

A404 Bisham Roundabout

Pinch Point Eradication Programme – Technical Note

(Transport Planning: Modelling & Economics)

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Contents

1	Introduction	6
1.1	Background.....	6
1.2	Bisham Roundabout.....	6
1.3	Report Objectives.....	6
2	Pinch Point Programme (PPP)	7
2.1	Pinch Point Programme	7
2.2	Prioritisation Framework.....	7
3	Bisham Roundabout – Existing conditions.....	9
3.1	Junction Location & Layout	9
3.2	Operational Assessment: Base Year.....	11
	3.2.1 Traffic Count Data	11
	3.2.2 ARCADY Assessment – Base Year	11
4	Junction Improvement Scheme	11
4.1	Option Development and Appraisal	11
4.2	Proposed Scheme Design.....	11
4.3	Deliverability.....	11
4.4	Operational Assessment: Opening & Design Years	11
	4.4.1 Traffic Growth	11
	4.4.2 Do Nothing – Priority Roundabout	11
	4.4.3 Do Something – Signalised Crossroads	11
5	Modelling Review	11

5.1	ARCADY – Base Year & Do Nothing.....	11
5.2	LINSIG – Do Something.....	11
5.3	Conclusions & Risks	11
5.3.1	Traffic Modelling and Data Collection	11
6	Project Appraisal.....	11
6.1	PAR (Project Appraisal Report).....	11
6.2	Conclusions	11
7	Conclusions and Risk Register.....	11
7.1	Conclusions	11
7.2	Risk Register.....	11

Table of figures

Figure 1: Bisham Roundabout: Location Plan	10
Figure 2: Bisham Roundabout: Immediate Surroundings.....	11
Figure 3: Bisham Roundabout: Junction Layout	12
Figure 4: Observed AM Peak Hour Traffic Flows	14
Figure 5: Observed PM Peak Hour Traffic Flows	15
Figure 6: Bisham Roundabout: Indicative Junction Design.....	19

Tables

Table 1: A404 Bisham Roundabout: 2009 Base Year ARCADY results.....	13
Table 2: A404 Bisham Roundabout: 2014 Opening Year & 2029 Design Year ARCADY results.....	17
Table 3: A404 Bisham Junction: Signalised Crossroads 2014 Opening Year & 2029 Design Year LINSIG results	18
Table 4: A404 Bisham Junction: Signalised Crossroads Option PAR Summary ..	22

1 Introduction

1.1 Background

The Highways Agency Pinch Point Programme (PPP) is an initiative announced by the Government (November 2011) focussing on delivering smaller scale improvements (to a maximum individual value of £10m) to the Strategic Road Network in England that can help to stimulate growth in the local economy, in particular the delivery of local housing and employment opportunities.

The purpose of these improvements is to relieve congestion and/or improve safety at key locations that are pinch points on the Agency's network.

1.2 Bisham Roundabout

The proposed scheme to improve the A404 Bisham roundabout has been put forward as part of the PPP.

The roundabout at Bisham on the A404 is the only at-grade junction on the A404 between the M40 (Junction 4 at Handy Cross) and M4 (Junction 8/9 at Maidenhead). High levels of congestion occur daily at the roundabout with the congestion impacting upon junctions to the north (Marlow) and south (Maidenhead).

The aim of the junction improvement scheme is to develop options to reduce recurrent congestion and address poor journey time reliability on the A404 approaching Bisham roundabout.

The high levels of congestion and delay experienced on a daily basis at the Bisham roundabout has a detrimental impact upon current economic activity and will continue to restrict and discourage economic opportunities and the potential for growth.

A feasibility study, produced by EM and submitted to the HA, was completed in March 2012 examining the options for the improvement of Bisham Roundabout: – “A404 Bisham Roundabout: Junction Improvement Study” (March 2012). Parts of that report are summarised in this report with the full report and appendices being included as supporting documentation in the PPP package.

1.3 Report Objectives

The scheme justification will be in accordance with and defined within the specified Prioritisation Framework. This is a technical report outlining the case for inclusion of this scheme within the PPP, including operational (junction modelling) and economic assessment (PAR).

2 Pinch Point Programme (PPP)

2.1 Pinch Point Programme

The Pinch Point Programme (PPP) fund was announced during the Chancellor of the Exchequer's Autumn Statement on 11 November 2011. A fund of £212 million was made available in the period up to 2014/15.

To be eligible for PPP funding, schemes should deliver under both of the following objectives which target:

- Some of the worst pinch points where the network is under particular stress; and
- Locations that are key to supporting economic growth.

There is a maximum limit of £10 million on any individual scheme and all PPP schemes must be fully deliverable within the 3 year duration of the PPP, which ends on March 31 2015. PPP schemes are also only to be implemented on the HA network.

The strategic outcome of the PPP is to deliver a programme of improvements on the HA network that will provide sustained stimulus to the UK economy.

2.2 Prioritisation Framework

The HA Asset Management Office has developed a methodology for prioritising transport interventions to deliver through the PPP. A Prioritisation Framework has been developed within which scheme promoters must provide justification and evidence for inclusion of their scheme within the PPP.

The framework is based around three dimensions:

- Policy Criteria;
- Value for Money; and
- Deliverability.

For each scheme a Pro Forma supplied by the HA must be completed with regards to a number of criteria. Guidance has been supplied regarding the completion of the pro forma in terms of evidence requirements and advice on how to utilise the scoring system to score submissions against the framework criteria.

The framework is made up of a number of sections:

- Scheme Summary
- Policy Criteria
 - Criteria 1 – Generate jobs and address regional economic imbalance
 - Criteria 2 – Address housing need
 - Criteria 3 – Support local economic growth
 - Criteria 4 – Support Gateways
- Value for Money
- Deliverability

- Risk to Programme
- Risk to Cost
- Risk to Acceptability

All sections of the pro forma must be completed with all supporting evidence and documentation.

3 Bisham Roundabout – Existing conditions

3.1 Junction Location & Layout

The Bisham Roundabout is located between Marlow and Maidenhead on the A404 Trunk Road. This section of the A404 is part of the Strategic Road Network (SRN), linking the M40 at Junction 4 (Handy Cross) with the M4 at Junction 8/9 (Maidenhead). The location of Bisham roundabout is shown in **Figure 1** with its immediate surroundings shown in **Figure 2**. The Bisham roundabout is a five-arm priority roundabout as shown in **Figure 3**.

The A404 is an all-purpose dual carriageway which runs north to south between the M40 Junction 4 and the M4 at Junction 8/9.

The A308 is a rural single carriageway between Bisham and Maidenhead. The road widens to two lanes on final approach to the junction northbound and upon exit southbound for a short distance. This section of the A308 is subject to a 13 tonne weight restriction.

Marlow Road is a suburban single carriageway road providing access to Bisham and further to Marlow Town Centre via Marlow Bridge. Marlow Road is unrestricted until it reaches the Marlow suspension bridge over the River Thames. This bridge is subject to a 3 tonne weight restriction and a 6'6" width restriction.

Under the Wood is a cul-de-sac serving a small number of residential properties. It produces minimal traffic flow and has little impact upon the operation of the junction. It is the only vehicular access for the residences that are located at the end of this small section of road.

This is a detailed road map of the Greater London area, showing major roads, towns, and landmarks. The map is color-coded with various shades of green, yellow, and blue. Major roads are labeled with numbers like M4, M25, and A40. Towns and cities are labeled in bold black text. The map includes a scale bar at the bottom left and a compass rose at the bottom right.

Figure 2 – Bisham Roundabout: Immediate Surroundings

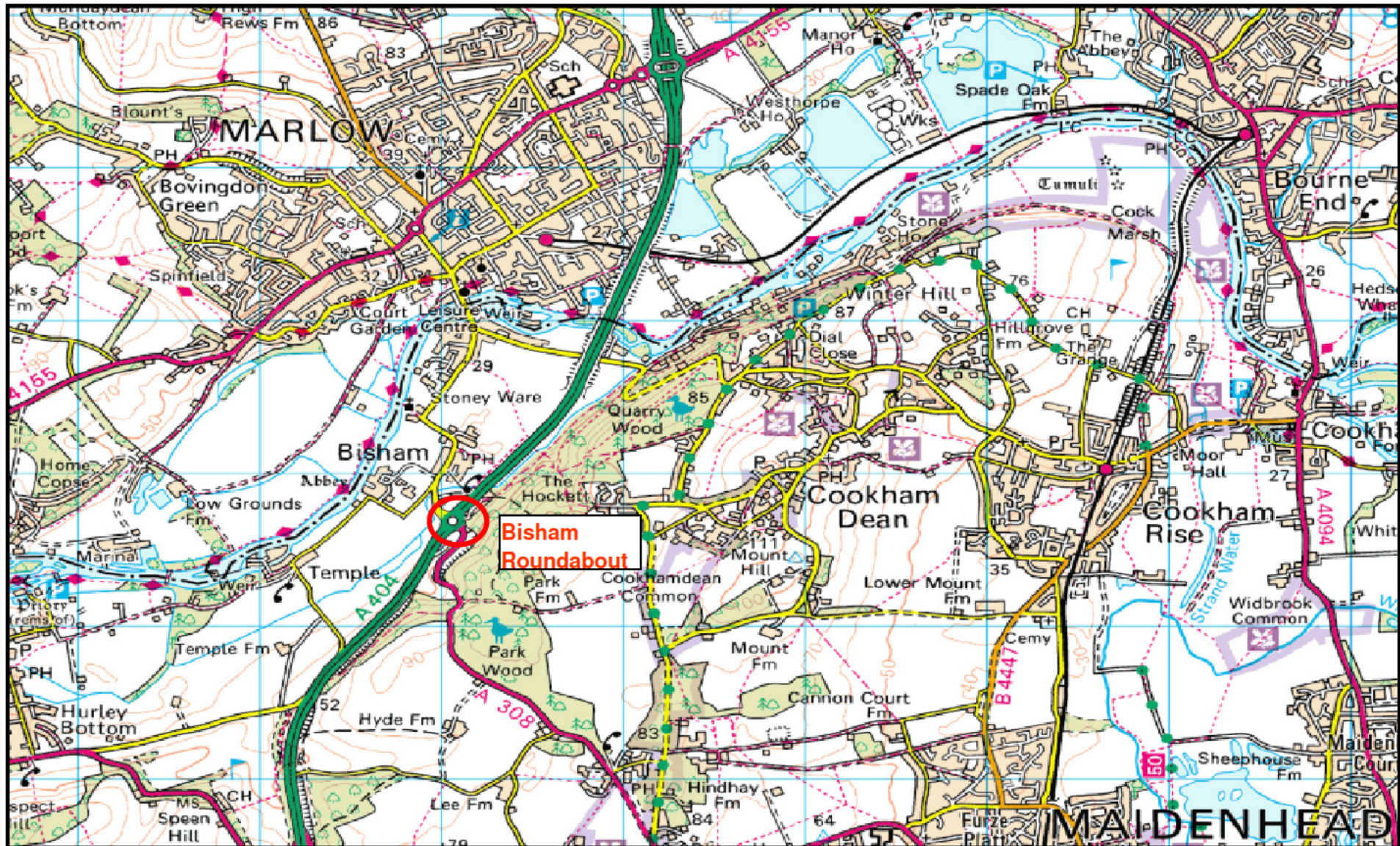
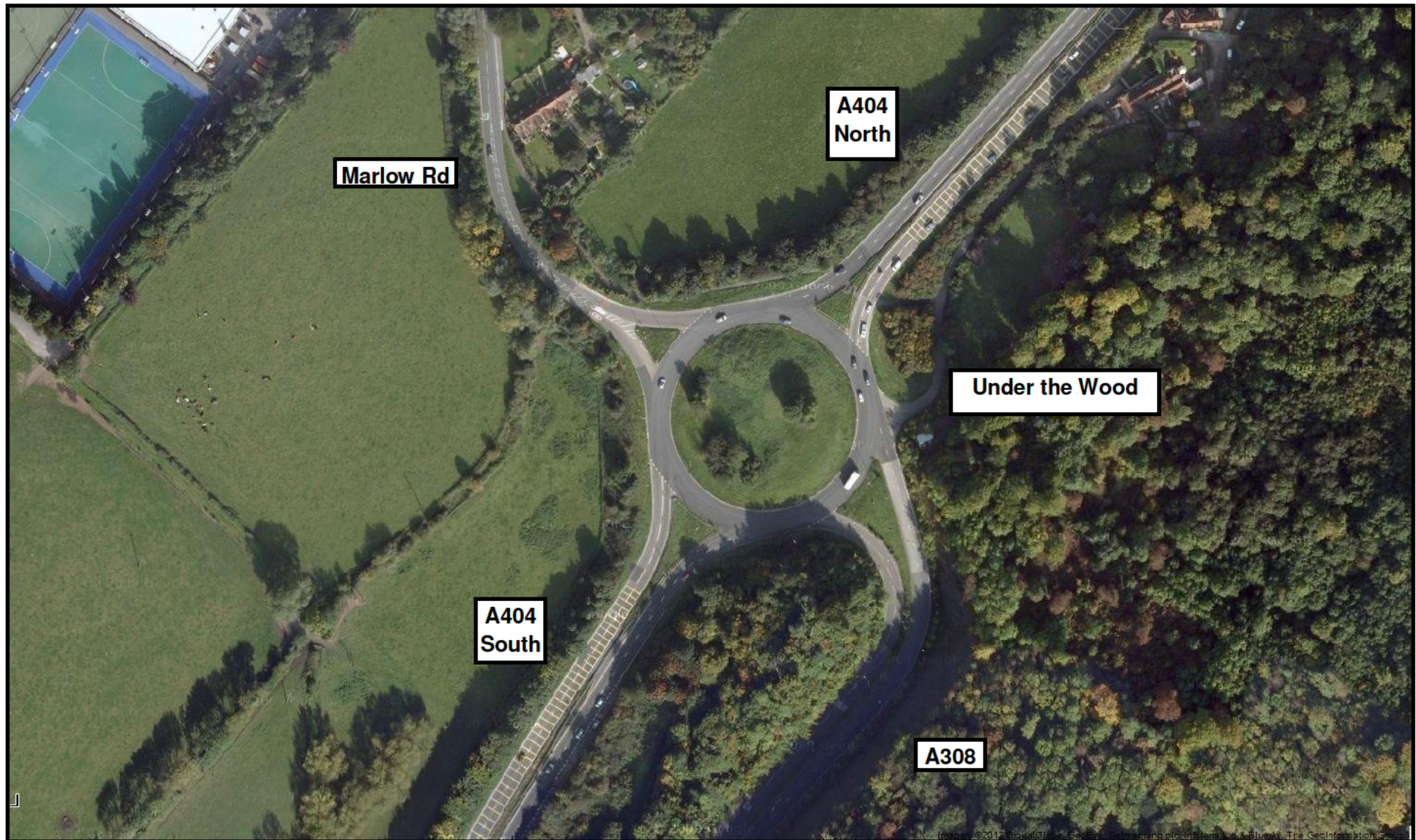


Figure 3 – Bisham Roundabout – Junction Layout



3.2 Operational Assessment: Base Year

3.2.1 Traffic Count Data

Traffic count data from 2 sources has been used in the operational assessment of the Bisham roundabout:

- Manual Classified Turning Count (Tuesday 12 & Thursday 14 May 2009); and
- TRADS Data May 2009.

Observed PM peak hour traffic flows are shown in **Figure 4**. Further traffic data, including counts and journey times is included in the study report dated March 2012.

3.2.2 ARCADY Assessment – Base Year

An ARCADY assessment has been made of the existing Bisham roundabout for the 2009 AM and PM peak hours.

The results of the ARCADY analysis of the Bisham roundabout are summarised in **Table 1**.

Table 1 – A404 Bisham Roundabout: 2009 Base Year ARCADY results.

Arm		2009 AM (07:00-08:00)			2009 PM (17:00-18:00)		
		Max RFC	Max end Queue (veh)	Queue Delay (min/veh)	Max RFC	Max end Queue (veh)	Queue Delay (min/veh)
A	Under the Wood	0.102	0.1	1.30	0.000	0.0	0.00
B	A308	0.460	0.8	0.10	0.459	0.8	0.10
C	A404 South	1.316	409.5	3.36	1.315	591.4	6.98
D	Marlow Road	0.564	1.3	0.13	0.387	0.6	0.11
E	A404 North	1.436	608.9	6.49	1.323	553.6	5.76
Total queuing delay (min/veh)		4.36			5.64		

It is clear from these results that high levels of congestion and delay are experienced at the Bisham Roundabout on a daily basis and that the roundabout is already operating at or above capacity on a regular basis. The maximum modelled queue on the A404 southbound during the AM peak is approximately 600 vehicles (spread over two lanes). If an average vehicle length of 6m was used (also taking into account a small gap between vehicles) that would result in a traffic queue in both lanes extending back for 1800 metres. This takes the end of the queue back over the Thames across the County boundary and on its way to the West Thorpe Junction with the A4155 at Marlow.

Figure 4 – Observed AM Peak Hour Traffic Flows

12&14 May 2009: Average
AM 08:00-09:00
All Vehicles

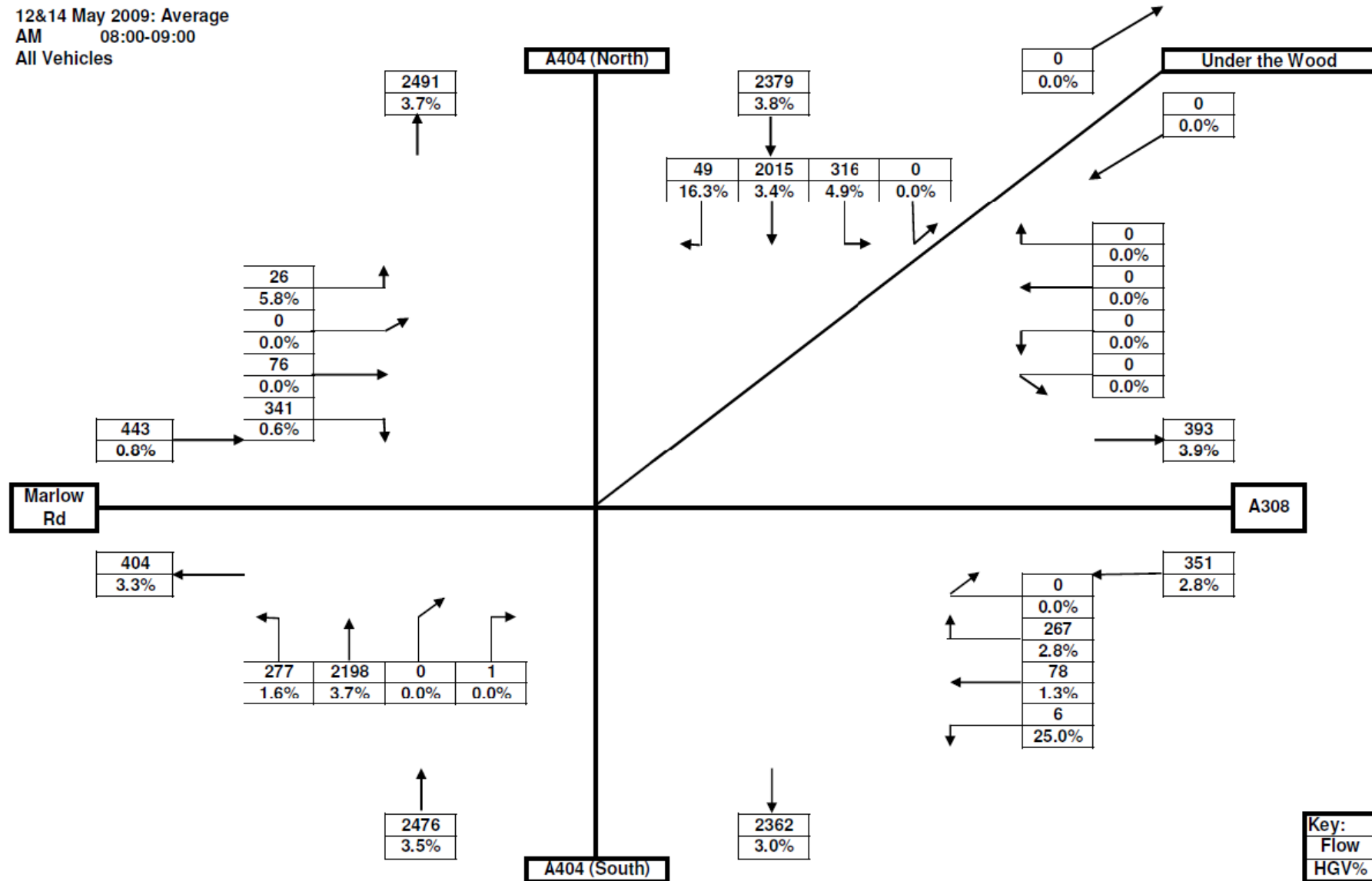
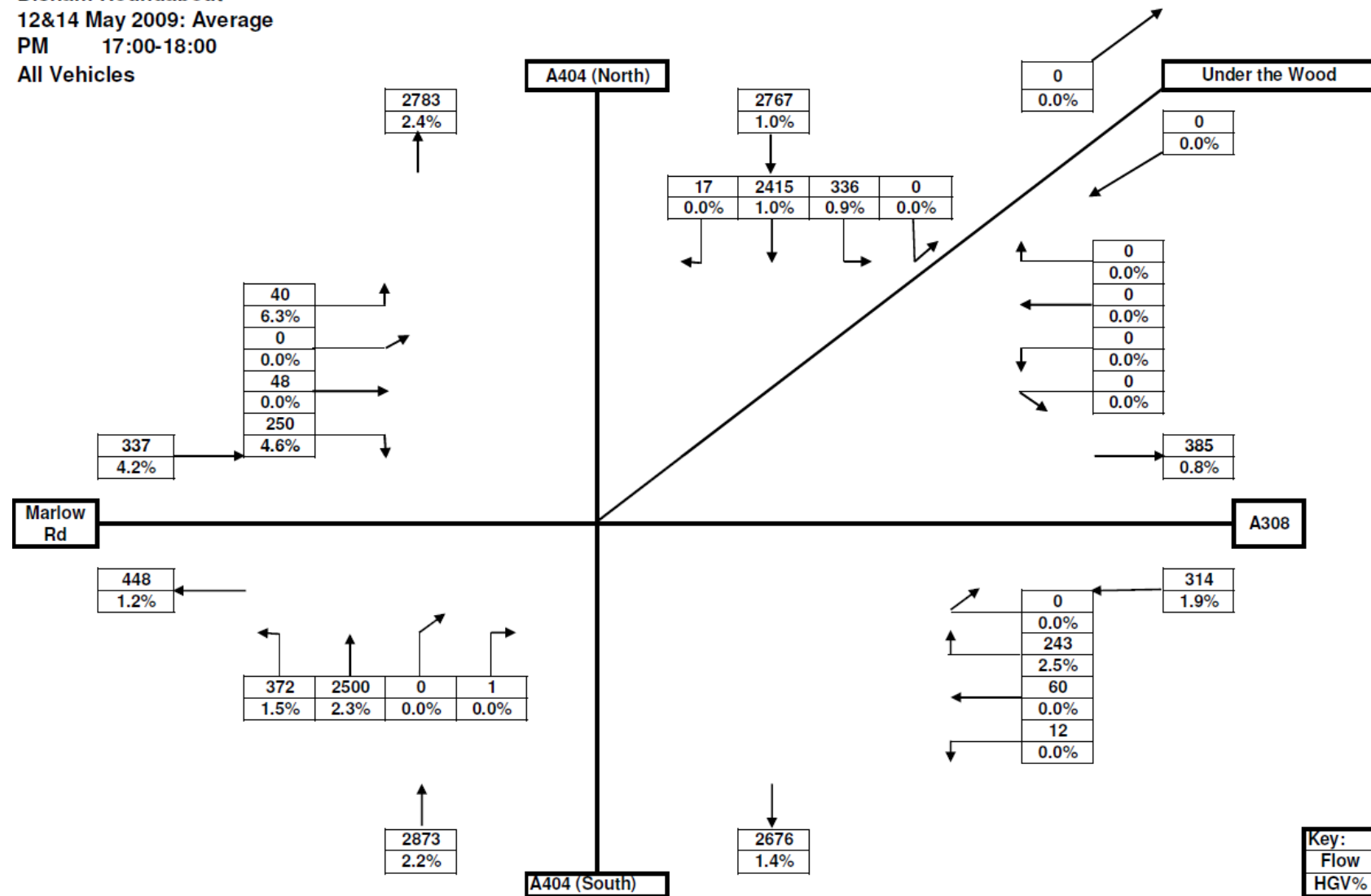


Figure 5 – Observed PM Peak Hour Traffic Flows

Bisham Roundabout
12&14 May 2009: Average
PM 17:00-18:00
All Vehicles



4 Junction Improvement Scheme

4.1 Option Development and Appraisal

Option development and appraisal was undertaken in previous studies (Study Report dated March 2012) and the preferred option was to change the existing priority roundabout into a signalised crossroads.

4.2 Proposed Scheme Design

An indicative scheme design was devised and is shown in **Figure 6**.

4.3 Deliverability

The schedule for construction of the improved Bisham junction is currently for an opening year of 2014. Therefore in terms of deliverability the current scheduled proposed scheme is within the timescales required of PPP schemes which must be completed by the end of the financial year 2014/2015.

4.4 Operational Assessment: Opening & Design Years

The operational assessment of the Bisham junction is reported in full in a previous report produced by EM and submitted to the HA – “A404 Bisham Roundabout: Junction Improvement Study” (March 2012), which is included as supporting documentation to this PPP bid. The sections below provide a brief summary of the modelling and the results.

The future year scenarios have been tested using ARCADY (Do Nothing) and LINSIG (Do Something). The options have been tested for the following scenarios

- 2014 Opening Year AM (7-8) & PM (17-18); and
- 2029 Design Year (7-8) & PM (17-18)

4.4.1 Traffic Growth

Traffic Growth Forecasts were taken from the Road Transport Forecasts 2009 from the DfT's National Transport Model (NTM).

4.4.2 Do Nothing – Priority Roundabout

The results of the ARCADY analysis are summarised in **Table 2**.

It is clear from these results that the existing layout of the Bisham junction as a priority roundabout will not be able to cope with future traffic flows. The modelled future year queues and delay are excessive (modelled queues in 2029 are approximately 1500 vehicles, which would equate to a queue length of around 4.5km). This situation would be unacceptable, as to the north this would take the queue past the West Thorpe junction with the A4155 at Marlow. Similarly to the south, queues would stretch nearly as far as Junction 9a on the A404(M).

**Table 2 – A404 Bisham Roundabout: 2014 Opening Year & 2029 Design Year
ARCADY results.**

Arm		2014 AM (07:00-08:00)			2014 PM (17:00-18:00)		
		Max RFC	Max end Queue	Queue Delay Min/Veh	Max RFC	Max end Queue	Queue Delay Min/Veh
A	Under the Wood	0.106	0.1	1.35	0	0	0.00
B	A308	0.474	0.9	0.10	0.473	0.9	0.10
C	A404 South	1.362	478.2	3.86	1.361	684.5	7.77
D	Marlow Road	0.582	1.4	0.13	0.399	0.7	0.11
E	A404 North	1.487	698.0	7.24	1.368	643.4	6.54
Total queuing delay (min/veh)		4.92			6.33		
Arm		2029 AM (07:00-08:00)			2029 PM (17:00-18:00)		
		Max RFC	Max end Queue	Queue Delay Min/Veh	Max RFC	Max end Queue	Queue Delay Min/Veh
A	Under the Wood	0.162	0.2	2.11	0	0.0	0.00
B	A308	0.602	1.5	0.12	0.590	1.4	0.13
C	A404 South	1.773	1148.9	8.35	1.771	1490.8	12.96
D	Marlow Road	0.737	2.6	0.19	0.505	1.0	0.13
E	A404 North	1.941	1475.1	12.34	1.771	1423.8	11.73
Total queuing delay (min/veh)		9.16			10.94		

4.4.3 Do Something – Signalised Crossroads

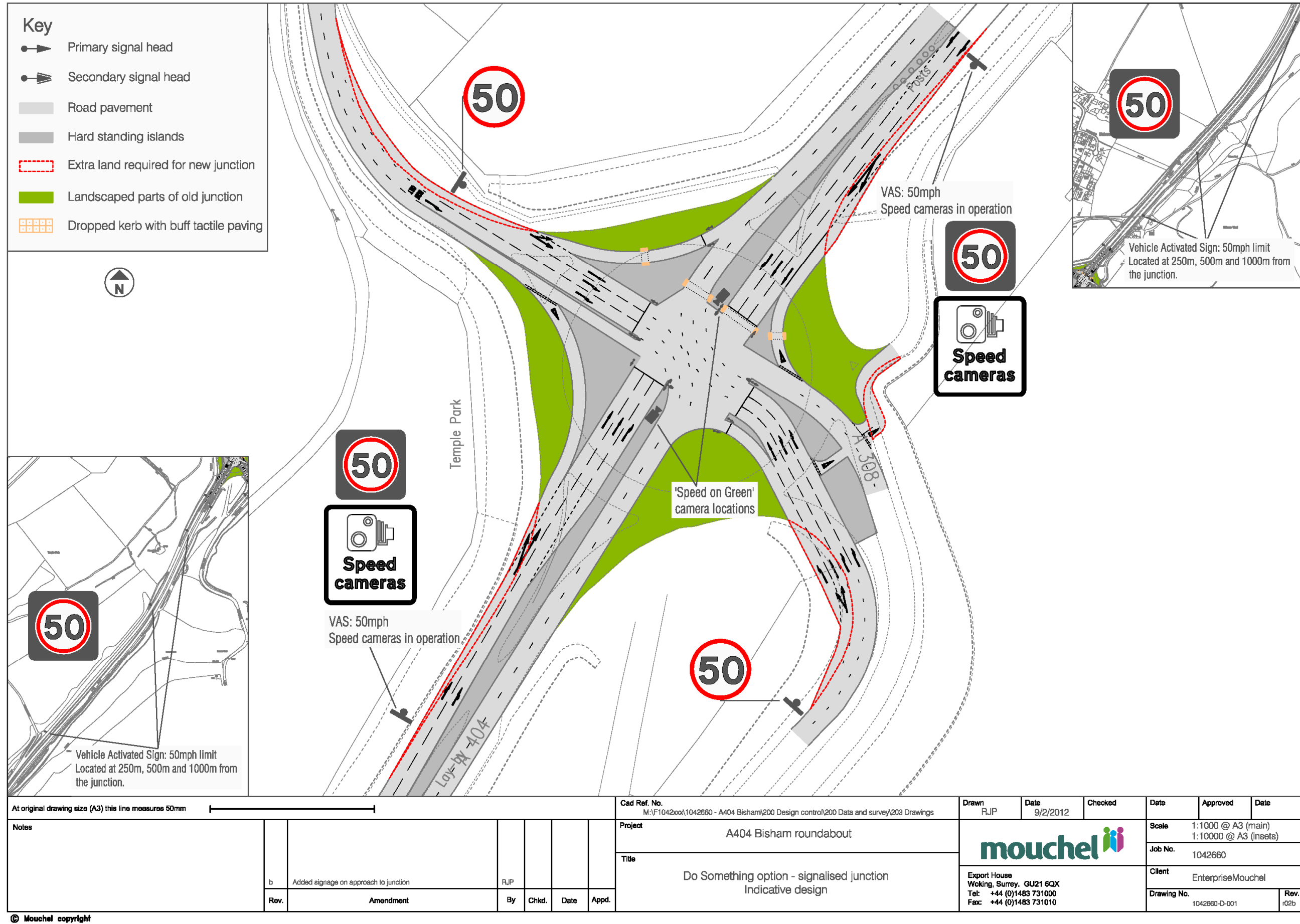
The results of the LINSIG analysis of the proposed signalised crossroads junction at Bisham junction for the opening and design years are summarised in **Table 3**. The tables summarise the overall results for each arm, for comparison with the Do Nothing scenario. Under the Wood has been included in the model as a Give Way arm.

It is evident from these results that, while there are still queues and delays, the situation is far better than with the existing roundabout layout. The maximum degree of saturation on any arm in 2029 is 106%, during the PM peak. The maximum queue is 213 vehicles northbound on the A404 spread across all lanes during the 2029 PM peak. This would equate to a traffic queue stretching back 600m from the junction as opposed to 4.5km if the existing roundabout was retained. Delay is similarly reduced. In the Do Nothing option, average delay per vehicle during the PM peak is 10.94 minutes, whereas in the Do Something (crossroads) it is 2.28 minutes.

Table 3 – A404 Bisham Junction: Signalised Crossroads 2014 Opening Year & 2029 Design Year LINSIG results.

		2014 AM (07:00-08:00)			2014 PM (17:00-18:00)		
Arm		Degree sat %	Mean max queue	Q Delay Min/Veh	Degree sat %	Mean max queue	Q Delay Min/Veh
A	Under the Wood	0.10%	0.0	0.00	0%	0.0	0.00
B	A308	53%	6.4	0.95	76%	10.6	1.32
C	A404 South	63%	58.5	0.28	67%	67.3	0.29
D	Marlow Road	64%	10.7	1.24	67%	8.9	1.25
E	A404 North	68%	69.2	0.34	65%	64.5	0.30
Junction degree of saturation (%)		60%			62%		
Junction delay (min/veh)		0.41			0.41		
Cycle time		120			120		
		2029 AM (07:00-08:00)			2029 PM (17:00-18:00)		
Arm		Degree sat %	Mean max queue	Q Delay Min/Veh	Degree sat %	Mean max queue	Q Delay Min/Veh
A	Under the Wood	0%	0.0	0.00	0%	0.0	0.00
B	A308	79%	14.9	2.00	97%	35.4	4.15
C	A404 South	77%	118.9	0.69	106%	212.9	2.09
D	Marlow Road	95%	95.8	10.16	85%	31.4	4.07
E	A404 North	83%	203.4	1.89	83%	208.4	1.99
Junction degree of saturation (%)		76%			80%		
Junction delay (min/veh)		1.98			2.28		
Cycle time		120			120		

Figure 6 – Bisham Roundabout: Indicative Junction Design



5 Modelling Review

5.1 ARCADY – Base Year & Do Nothing

In order to further investigate the benefits of the proposed junction improvements it will be necessary to provide a more up to date and robust operational appraisal of the junction itself and of the wider network impact of the proposed scheme. The wider impact of the scheme will need to be assessed with regards to the scheme impact upon the junction of the A404 with M40 at Wycombe (Junction 4 Handy Cross) and the M4 at Maidenhead (Junction 8/9).

5.2 LINSIG – Do Something

The traffic growth forecasts used have been calculated using the Road Transport Forecasts 2009 from the DfT's National Transport Model (NTM).

5.3 Conclusions & Risks

In operational and economic terms the proposed improvement scheme at Bisham roundabout has significant benefits in terms of congestion and delay which is likely to have a beneficial impact upon the economic growth and sustainability of the area.

In terms of deliverability the current scheduled opening year is 2014 which would put the scheme within the timescales required of PPP schemes.

It is therefore recommended that the proposed improvements to the A404 Bisham roundabout are eligible for the PPP in terms of congestion relief, benefiting local economic development and sustainability as well as in terms of deliverability.

5.3.1 *Traffic Modelling and Data Collection*

In order to make a robust appraisal of the proposed scheme with regards to its impacts on the junction and the wider road network it will be necessary to use the most appropriate modelling software, which in this case is most likely to be a microsimulation model (Paramics or Vlissim).

6 Project Appraisal

6.1 PAR (Project Appraisal Report)

PAR Version 6.2 has been used to undertake an economic appraisal of the proposed scheme, taking account of the costs and benefits of the scheme. A foundation PAR at conception stage has been produced. The main inputs and outputs of the PAR are summarised in **Table 4**.

The Signalised Crossroads option has produced a BCR of 83.70 with a VM score of 9.4. The PVC and PVB are both discounted to 2002 values. The total cost is in 2012 Q1 prices.

The modelled journey time benefits accrued by the scheme are expressed in time saved per vehicle in the modelled period, which are

- AM peak: 4.51 minutes per vehicle per hour
- PM peak: 5.92 minutes per vehicle per hour

The benefits are accrued over 2 hours in both peak periods due to the high flows observed over the two hour peak periods.

In terms of congestion relief the calculated relief for the junction is 25,902 PCUs per week. The congestion benefit is only included for the A404 arms as it is these arms of the junction that are over capacity ($RFC > 1$) in the opening year with regards to the Do Nothing (without scheme) scenario.

6.2 Conclusions

The high BCR and VM score indicates that the proposed scheme would provide good value for money as it will be beneficial in terms of reducing congestion and delay as well as maintaining economic sustainability and growth.

Table 4 – A404 Bisham Junction: Signalised Crossroads Option PAR Summary.

Scheme Cost (PVC) (2002)	£2,411,788
Total Cost (2012)	£4,175,415
Total PVB (2002)	£201,862,516
Total BCR	83.70
VM Points	
Economy – TEE (Business Users)	3.96
Economy – Reliability (Business Users: DDV), Large Beneficial	0.97
Environment (Landscape & Biodiversity)	-1.00
Society – TEE (Commuting & Other Users)	4.41
Society – Reliability (Commuting & Other Users: DDV), Large Beneficial	1.02
NATA Impacts: Unmonetised (Congestion Benefits)	1.0
Total VM points	9.4

7 Conclusions and Risk Register

7.1 Conclusions

In operational and economic terms the proposed improvement scheme at Bisham roundabout has significant benefits in terms of congestion and delay which is likely to have a beneficial impact upon the economic growth and sustainability of the area. This is reflected in the high BCR (83.7) and VM (9.4) score.

In terms of deliverability, the current scheduled opening year is 2014 which would put the scheme within the timescales required of PPP schemes.

It is therefore recommended that the proposed improvements to the A404 Bisham roundabout are eligible for the PPP in terms of congestion relief, benefiting local economic development and sustainability as well as in terms of deliverability.

Nevertheless in order to further investigate the benefits of the proposed junction improvements it will be necessary to provide a more up to date and robust operational appraisal of the junction itself and of the wider network impact of the proposed scheme. This would involve the collection of further traffic data and the construction of a microsimulation model.

7.2 Risk Register

A Risk Register has been produced for this scheme which includes those concerned with the operational and economic assessment of the scheme.