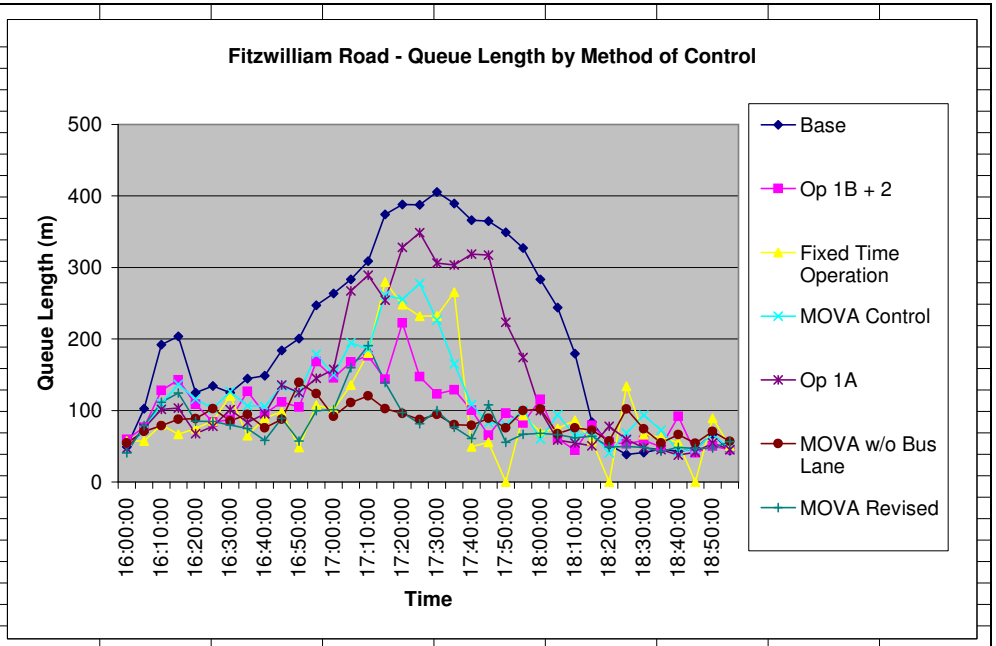
Queue Length Comparison by Approach - Morning Peak

	Base	Op 1A	Op 1B + 2	Fixed Time Operation	MOVA Control	MOVA w/o Bus Lane	MOVA Revised
07:00:00	29.9631	0	27.2137	0	34.9497	53.1709	21.3339
07:05:00	43.961	44.6204	35.6208	0	46.201	72.0342	30.3418
07:10:00	29.06885	35.54075	43.4153	0	47.5649	59.56715	37.63975
07:15:00	43.86755	29.5271	40.88565	0	38.15035	55.217	28.5019
07:20:00	44.0872	39.07105	41.2777	0	60.81835	75.7765	38.6852
07:25:00	42.9694	32.869	54.8092	0	34.92775	55.9857	54.11215
07:30:00	42.83435	38.16175	41.736	52.2821	44.7401	77.1162	43.85845
07:35:00	45.6768	43.2839	36.9896	0	42.60605	59.2166	35.0779
07:40:00	34.68815	43.75525	38.6381	0	44.05433333	52.8758	63.4355
07:45:00	41.64135	40.38005	36.8282	0	42.5331	71.8761	47.534
07:50:00	44.2177	38.54985	40.28173333	53.3434	57.2179	72.5056	42.9197
07:55:00	44.61605	39.63445	43.8939	47.0689	46.5528	62.6468	47.7964
08:00:00	45.50495	36.4046	41.58425	34.03103333	53.7653	64.4504	34.52345
08:05:00	63.75725	59.03765	79.0522	72.08925	60.09956667	107.8345	76.6226
08:10:00	66.4073	45.1997	39.4821	69.8218	47.323	91.4799	53.84435
08:15:00	53.7297	64.78025	64.5827	78.44	54.6028	74.46795	46.6257
08:20:00	41.32965	47.51565	52.4984	0	56.34845	59.2708	41.08905
08:25:00	53.0585	68.1629	53.05713333	53.84595	64.50166667	66.7061	48.49265
08:30:00	44.79725	42.6177	64.6888	0	44.69005	68.44035	66.32305
08:35:00	65.82775	54.0834	57.83003333	0	68.7479	112.16715	49.2332
08:40:00	67.3945	45.2268	57.7516	95.03385	53.50255	87.9005	45.61805
08:45:00	64.18405	63.24375	68.0774	89.006	98.61965	69.45845	101.7376
08:50:00	46.66095	47.17146667	61.05475	0	39.8013	69.6481	42.0252
08:55:00	60.2466	53.9215	59.09033333	73.2642	51.86503333	68.5733	43.36625
09:00:00	50.1	44.32195	48.4408	0	51.87485	70.65705	69.712
09:05:00	57.1414	47.75555	49.29563333	0	54.50936667	65.7144	55.25435
09:10:00	45.45876667	43.95255	45.5233	88.6108	59.7362	59.0541	45.7394
09:15:00	60.39675	45.0586	41.7755	59.291	58.32296667	89.55265	36.819
09:20:00	39.6881	58.7929	72.303	67.4447	54.30976667	66.02825	54.9266
09:25:00	52.8518	43.88585	69.9643	0	43.12466667	75.97765	67.7419
09:30:00	44.9688	43.4164	50.42265	0	39.74415	67.32435	47.51935
09:35:00	38.34583333	44.16645	40.9443	0	57.31025	83.6348	57.35345
09:40:00	53.277	51.73715	46.20695	0	39.4307	74.37945	40.8825
09:45:00	45.34935	38.3275	48.82775	0	65.9101	72.96225	44.6715
09:50:00	40.06485	46.9216	41.3077	0	45.8006	65.5965	42.36565
09:55:00	55.27955	45.5491	40.84545	0	41.1313	53.4526	58.59595



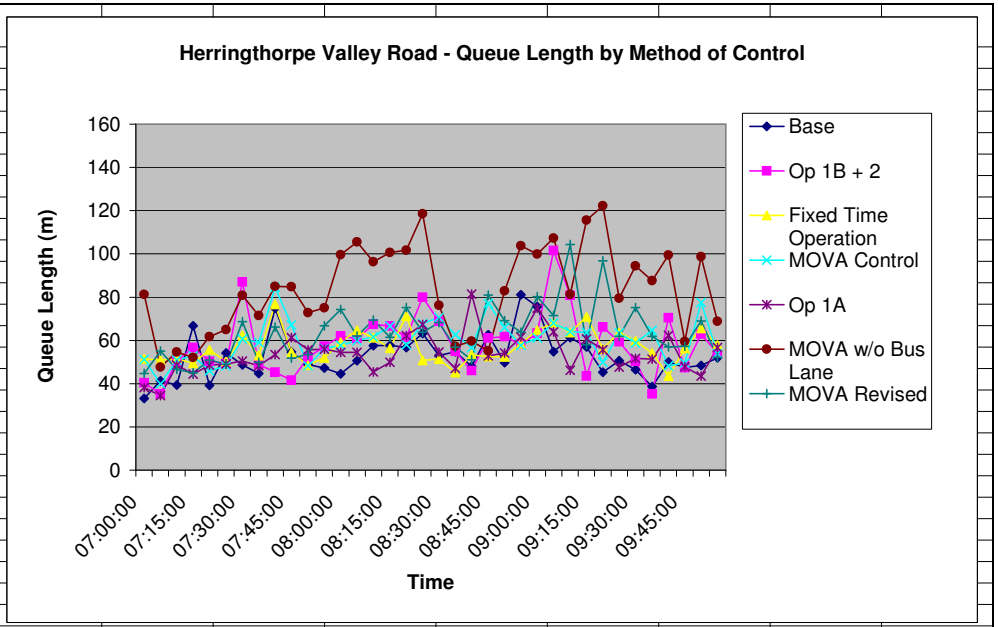
Queue Length Comparison by Approach - Evening Peak

	Base	Op 1A	Op 1B + 2	Fixed Time Operation	MOVA Control	MOVA w/o Bus Lane	MOVA Revised
16:00:00	49.24415	46.9156	59.6735	57.44085	47.1834	54.6765	40.54895
16:05:00	102.64865	75.33745	76.67296667	57.1924	72.70285	70.65495	78.6702
16:10:00	192.07455	101.78695	128.2093	80.17	109.80185	78.7787	111.3185
16:15:00	203.87285	103.56295	142.8854	66.6895	136.45995	87.55755	124.40975
16:20:00	124.71335	67.6615	108.67185	74.6975	116.109	88.64955	85.16415
16:25:00	134.2592	77.8337	83.90496667	85.3348	102.9208	102.4857	84.45885
16:30:00	124.77225	101.0254	87.39586667	120.36845	126.0386	85.7135	79.89955
16:35:00	144.6469	83.10866667	126.56425	64.74415	106.74685	94.46885	74.7255
16:40:00	148.5001	95.15245	95.1408	89.7389	105.5658	75.70045	58.18465
16:45:00	184.04705	135.66775	111.9257	98.0833	133.9925	87.74895	89.0786
16:50:00	200.5231	124.75215	104.9179	48.20885	123.9925	139.30155	57.4293
16:55:00	247.0266	145.25315	168.33635	107.3139	178.5018	123.718	99.67095
17:00:00	263.43585	157.3423667	145.4954	101.7026	149.95715	91.7204	101.2385
17:05:00	283.22865	267.1478	167.8905	135.67945	194.52395	111.03265	159.7632
17:10:00	309.0610667	288.982	176.1793	180.4385	185.7695667	120.25175	190.8651
17:15:00	374.4221667	254.29935	143.79855	279.8945	261.30555	102.60175	139.04245
17:20:00	388.2566	327.9939	222.57175	247.94035	255.49375	95.6429	96.9784
17:25:00	387.5234333	348.56265	147.2859667	231.77925	277.6533	87.30305	81.3264
17:30:00	405.6604	306.1109	122.9242	232.43825	226.64435	94.62305	99.6705
17:35:00	389.6042333	303.35775	128.84045	265.6278	165.3132	79.90755	76.62385
17:40:00	366.3519	318.49865	100.4751	49.2929	108.1857	79.3781	60.68195
17:45:00	364.7996333	317.31525	65.2245	55.40535	82.66115	89.08655	107.70925
17:50:00	349.1561333	223.4733667	96.2867	0	80.26175	75.76055	55.37215
17:55:00	327.27565	174.2275	82.2604	93.159	99.7984	99.67295	66.67065
18:00:00	283.13035	99.7366	115.34005	69.7408	60.0574	101.99675	68.01275
18:05:00	244.1124	58.47225	60.7245	74.713	94.0472	67.5267	66.1259
18:10:00	179.3307	54.59605	44.53165	86.5269	65.1285	75.589	61.7327
18:15:00	83.635	50.7078	79.3871	57.60505	69.4483	72.73935	63.93075
18:20:00	51.7041	77.9525	55.8757	0	40.53106667	57.1589	48.8918
18:25:00	38.5181	59.35805	53.22445	133.8321	68.3204	101.9553	49.65705
18:30:00	41.0596	47.75565	58.2068	66.29205	93.7001	74.485	48.20345
18:35:00	46.2107	45.05665	49.1265	62.5485	72.45795	54.71665	42.74845
18:40:00	42.4871	37.45545	91.80225	54.85555	42.83315	66.34515	48.29845
18:45:00	46.92595	41.6895	40.7186	0	46.69525	54.00775	46.781
18:50:00	66.60785	54.4977	50.21086667	89.0953	66.7885	70.52115	47.4896
18:55:00	43.6839	45.23165	45.27425	50.31305	45.92505	56.93065	56.3407



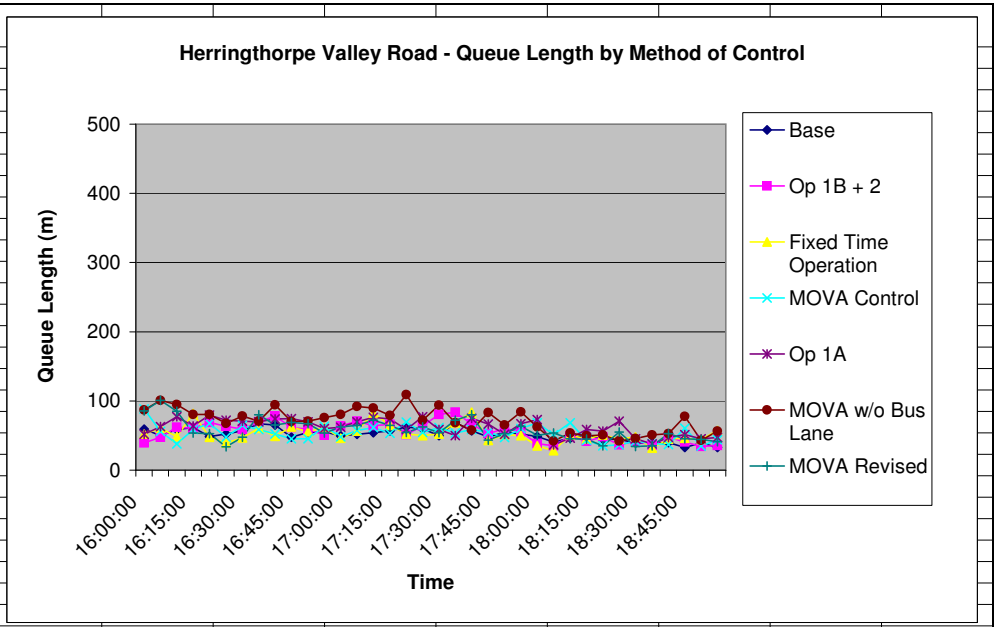
Queue Length Comparison by Approach - Morning Peak

	Base	Op 1A	Op 1B + 2	Fixed Time Operation	MOVA Control	MOVA w/o Bus Lane	MOVA Revised
07:00:00	33.1791	38.1883	40.4548	51.52975	51.20273333	81.23566667	44.753
07:05:00	41.34	34.49505	35.2187	50.96345	39.96213333	47.66656667	55.051
07:10:00	39.34	48.5268	50.52625	51.53075	50.84433333	54.5681	46.60546667
07:15:00	66.7711	44.3992	56.70113333	49.38296667	52.76823333	52.08156667	45.06846667
07:20:00	39.2143	48.51315	50.3815	55.6791	45.92036667	61.67476667	50.91606667
07:25:00	54.178	49.13896667	49.2601	50.1632	48.2616	65.01633333	49.03813333
07:30:00	48.72855	50.41195	87.0844	62.3584	60.62013333	80.74676667	68.64243333
07:35:00	44.668	48.2644	48.8821	52.95343333	59.1001	71.45223333	49.916
07:40:00	74.88775	53.49336667	45.2963	76.67183333	84.47905	84.99983333	66.22683333
07:45:00	54.6708	61.2033	41.56045	54.4357	67.2367	84.84853333	51.83966667
07:50:00	48.84675	55.6311	52.03016667	48.59573333	48.21565	72.88553333	53.38193333
07:55:00	47.18045	55.93275	57.22355	51.96953333	56.17273333	75.02296667	66.71653333
08:00:00	44.4995	54.5236	62.04635	59.24393333	57.75616667	99.58436667	74.23563333
08:05:00	50.5706	54.47576667	60.78565	64.68216667	59.99036667	105.5294333	62.0112
08:10:00	57.57385	45.50085	67.5033	61.33863333	61.602	96.36886667	69.44953333
08:15:00	57.6964	49.9453	66.6485	56.32366667	66.579	100.6355	61.40333333
08:20:00	56.7032	62.1403	61.4611	71.1322	57.99496667	101.7466667	75.24613333
08:25:00	63.17005	67.3352	79.9948	50.69783333	67.8274	118.6110333	63.8246
08:30:00	52.99285	54.62075	68.801	51.3733	70.55573333	76.17383333	68.28876667
08:35:00	54.7268	47.1105	54.94533333	45.1307	62.5677	57.323	56.77396667
08:40:00	47.9468	81.4124	46.05583333	53.31506667	56.75793333	59.64036667	51.05363333
08:45:00	62.5736	52.90386667	61.18456667	52.50823333	77.1617	55.25476667	80.98036667
08:50:00	49.7069	54.09903333	61.74256667	52.38426667	65.9742	82.8873	69.09343333
08:55:00	81.07155	61.52373333	58.20333333	58.4686	57.69673333	103.7662	63.74123333
09:00:00	75.69875	74.94973333	63.28796667	64.72073333	61.1197	99.96666667	80.23343333
09:05:00	54.7986	63.98686667	101.5831	68.0941	68.04256667	107.3368	71.46483333
09:10:00	61.31	46.20426667	80.8307	63.71223333	64.15143333	81.19383333	104.3899333
09:15:00	56.95995	60.64183333	43.58583333	70.95476667	63.61236667	115.5454	57.98746667
09:20:00	45.3295	55.6593	66.19753333	56.03366667	49.88723333	122.3278333	96.78763333
09:25:00	50.6344	47.70686667	59.344	63.70773333	63.5279	79.5034	61.8881
09:30:00	46.5264	51.7052	50.3405	59.8579	58.80956667	94.45693333	75.2521
09:35:00	38.6554	51.3468	35.18015	54.15216667	64.70513333	87.60006667	61.83066667
09:40:00	49.98025	62.2611	70.41895	43.56525	48.21313333	99.4918	56.98173333
09:45:00	47.5268	47.7442	47.3867	56.2912	49.65273333	59.4639	57.22003333
09:50:00	48.33265	43.472	62.89793333	65.51036667	77.61133333	98.71673333	68.99746667
09:55:00	51.8849	56.63633333	54.0438	57.83863333	53.88356667	68.8681	52.2577



Queue Length Comparison by Approach - Evening Peak

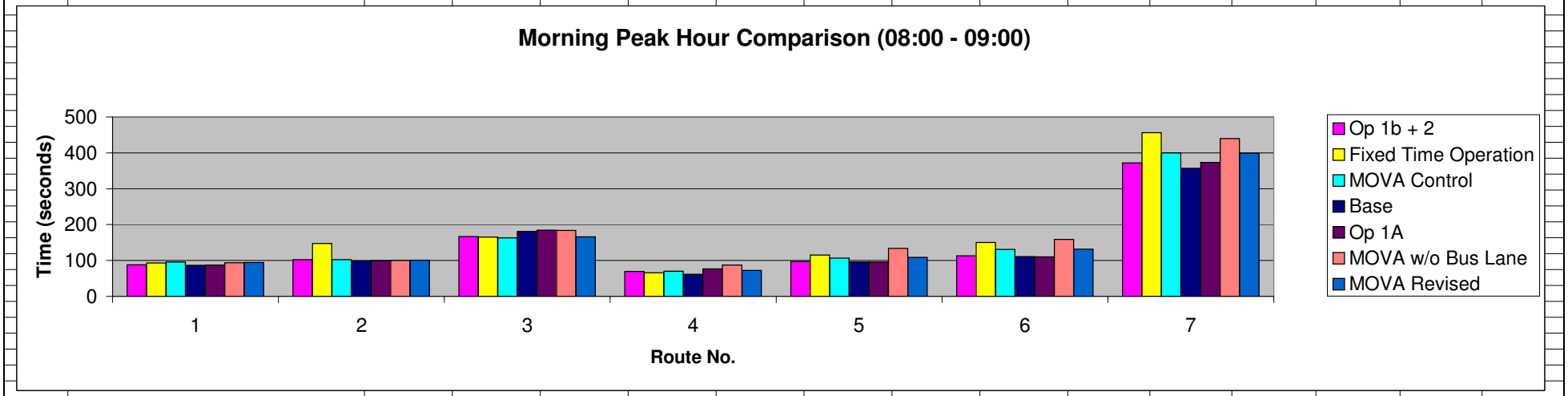
	Base	Op 1A	Op 1B + 2	Fixed Time Operation	MOVA Control	MOVA w/o Bus Lane	MOVA Revised
16:00:00	59.202	51.8879	39.1088	52.4123	88.5256	87.15086667	85.36033333
16:05:00	49.88633333	63.07296667	47.5227	60.37973333	55.8977	100.6906667	100.7645667
16:10:00	58.96215	77.34653333	62.1179	48.67493333	37.74943333	94.78206667	85.11196667
16:15:00	61.34515	63.84873333	60.36606667	81.6916	58.5803	80.34023333	53.66065
16:20:00	48.5009	79.5768	68.90063333	47.7744	67.68965	80.39036667	52.60126667
16:25:00	52.3684	72.0464	63.3435	39.43246667	47.85103333	67.55966667	33.67215
16:30:00	56.97055	70.85216667	59.342	46.7579	64.57126667	78.36663333	47.5334
16:35:00	67.0659	69.75983333	69.93185	60.68486667	58.57226667	70.71836667	79.88896667
16:40:00	64.9903	74.00233333	78.09475	48.96206667	52.29816667	94.4943	65.17116667
16:45:00	47.46765	74.45136667	61.34585	62.24393333	45.3691	70.5357	69.09003333
16:50:00	54.4772	69.94346667	59.08565	55.46996667	45.17896667	70.72606667	67.2334
16:55:00	55.30865	60.11893333	50.5097	61.4876	63.19163333	76.0372	53.51296667
17:00:00	49.63636667	61.87023333	64.02903333	46.0407	47.92753333	80.41616667	62.66133333
17:05:00	51.93725	69.80876667	70.87476667	56.5399	57.48536667	92.06656667	64.80153333
17:10:00	54.21375	76.51703333	64.17203333	82.94233333	61.70186667	89.74703333	72.29106667
17:15:00	57.0974	74.1808	66.07556667	64.88803333	53.2624	79.26353333	64.55775
17:20:00	62.42165	58.60393333	51.20666667	52.16825	69.5422	109.0739333	54.47153333
17:25:00	59.437	77.0488	63.7305	49.89336667	54.6001	72.29036667	62.2164
17:30:00	50.09235	58.93786667	80.46435	52.24743333	61.72615	93.9175	54.27596667
17:35:00	68.9817	50.08	83.70355	68.52265	53.73163333	68.46226667	72.3412
17:40:00	56.71485	75.039	66.51585	83.73505	58.79553333	57.6745	79.97946667
17:45:00	48.16325	66.5042	52.7789	42.90926667	55.1312	83.09723333	43.43323333
17:50:00	54.79225	51.80393333	60.2461	51.2853	47.37076667	65.0096	52.7249
17:55:00	52.16965	66.958	55.5308	49.9067	60.10983333	84.39983333	63.46836667
18:00:00	48.7817	73.1741	38.17106667	35.0638	68.257	62.41233333	50.24673333
18:05:00	40.69275	36.65513333	35.1716	28.19753333	51.2261	42.12283333	53.7562
18:10:00	46.21955	46.2225	49.44905	50.4115	68.45665	53.44753333	45.41825
18:15:00	50.9826	58.8298	41.624	45.47863333	42.79083333	49.2639	44.8895
18:20:00	44.8158	56.4079	47.9782	50.9396	35.1477	50.88305	35.3285
18:25:00	44.4605	70.8603	36.62165	45.0273	36.6872	42.1291	54.9479
18:30:00	39.2701	45.509	41.87693333	48.2691	42.0636	45.75566667	34.35755
18:35:00	39.34	37.822	36.071	32.0387	38.5629	50.92	35.3285
18:40:00	39.6372	47.2958	47.52555	44.6672	37.0215	52.5212	52.8017
18:45:00	32.949	51.5629	40.7046	46.2984	60.64215	77.8839	45.32993333
18:50:00	39.1587	45.51666667	34.2381	44.28656667	34.48315	43.0273	44.4395
18:55:00	32.81495	47.1778	35.6891	57.30113333	44.05256667	56.2849	41.09755

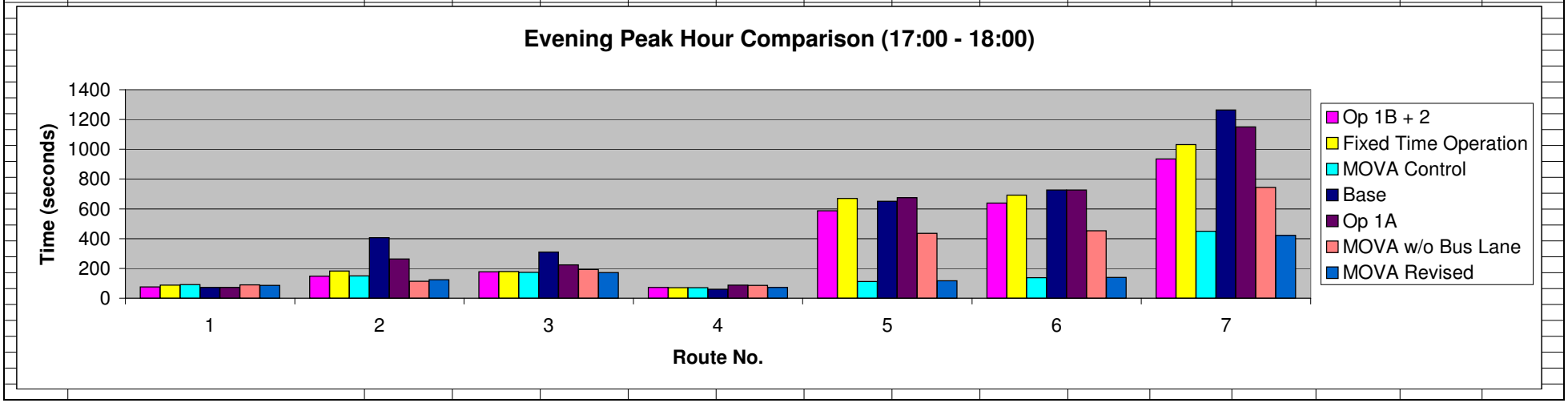


Appendix B Additional Option Testing - Journey Time Graphs

Journey Time Comparison at Mushroom Roundabout

		Base		Op 1A		Op 1B + 2		Fixed Time Operation		MOVA Control		MOVA w/o Bus Lane		MOVA Revised	
Route	**Journey Path**	**08:00 - 09:00**	**17:00 - 18:00**	**08:00 - 09:00**	**17:00 - 18:00**	**08:00 - 09:00**	**17:00 - 18:00**	**08:00 - 09:00**	**17:00 - 18:00**	**08:00 - 09:00**	**17:00 - 18:00**	**08:00 - 09:00**	**17:00 - 18:00**	**08:00 - 09:00**	**17:00 - 18:00**
1	Magna Lane to Mushroom Rbt	86.4313	71.9021	86.9386	72.0341	87.6488	76.1532	92.9213	88.1187	95.913	91.3147	93.7021	90.3716	94.6202	86.4137
2	Cranworth Road to Mushroom Rbt Cars	97.954	405.914	99.1263	262.707	102.215	148.311	147.425	182.326	102.446	150.544	100.436	114.289	101.176	123.515
3	Cranworth Road to Mushroom Rbt Buses	181	309.267	184.4	223.578	166.725	177.156	165.575	178.756	163.3	173.533	183.675	193.556	165.65	172.044
4	Herringthorpe Valley Road to Doncaster Road EB	61.521	60.3467	76.8074	88.1076	69.1226	72.2672	65.7563	69.9171	69.9962	70.8214	87.0855	86.4755	72.0182	72.1997
5	Aldwarke Lane to Doncaster Road EB	95.7319	651.328	95.5229	674.577	97.1668	586.69	115.055	669.273	106.746	112.072	133.8	436.518	108.769	117.777
6	Aldwarke Lane to Doncaster Road WB	110.763	726.467	110.169	726.696	113.186	638.9	149.944	691.85	131.175	137.519	158.953	453.133	131.677	139.335
7	**Total Junction Journey Time**	**356.6693**	**1264.6298**	**373.0413**	**1149.5447**	**372.1724**	**935.6314**	**456.0466**	**1032.2118**	**399.5302**	**450.1991**	**440.1766**	**744.2691**	**399.4914**	**421.4634**





Journey Time Comparison at Mushroom Roundabout

		Base		Op 1A		Op 1B + 2		Fixed Time Operation		MOVA Control		MOVA w/o Bus Lane		MOVA Revised	
Route	**Journey Path**	**07:00 - 10:00**	**16:00 - 19:00**	**07:00 - 10:00**	**16:00 - 19:00**	**07:00 - 10:00**	**16:00 - 19:00**	**07:00 - 10:00**	**16:00 - 19:00**	**07:00 - 10:00**	**16:00 - 19:00**	**07:00 - 10:00**	**16:00 - 19:00**	**07:00 - 10:00**	**16:00 - 19:00**
1	Magna Lane to Mushroom Rbt	79.5754	73.3327	79.8288	73.9191	80.5201	77.5809	87.3152	87.0596	88.8651	90.1495	87.1863	89.2649	87.1547	85.6139
2	Cranworth Road to Mushroom Rbt Cars	96.2376	245.527	96.4415	171.367	98.9954	128.281	131.029	144.864	101.089	131.553	97.9847	110.029	100.131	116.385
3	Cranworth Road to Mushroom Rbt Buses	179.844	249.652	184.144	205.835	164.589	171.896	166.789	179.861	163.844	171.835	185.978	195.417	165.322	170.339
4	Herringthorpe Valley Road to Doncaster Road EB	59.2932	58.6717	72.2836	83.0659	67.2882	68.5911	66.0353	69.2512	68.4107	70.2874	83.5335	82.4192	70.5438	73.2128
5	Aldwarke Lane to Doncaster Road EB	93.6547	422.524	93.3821	431.687	94.6632	418.37	110.493	623.956	103.833	120.028	118.551	387.395	104.854	123.096
6	Aldwarke Lane to Doncaster Road WB	107.463	485.75	106.838	486.408	109.133	463.782	141.723	645.939	126.023	144.783	140.696	404.279	125.469	143.655
7	**Total Junction Journey Time**	**342.5692**	**863.2814**	**355.3919**	**814.76**	**355.9367**	**738.235**	**426.1025**	**947.1138**	**384.3878**	**436.7729**	**409.4005**	**685.9921**	**383.2985**	**418.8667**