A4123 Birchley Island / M5 Junction 2 Improvement: Options Report

1. Introduction

Birchley island is located in Oldbury within the borough of Sandwell. It is situated at the intersection of the M5, A4123 and A4034 approximately 1km south of Oldbury town centre, 3km from Blackheath High Street and 3.5km from Burnt Tree island. It consists of two signal-controlled roundabouts connected by a dual-carriageway link road. In its current form Birchley island is a six arm roundabout of which three are signal-controlled. As five of the six arms carry large volumes of traffic, especially during peak periods, this partially signalled roundabout is crucial to the highway network. The A4123 links Wolverhampton, Dudley and Birmingham to the M5 Motorway whilst the A4034 runs north-south connecting Walsall, West Bromwich, Oldbury and Blackheath.

The junction therefore provides a link from a number of locations to the national motorway network, making it a vital asset for many local and national businesses in the surrounding area. It is also part of two major arterial commuter routes passing through the Black Country and Birmingham.

The area around the junction is a mix of commercial and retail uses with major office units fronting the A4123 on the north-west side of the junction, a retail park to the south-west and a large toy store and fast food restaurant to the south-east. Much of the central island is occupied by an electricity sub-station.

The junction suffers from considerable congestion, particularly during peak periods and offers limited or no provision for pedestrian and cyclists. This lack of provision also results in severance and a low level of service for bus users interchanging between services.

The preferred scheme option (chosen from four options) would include a major capacity improvement to the combined Birchley island and M5 Junction 2, complementing the Pinch Point Programme undertaken by the Highways Agency (HA) to widen the motorway off-slips in order to increase capacity. Signal control would be introduced on all entries to and exits from Birchley island in order to aid pedestrian and cycle movements through the area, which would also be assisted by wider footways and cycle routes around the island. Provision of road space through the centre of the island has also been considered.

2. Problem Identification

2.1 Introduction

The junction suffers from significant levels of congestion, not only during peak periods but throughout the day. This impacts upon the competitiveness of local businesses, and the reliability of bus services which use both the A4034 and A4123. The study carried out in August 2010 on behalf of the Highways Agency, as part of the Black Country Core Strategy evidence base, clearly demonstrated a need for capacity improvements at this location because it concluded that the junction would reach operational capacity in 2013. Congestion already creates queuing on to the M5 during peak periods and this is likely to increase in time. Improvements are therefore needed to both address existing congestion and to accommodate traffic generated as a result of growth in the Black Country Core Strategy regeneration corridors RC12 and 13.
2.2 Queues and Delays

The existing traffic situation on Birchley island, is characterised by constant queuing, delays and congestion on the roundabout and its approaches, with the average queue ranging between 10 and 61 vehicles per lane. The worst affected arm is Wolverhampton Road North, as traffic flows are very heavy during peak periods, creating extremely long queues. Queues are a regular occurrence across all entry arms but some arms experience less queuing during different time periods, although average queues exceed 12 vehicles at peak periods on all arms. Delays on the M5 junction 2 link into Birchley island have worsened due to the widened M5 off-slips, with regular queuing on the approach to Birchley island. This has exacerbated the already poor traffic conditions around the island with congestion and delays occurring due to traffic queuing through the signalised junctions on the island. Data from recent queue surveys is outlined below.

**Churchbridge** – Queues gradually build up, as shown in Figure 1 below. Queue lengths are at their greatest between 08:30 and 09:00 during the peak period, with the queue length reaching 25 vehicles (Lane1 = 20, Lane 2 = 5). The majority of traffic heads towards M5 J2, Wolverhampton Road and Birchfield Lane. In comparison, the PM traffic flows dramatically increase between 16:30 until 18:00 with queue lengths reaching 75 vehicles. The traffic volume significantly increases and remains at a high level with the evening peak occurring between 16:30 and 18:00.

**Figure 1  Total Queues at Churchbridge (peak periods, 11-12-2013)**

![Total Queues at Churchbridge (including lane 1 & 2)](image)

**Wolverhampton Road North** – AM peak queue lengths exceed 50 vehicles in Lane 1 and 20 in Lane 2. During the PM peak the average queue reaches 60 in Lane 1 and 25 in Lane 2. Figure 2 shows there are times when the combined queue length exceeds 100, which highlights significant congestion problems. There were several occasions where the queue in Lane 1 exceeded 70 vehicles, but during the survey it became impractical to count these vehicles. Therefore any queues over 70 vehicles were capped at this figure on the recording sheet. Queue lengths are at their greatest between 08:00 and 09:00 and 16:30 and 17:30 with the majority of traffic heading towards M5 J2.
Wolverhampton Road South — Traffic flows along this approach to Birchley island are lower than on other major arms of the roundabout. Instead, this approach experiences surges in traffic demand, as shown on Figure 3 below. The first surge occurs at around 07:30 and lasts approximately 20 minutes, with the highest combined queue length reaching 100 vehicles. This appears to be a general trend that occurs every 15 to 20 minutes with queue lengths hitting peaks and troughs during the peak periods. Queue lengths are at their greatest between 07:30 and 08:00. The PM peak starts around 16:00, with fluctuating queue lengths until 17:30 when queues begin rising to a greater level.

Figure 3 Total Queues at Wolverhampton Road South (peak periods, 11-12-2013)
compared with the other approaches to the roundabout, especially during the PM peak. The approach experiences extremely large volumes of traffic during the AM peak, with the highest recorded number of 80 vehicles in both Lanes 1 and 2 around 08:00. Figure 4 below shows that the AM peak period occurs between 08:00 and 08:30. This situation is dramatically different during the inter peak and evening peak with relatively low queue lengths. The PM peak remains consistent, displaying no significant peaks and troughs, with queue lengths between 10 to 30 vehicles per lane.

**Figure 4  Total Queues at Birchfield Lane (peak periods, 11-12-2013)**

M5 J2 link to Birchley Island – Traffic flows along this approach are heavy during the AM and PM peaks, as commuters leave the motorway to access Sandwell, Wolverhampton, Dudley and Birmingham. Traffic along this approach has an increased arrival rate, due to the motorway off-slip road widening carried out by the Highways Agency. It can be seen in Figure 5 that queue lengths remain consistent at around 20 to 30 vehicles during the AM peak, which is split over three lanes. The PM peak queues gradually increase from about 16:00 and are longest at around 17:00, with a vehicle queue length of 15 per lane.
2.3 Impact on Public Transport

An aspiration of improving Birchley island is to bring about journey time savings for all bus services passing through it. Increased capacity on the approach arms of Wolverhampton Road North and Wolverhampton Road South would allow a faster approach to the island for the 126 bus service, a high frequency service connecting Wolverhampton, Dudley and Birmingham. Rather than having to follow the circulating route around the island, a road through centre of the island would allow buses to pass through the island more efficiently, especially if combined with a green traffic signal wave.

The 4, 4H, 4M and 20 services along the A4034 corridor would benefit from capacity improvements to the Churchbridge and Birchfield Lane approaches. These services would benefit further from the removal of the circulating flow between Wolverhampton Road North and Wolverhampton Road South should road space through the island be provided.

2.4 Severance

The junction lies at the midpoint of two Local Sustainable Transport Fund corridors and two routes on the Sandwell Cycle Network along the A4123 and A4034. Birchley island represents a significant barrier to pedestrian movement and the passage of cyclists. There are no controlled pedestrian crossing facilities immediately at the junction nor are there any measures to accommodate cycle movements. This situation also makes it difficult for public transport users to interchange between services by walking around the island. As such it is a priority for sustainable transport initiatives involving the reduction of congestion, reduced carbon emissions, reduction of bus journey times and improvements for cycling and walking.
2.5  Cycle Provision

Birchley island is regarded as a very unfriendly environment for cyclists, mostly due to the speed of traffic on the circulating carriageway and the multiple lanes between which it is difficult manoeuvre safely to be in the correct lane when exiting the island. The current footway is also a barrier to what would be illegal pavement cycling because not all the approaches to the island are signalised. In particular, the roundabout exit to Wolverhampton Road north experiences high speed traffic flows on the main carriageway that make it difficult for both cyclists and pedestrians to cross at this point. Also, the uncontrolled left turn from Churchbridge to the M5 junction 2 link makes it difficult for pedestrians and cyclists to find gaps in the almost continuous traffic flow. These problems contribute to the severance described above in section 2.3.

2.6  Accidents

Figure 6 shows details of accidents occurring in the last five years taken from the Spectrum database in terms of the number, type, time and location of incidents.

Figure 6  Accidents between 2008 and 2013 at Birchley Island

Within the specified search area, the results show that 46 accidents of varying severity occurred in the last five years (Table 1). A total of 66 casualties, including one fatality, were involved. It is likely that more accidents actually occurred as some are not reported.
Table 1  Number of Accidents and Casualties

<table>
<thead>
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<th>Total Accidents:</th>
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<td>Accidents by Severity:</td>
<td>Casualty by Classification:</td>
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<tr>
<td>Fatal:</td>
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<td>Pedestrian:</td>
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| Accidents by Lighting: | Casualty by Severity: | |
|-----------------------|----------------------| |
| Daylight: | 32 (69.6%) | Fatal: | 1 (1.5%) |
| Darkness: | 14 (30.4%) | Serious: | 11 (16.7%) |
| Slight: | | 54 (81.8%) |
| Road Surface: | | |
| Dry: | 33 (71.7%) | |
| Wet: | 12 (26.1%) | |
| Snow: | 1 (2.2%) | |
| Ice, Flood, Unknown | 0 (0%) | |

2.7  Air Quality

The Air Quality Action Plan 2009 (AQAP) provides a detailed summary of the existing air quality in Sandwell. Oldbury, which includes M5 J2 / Birchley island, is of particular importance and is one of fifteen areas (shown on Figure 7) where exceedance is more than the annual average nitrogen dioxide (NO₂) objectives. The exceedances are directly linked to traffic emissions. Data shows that 69% of NOx emissions are generated by motorway traffic in and around the area of M5 J2 Oldbury, although the impact of air quality upon receptors (buildings) is not as severe as it seems. This is partly due to the motorway being elevated along the section near to Birchley island and the majority of the receptors are not within close proximity of the junction.

The AQAP 2009 requires a 17% reduction in NO₂ in and around the M5 J2 / Birchley island area. It is likely that all of the scheme options being considered should assist with reducing exceedance levels of annual average NO₂ emissions. This would be achieved through; reducing congestion, improving traffic flows, minimising queues and creating reliable journey times. (Sandwell MBC, 2013, Air Quality Progress Report for Sandwell MBC).
3. Strategic Context

3.1 Introduction

The need for improvements at Birchley island and M5 Junction 2 Junction has been highlighted for a number of years both from local politicians and local business forums such as the Black Country Chamber of Commerce (BCCC). The BCCC proposed improvements as part of the Quick Wins Programme in 2009. The Black Country Local Enterprise Partnership have identified the improvements as a key priority in the Black Country Core Strategy and in the Strategic Economic Plan (SEP), which has been further supported by Highways Agency.

3.2 Black Country Core Strategy

The Black Country Core Strategy (BCCS) spatial strategy is based around the growth network of four Strategic Centres and sixteen Regeneration Corridors (RCs). The junction lies within RC12 (Oldbury-West Bromwich-Smethwick) but also provides motorway access for a wider part of the west of the Black Country covered by RC10 (Pensnett-Kingswinford), RC11 (Dudley-Brierley Hill-Stourbridge) and RC13 (Rowley Regis-Jewellery Line). The transport strategy (CSP5) identifies ‘Improved road network and links to the national M5 and M6 motorway network’ as a key factor in supporting the spatial objectives (BCCS 2011, p51).

Transport Policy TRAN1 outlines the priorities for development of the transport network. It recognises that the delivery of an improved and integrated network both within the Black Country, and links to regional and national networks, as being vital to achieve the economic growth and regeneration envisaged in the strategy. The policy sets out the
improvements needed to deliver the transport strategy, which include Junctions 1 and 2 of the M5, and Junctions 9 and 10 of the M6 (p117-118).

Improvements at the island would also contribute to policies TRAN3 (The Efficient Movement of Freight) and TRAN4 (Creating Coherent Networks for Cycling and for Walking).

In reality, M5 Junction 2 and Birchley island operate as a single entity. This was recognised in a study of the four motorway junctions carried out on behalf of the Highways Agency by Mott MacDonald in 2010 as part of the evidence base for the BCCS Examination in Public. Following modelling work, this study concluded that M5 Junction 2 (along with Birchley island) would reach operational capacity in 2013. The study proposed mitigation measures which are included in Option A, with the exception of widening the motorway off-slips because these works were completed during 2013 as part of the Highways Agency’s Pinch Point Programme. (It should be noted that scheme Option A includes both the mitigation measures proposed by the study and the widened M5 Junction 2 off-slips. The other scheme options, B, C and D, include elements of the mitigation measures and the widened off-slips.)

3.3 Sandwell Site Allocations and Delivery Plan

The Site Allocations & Delivery Plan (SAD) document sets out local policies and site allocations for Sandwell which underpin the spatial strategy set out in the BCCS. Within regeneration corridors 12 and 13 the BCCS envisages the following growth by 2028:

- 240,000m² of new office floorspace
- 65,000m² of new retail floorspace
- 578ha of new employment land
- 8713 new housing units.

The bulk of this growth is anticipated by 2021 and is detailed in the SAD. Around 25ha of new employment land allocations lie within 1km of the junction, the development of which would clearly impact on its operation. In addition, the key retail site at ‘The Junction’ in Oldbury town centre would increase traffic flows through Birchley island.

As a result of representations from the Highways Agency, the SAD includes the improvement of Junction 2 (along with the other motorway junctions) as a specific proposal in order to make the plan ‘sound’. This was accepted at the Examination in Public held in February 2012 and subsequently incorporated into the adopted plan.

3.4 Black Country Local Enterprise Partnership

The Black Country LEP sees transport as being key to addressing barriers to private sector economic growth through three overarching aims:

- Improve the flow, reliability and access of employees to and from the workplace
- Improve the flow, reliability and access of goods to and from the market
- Improve the flow, reliability and access for visitors (tourism and business) through the Black Country.
To achieve these aims it has identified four Transport Priorities:

- Improvements to the M5/M6 junction (including Junctions 1 and 2 of the M5 and Junctions 9 and 10 of the M6) to address the congestion in the West Midlands
- The Stourbridge to Walsall Freight Line
- Access to Birmingham Airport
- Increased and better active management of the network across the Black Country.

Proposals to improve Birchley island/Junction 2 are therefore considered to be a priority by the Black Country LEP and within the SEP.

The SEP is a document produced by the Black Country Local Enterprise Partnership, which details how the area is expected to grow and what measures will be undertaken to achieve sustainable growth for the area. Within the report, there is a section that identifies transport priorities for the region, which aim to improve the reliability of journey times, efficiency and capacity of the network in order to increase investment. It also mentions that infrastructure must be able to provide quick, efficient and reliable movement of products and people to the road and rail network. Finally, it identifies the weaknesses that are hindering investment and growth in the region such as: high levels of congestion, the need for junction improvements and the lack of journey time reliability. All the points raised have been integral to the highway improvements at Birchley island with the aim of reducing congestion and bringing about reliable journey times.

### 3.5 West Midlands Local Transport Plan

The current West Midlands Local Transport Plan (LTP3) is a statutory document prepared by the West Midlands Integrated Transport Authority (WMITA) which sets out the local transport strategy for the period between 2011 and 2026. It also includes an implementation plan for the first five years (up to 2016) as well as setting out those proposals it considers necessary to deliver the strategy during the period between 2016 and 2026. Furthermore, it aims to assist the West Midlands region in creating a prosperous, healthier, safer and higher quality environment. LTP3’s top priorities are:

- Tackling congestion and providing alternatives to the private car
- Ensuring delivery with limited resources to support a low carbon economy and regeneration
- Integration / alignment of land use and transport
- Public and Child Safety on Roads – Accident reduction schemes and safe routes to schools, accident analysis and a road safety plan.

### 3.6 Highways Agency Proposals

The Highways Agency is of the view that improvements are required at Birchley island / Junction 2 in order to mitigate the impact of the development set out in the BCCS, particularly in regeneration corridors 10, 11, 12 and 13. The HA has already undertaken improvements to the motorway slip roads but has always taken the position that the works to Birchley and the link road to Junction 2 should be lead by the Local Authority.

In September 2013 improvement works were completed by The Highways Agency (HA), as part of their ‘pinch point programme’ along the exit slip roads from the M5 at junction 2. The £1.75m works included widening both north and southbound exit slip roads by one lane and improving the associated signage and lighting along these stretches. The works
were required to reduce congestion and increase capacity during peak periods and to prevent traffic queuing onto the main M5 carriageway. The increased capacity of the slip roads has impacted upon the efficiency of Birchley island because higher volumes of traffic now enter the motorway approach arm more quickly during peak periods. Further improvement schemes are proposed (M6 J9 Traffic signal upgrades and M5 J4), which may have an impact upon the M5 J2 and subsequently Birchley island.

The HA has indicated its support for the proposals in principle, but would need to approve the works to the link road between the two roundabouts as this section of highway forms part of its area of responsibility. It is likely that an agreement under Section 6 of the Highways Act 1980 would be required to facilitate this.

4. Objectives

It is proposed to carry out a major at-grade improvement which will increase the capacity of all approaches to Birchley island, provide controlled pedestrian/cycle crossings and dedicated pedestrian/cycle routes. This would achieve the following aims:

- **Reduce delays and congestion**
  This would have a positive impact on Black Country businesses which are transporting goods through this junction regionally and onto the national networks. It would support growth and increase regeneration opportunities.

- **Improve bus service reliability**
  This would assist in improving the attractiveness of buses and contribute to modal shift from single occupancy cars.

- **Reduce severance and improve pedestrian and cycle links**
  Safer and more convenient links would reduce the severance affect of the junction and its approaches.

- **Improve road safety**
  Improved junction control, lane markings and pedestrian/cycle facilities would reduce the potential for accidents.

5. Options Considered

5.1 Introduction

Four scheme options are being considered, from which a preferred option is identified at the end of this report. The options are compared to the existing situation, known as the “Do Minimum”. Flyover and underpass options are not being considered due to their considerable cost and the technical difficulties of constructing them at Birchley.

5.2 Description of Scheme Options

**Do minimum**

The existing situation is the option that does not require any construction or physical change. The works includes the widening of the M5 junction 2 slip roads, resurfacing and lane marking.
Option A
This option consists of signalisation and widening all approach arms to Birchley island. It also includes widening the link between M5 junction 2 and Birchley island to four lanes in both directions. This proposal also includes improved pedestrian and cycle facilities which includes a segregated cycleway/footway, signalised crossings and signage (see Figure 8).

Option B
This is shown in Figure 9 and is similar to Option A except that the A4123 Wolverhampton Road would form a “hamburger” through the centre of the island. The “hamburger” junctions with the circulating carriageway would be signal controlled and integrated with the roundabout signals. The through road would provide a single lane in each direction.

Option C
This is shown in Figure 10 and combines both Option A and Option B including the ‘hamburger’ linking Wolverhampton Road and a link from M5 junction 2 to Wolverhampton Road and Churchbridge.

Option D
This is shown in Figure 11 and involves the creation of a signalised crossroads and the removal of the roundabout structure to accommodate all approach arms. In effect the crossroads option creates three minor junctions. It is unlikely that this proposal would assist in reducing traffic congestion and queue lengths (see appendix). It is unlikely to be as effective as options B and C.

5.2 Flyover and Underpass Options

Constructing a flyover or underpass along the A4123 Wolverhampton Road alignment would remove the through-traffic from the island and therefore create extra capacity due to the reduction of conflicting vehicle movements around the island. This option would however require overcoming substantial physical constraints including the re-location of the electricity sub-station and possibly altering the elevated section of the M5 motorway. This would be extremely costly and not offer value for money, furthermore it would require the agreement of the Highways Agency to alter part of the motorway which would create disruption. For these reasons Option 5 will not be progressed.

An underpass on the Wolverhampton Road alignment would achieve the same reductions in delays and queues as a flyover although the same physical constraints would exist. It would be the most expensive, complex and technically challenging option and it is unlikely that the available funding would not cover the costs of providing it. As such it is not considered as being a viable option.
Figure 8  Option A
Figure 10  Option C
Figure 11   Option D
6. Option Comparison

6.1 Queue and Delay Reduction

A series of TRANSYT models to analyse queues and delays for the Do Minimum (DM) and each Do Something scheme option (A, B, C, D) were created in order to predict the impacts of the junction improvements and provide quantified outputs that could support subsequent scheme appraisal activities. TRANSYT outputs summarising the performance index and highest degree of saturation are presented in Appendix A.

Do Minimum

The current operation of the junction results in queues and delays, particularly during peak periods, as well as demonstrating a historic trend of accidents. Pedestrian provision at the junction is very limited, as are facilities for cyclists and public transport users.

The DM average peak period speeds would reduce from 13kph in 2014 to 8kph in 2028. The degree of traffic saturation at the junction would increase from around 110% in 2014 to around 130% in 2028. A value of less than 85% enables optimum junction performance.

The total distance travelled in the network, which represents the overall traffic demand, would increase from around 4400 vehicle kilometres per hour (vkm/h) in 2014 to around 5000 vkm/h in 2028. Similarly, fuel consumption would increase from around 630 litres per hour (l/hr) to around 1050 l/hr. The performance index (PI), which is the monetary cost of delay and the time vehicles spend being stationary at Birchley island and on its approach roads, ranges from £3200 in the 2014 PM peak to £7800 in the 2028 PM peak. The PI is a reflection of the reducing average speeds, increasing traffic saturation, distance travelled and the time vehicles spend negotiating Birchley island.

Option A

Option A would slightly improve journey time reliability, resulting from the provision of an additional lane at each approach arm. Also, the introduction of a fully signalised junction rather than the current partially signalled junction would reduce journey times, delays and congestion and improve public transport punctuality and the overall commuter experience.

A comparison of option A with the DM for the year 2028 shows that PI values would decrease to around £2200 and average speeds would increase to around 20kph. This would be an improvement on the 2028 DM speeds, which are expected to be as low as 7kph. Distance travelled would not change significantly because the island’s layout with option A would be very similar to the DM layout. The increased capacity due to extra lanes and widening would however result in less traffic saturation (at 94%), less time spent travelling (270 vehicle hours per hour) and less fuel consumption (631 l/hr).

Option B

Option B would have a greater impact upon the junction, because it has all the benefits of option A and includes the hamburger through-route. The construction of the hamburger road would alleviate congestion and delay for traffic on all approach arms because some traffic would be removed from the circulating carriageway of the roundabout, especially for traffic travelling between Wolverhampton North and Wolverhampton South.

The PI values for option B in 2028, at £1859 and £1736 for the AM and PM peaks respectively, would be significantly less than those for DM and option A. In 2028, values for degree of traffic saturation, distance travelled, time spent at the island and average speeds are expected to be similar to option A. Fuel consumption would be slightly lower.
Option C
Option C combines both options A and B and would provide similar benefits for vehicular traffic. In addition, this option includes a one-way road connecting the M5 junction 2 link to Churchbridge, allowing traffic travelling from the motorway to take a more direct route through the junction. Although option C caters more for traffic originating from the motorway network, it would alleviate congestion and delay around the roundabout.

Option C would bring about a PI reduction in 2028 to around £2000 compared with DM values of up to £7800. For the same year, PI values for option C are lower than those for option A (around £2200) but higher than those for option B (around £1700). The degree of traffic saturation, average speeds, time spent at the island and fuel consumption are expected to be similar to the values for option B.

Option D
This option would not create significant benefits for vehicular traffic to the same extent as options B and C. The road layout would however create more direct routes for pedestrians and cyclists and make it easier for people to interchange between bus services. Option D would also provide for safer traffic manoeuvres due to the removal of the weaving between lanes that would be necessary on a circulating roundabout carriageway.

The traffic modelling for option D however shows that queues and delays would be greater during peak periods than in options A, B and C. Also, even with the current traffic levels, which are expected to increase, option D would perform worse than the existing layout. Average speeds for example would drop to around 10kph and further still to around 7kph in 2028. Further development of option D will therefore not be progressed.

Grade Separation Options
A grade separation option (flyover or underpass) would result in lower PI values than the DM in 2028 at around £1625 and average speeds would increase to around 19kph. Most of the speed increase would result from through-traffic being able to travel significantly faster than at present. Distance travelled, time spent at the island and fuel consumption levels would not however improve significantly on the levels for 2028 that would be achieved by options B and C. Also, the degree of saturation at the roundabout element of a grade separation option, at 90%, would not be brought down to optimum levels. This is because the option would not enable roundabout capacity to be increased as much as with options A, B and C due to the need for space to create the flyover or underpass road sections. Space at the island is however constrained by the surrounding land uses.

6.2 Public Transport
The benefits described above are also true for those using public transport and as a result it is anticipated that bus service reliability would improve. Options A, B and C are likely to achieve service reliability in terms of journey time and congestion, but the hamburger island road layout is likely to achieve the greatest journey time and congestion savings. This could assist with bringing about modal shift from private cars to buses.

Another effect of each option would be the increased ease with which bus passengers could interchange between bus services due to the provision of signalised crossings of all vehicle routes and the provision of high quality footways.
6.3 Severance Reduction

Birchley island in its current layout serves as a disincentive to cyclists and pedestrians, mainly as a result of poor safety features and currently there are limited safety features in and around this junction. This combined with inconsistent signal controlled crossing points creates a sense of vulnerability whether perceived or actual.

All the options proposed for Birchley island greatly reduce pedestrian and cycle severance, because all options include tactile paving, refuges, street lighting and signalised crossing points for all users. Options B and C include more pedestrian refuges than option A in order to accommodate the hamburger through route. The only option that might have a neutral / positive impact upon severance could be the crossroads option (D). Due to the location and amount of crossing points, pedestrians may see this as a disincentive and therefore use other forms of transport.

6.4 Cycle Provision

Each junction improvement option includes facilities that would separate cyclists (and pedestrians) from the main carriageway flows and create signalised crossing points at each the entry and exit. This is consistent with the need to develop cycle facilities in line with the cycle route strategy adopted by Sandwell Council, such that it caters for people with at least Bikeability Level 2 capability. Pedestrians and public transport users would also benefit from such facilities. Main carriageway cycle facilities would also be provided for confident and experienced cyclists who would be unlikely to use the separate (or "segregated") facilities.

The facilities to separate cyclists (and pedestrians) from the main carriageway would take the form of a segregated path with a total width of 4.8 metres. This includes 2.5m for cyclists (accommodating two-way flows), 2.0m for pedestrians and a 0.3m splash strip to the main carriageway. A 75mm kerb upstand at the rear of the footway would be provided as a tapping structure for people with sight impairments who are white stick users. The cross section of such a route, which would be applied to the scheme option chosen from the being considered, is shown as Figure 12. For options A, B and C the proposed width of 4.8m might need to be reduced to a minimum 3.8m width over short sections where land is not available.

Pedestrian and cyclist Toucan crossing points would be installed at each entry and exit point for each scheme option. Along with the segregated paths, the crossing points would create a consistent safe route around the improved junction.

For more confident and experienced cyclists advanced stop lines (ASLs) would be introduced where appropriate, with a minimum depth of 5m to ensure that cyclists are visible to all vehicles. To further improve visibility of cyclists specifically from the perspective of Heavy Good Vehicles, each signal head adjacent to ASLs would be fitted with Trixi Mirrors.

Through the provision of clear, consistent and a well laid out cycle facilities, enabled by the improvement of Birchley island, severance in the local area should be reduced, encouraging greater use of alternatives to private vehicles such as by cycling, walking and public transport. In all options the facilities would be tied-in to existing cycle routes along A4034 Churchbridge and those proposed along the A4123 Wolverhampton Road.
Figure 12  Segregated Cycle and Pedestrian Provision for Birchley Island Improvement Options
6.5 Road Safety Improvements

Making an improvement to road safety for motorists, cyclists and pedestrians is a major aim of each scheme option. In the last five years there have been 46 accidents at this junction. It is expected that options A, B and C would reduce the number of accidents because they reduce the degree of traffic congestion. Furthermore, since the junction would be fully signalised, the potential for drivers to block exits should be reduced and pedestrians and cyclists would be provided with safer continuous routes through the junction. The option that is likely to provide the best balance between safety and journey time savings would be option B. However, although option D is more likely to provide a greater accident saving, the road layout itself may not ease congestion as anticipated.

6.6 Construction Costs

Estimated scheme costs for each option are expressed at a 2012 price base (except option D which is at 2013 price base Appendix E)

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<th>Construction Costs for Each Proposed Option</th>
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<td>Statutory Undertakers Diversions</td>
<td>£ 4,267,275</td>
<td>£ 5,119,625</td>
<td>£ 5,602,875</td>
<td>£ 5,635,874</td>
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<tr>
<td>Land Acquisition</td>
<td>£ 672,180</td>
<td>£ 1,403,350</td>
<td>£ 1,904,510</td>
<td>£ 250,000</td>
</tr>
<tr>
<td>Construction</td>
<td>£ 3,912,486</td>
<td>£ 4,474,222</td>
<td>£ 4,691,978</td>
<td>£ 12,242,264</td>
</tr>
<tr>
<td><strong>Sub-Total</strong></td>
<td><strong>£ 9,956,816</strong></td>
<td><strong>£12,102,072</strong></td>
<td><strong>£13,304,238</strong></td>
<td><strong>£19,239,013</strong></td>
</tr>
<tr>
<td>10% Risk Contingency</td>
<td>£ 568,954</td>
<td>£ 698,245</td>
<td>£ 770,136</td>
<td>£ 660,639</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>£10,525,770</strong></td>
<td><strong>£12,800,317</strong></td>
<td><strong>£14,074,374</strong></td>
<td><strong>£19,909,652</strong></td>
</tr>
<tr>
<td>Fees</td>
<td>£ 663,820</td>
<td>£ 663,820</td>
<td>£ 663,820</td>
<td>£ 663,820</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>£11,189,590</strong></td>
<td><strong>£13,464,137</strong></td>
<td><strong>£14,738,194</strong></td>
<td><strong>£20,563,472</strong></td>
</tr>
</tbody>
</table>

The complexity of constructing option D compared to the other options is reflected in the much higher cost and, since the modelling work shows that option D does not perform as well in traffic terms, it cannot be regarded as a potential preferred option.

6.7 Strategic Impact

The proposed options A, B and C are likely to improve the existing traffic situation and produce a multiplier effect upon the strategic economic output of the area, but option D does not offer any congestion relief.
The road layout proposed in Option B allows vehicles to travel between the Wolverhampton Road (North and South) with less delay than the existing, Do Minimum and Option A scenarios, especially if a “green wave” could be provided. The strategic impact of a through-road which reduces journey times and delays would be a positive benefit for businesses and commuters. Journey times would be more reliable and overall congestion would be reduced as fewer vehicles would have to circulate around the junction.

The proposed road layout in option C provides the same benefits but includes a one-way link from the motorway exit to Churchbridge and Wolverhampton Road North only. The strategic impact of this layout would increase the accessibility of the Black Country because the newly created link would be more direct and less congested. It would enhance Birchley island’s ability to be a key gateway for commerce.

Since option D does not offer improved journey time reliability it cannot be regarded as a potential preferred option for improving Birchley island.

In summary, the efficiency improvements resulting from providing either options A, B or C would create new opportunities and contribute to the economic growth of the local and wider regional area. Business costs could be reduced and supply chains could be more reliable because the junction would be less congested. This may increase competitiveness for business, improve labour mobility and create new opportunities to attract inward investment. The suggested options could also reduce barriers to growth by opening up previously under-utilised land for development, making it more accessible and enabling all road users to reach local, regional and national destinations.

7. Summary and Recommended Option

The traffic modelling undertaken shows that, compared with the Do Minimum and options A and D, options B and C would provide the greatest capacity improvements at the junction. Although a grade separation solution would create more traffic capacity, the performance of the roundabout element would not be significantly better than options B and C.

Whilst options B and C have similar traffic capacity characteristics, the preferred option would need to be identified by taking other considerations into account. Traffic behaviour for each option and future year was analysed using the TRANSYT traffic model and this found that some of the operational aspects of option C could prove to be confusing for drivers, which could lead to safety problems. The interface between the northbound through-road and the M5 to Churchbridge sections in the centre of the island is of particular concern. Similar concerns were also raised by members of the public and other stakeholders during the consultation process. Since the traffic capacity benefits of providing either the options B or C are similar, the development of option C should not be progressed further.

In summary, the preferred scheme option is option B. Option B meets or exceeds the stated objectives for making improvements to Birchley island. The traffic operation and capacity analysis undertaken for future years (using TRANSYT) shows that option B performs better in comparison with the Do Minimum and options A and D in terms of performance index, degree of traffic saturation, fuel consumption, queue lengths and time spent travelling through the junction. Whilst option C performs as well as option B in terms of these parameters, the layout for option B would be less confusing for drivers. Option B would also cost less to construct and detailed cost/benefit analysis is expected to show that monetary benefits accruing from less delay and congestion will be significantly greater than the cost of construction.
Appendix A  TRANSYT Results Comparison between Do Minimum and Scheme Options

<table>
<thead>
<tr>
<th>Junction Performance Item</th>
<th>Existing / Do Minimum (DM)</th>
<th>Option A</th>
<th>Difference (DM - Option A)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2014</td>
<td>2018</td>
<td>2028</td>
</tr>
<tr>
<td></td>
<td>AM</td>
<td>PM</td>
<td>AM</td>
</tr>
<tr>
<td>P.I (£ per hour) - note 1</td>
<td>3271</td>
<td>3183</td>
<td>4145</td>
</tr>
<tr>
<td>Mean Speed (kph)</td>
<td>13</td>
<td>13</td>
<td>12</td>
</tr>
<tr>
<td>Highest Degree of Saturation (%)</td>
<td>114</td>
<td>108</td>
<td>119</td>
</tr>
<tr>
<td>Distance Travelled (pcu-km/hr) - note 2</td>
<td>4468</td>
<td>4307</td>
<td>4664</td>
</tr>
<tr>
<td>Time spent (pcu-hr/hr) - note 3</td>
<td>336</td>
<td>332</td>
<td>400</td>
</tr>
<tr>
<td>Fuel Consumption Total (Litres/hr)</td>
<td>645</td>
<td>616</td>
<td>740</td>
</tr>
</tbody>
</table>

Note that growth factor (flow scale) of 1% per annum has been derived from Tempro 6.2
<table>
<thead>
<tr>
<th>Junction Performance Item</th>
<th>Option C</th>
<th>Difference (DM - Option C)</th>
<th>Option D</th>
<th>Difference (DM - Option D)</th>
<th>Grade Separation</th>
<th>Difference (DM - GS)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AM</td>
<td>PM</td>
<td>AM</td>
<td>PM</td>
<td>AM</td>
<td>PM</td>
</tr>
<tr>
<td>P.I (£ per hour) - note 1</td>
<td>1444</td>
<td>1411</td>
<td>1562</td>
<td>1533</td>
<td>1952</td>
<td>2003</td>
</tr>
<tr>
<td>Mean Speed (kph)</td>
<td>21</td>
<td>21</td>
<td>21</td>
<td>21</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>Highest Degree of Saturation (%)</td>
<td>82</td>
<td>84</td>
<td>86</td>
<td>88</td>
<td>94</td>
<td>93</td>
</tr>
<tr>
<td>Distance Traveled (pcu-km/hr) - note 2</td>
<td>4172</td>
<td>4115</td>
<td>4339</td>
<td>4278</td>
<td>4756</td>
<td>4691</td>
</tr>
<tr>
<td>Time spent (pcu-hr/hr) - note 3</td>
<td>198</td>
<td>195</td>
<td>210</td>
<td>207</td>
<td>245</td>
<td>246</td>
</tr>
<tr>
<td>Fuel Consumption Total (Litres/hr)</td>
<td>474</td>
<td>464</td>
<td>501</td>
<td>490</td>
<td>581</td>
<td>578</td>
</tr>
<tr>
<td>P.I (£ per hour) - note 1</td>
<td>7491</td>
<td>5829</td>
<td>8865</td>
<td>7548</td>
<td>12744</td>
<td>11944</td>
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<tr>
<td>Mean Speed (kph)</td>
<td>9</td>
<td>11</td>
<td>8</td>
<td>10</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Highest Degree of Saturation (%)</td>
<td>206</td>
<td>131</td>
<td>244</td>
<td>136</td>
<td>352</td>
<td>149</td>
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<tr>
<td>Distance Traveled (pcu-km/hr) - note 2</td>
<td>5510</td>
<td>5597</td>
<td>5731</td>
<td>5821</td>
<td>6281</td>
<td>6381</td>
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<tr>
<td>Time spent (pcu-hr/hr) - note 3</td>
<td>625</td>
<td>498</td>
<td>733</td>
<td>586</td>
<td>1005</td>
<td>869</td>
</tr>
<tr>
<td>Fuel Consumption Total (Litres/hr)</td>
<td>991</td>
<td>841</td>
<td>1118</td>
<td>960</td>
<td>1473</td>
<td>1323</td>
</tr>
</tbody>
</table>

Note 1 – Performance Index is calculated in terms of the monetary costs of delay and stops summed for all links in the network.
Note 2 – Represents traffic demand in the network.
Note 3 – Total time spent (pcu-hr/hr) – Represents average number of vehicles in the network during the specified period.