

RWA Technical Note			
Project -	Chiswell Green		
Subject -	LinSig Modelling Support		
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## 1. Introduction

Red Wilson Associates (RWA) have been appointed by Glanville Group and Milestone Transport Planning to provide expert LinSig modelling advice concerning the housing applications 5/2022/0927 and 5/2021/3194.

RWA is a progressive Traffic Engineering Consultancy. We specialise in highway and traffic signal design, traffic modelling and planning the construction of highway schemes from concept through to implementation. With regards to traffic modelling, we provide expert services in local junction and microsimulation modelling with extensive knowledge in LinSig and Vissim. This has included supporting other development proposals through inquiry.

In the absence of specific Local Authority modelling guidelines, we undertake modelling in accordance with WebTAG or TfL Model Audit Process guidance as best practice to ensure a robust modelling assessment. We recognise the importance of robust assessments to accurately reflect the impact of a proposal.

### Project Appreciation

Glanville Group have previously completed LinSig modelling of a proposed double junction to replace the existing double mini roundabout of Watford Road with Tippendell Lane and Chiswell Green Lane. This is to mitigate the combined impact of introducing the two proposed housing developments.

Hertfordshire County Council (HCC) have provided the following comments with relation to the model as part of their review as the Local Highway Authority;

*'this is based on the preferred option 1, and the intermediate case of 'alternate crossings', its mainly northbound and in the AM peak*

1. *Internal lanes 7/1, 9/1 and 9/2 fill and block early in the green time of the feeder lanes supplying them 6/1, 8/1, 8/2*
2. *Internal Lanes 7/2 and 6/2 fill and block early in the green time of the feeder lanes supplying them 1/2 and 5/1*

*In essence some of the lanes will be on green when no traffic can disperse, whereas the model shows dispersal throughout the green time.'*

RWA were appointed to address HCC's comments and provide an independent and expert review of the LinSig model to ensure it accurately represents how the junction will be used. LinSig does not have the capability to recognise mean max queues potentially blocking back to an upstream link in the model.

Therefore, RWA have made adjustments to the bonus green on the links, through adding underutilised green time.

This technical note details the changes made to the model, the anticipated impact of these changes and recommended design amendments to ensure the optimal proposal is produced for all road users.

## 2. Review of Option 1

We have undertaken a review of the LinSig model in accordance with the design drawing provided by Glanville Group as well as the turning counts. The following amendments have been made to the model to ensure it accurately reflects how we would anticipate it would operate;

- Adjustments to turning radii for saturation flows;
- Changes to AM and PM flows;
- Adjustments to intergreen timings;
- Demand dependency calculations for stage 4 (the shops) at the northern junction; and
- Underutilised green times to account for blocking back.

Further details of these amendments are noted below.

### Adjustments to turning radii for saturation flows

Turning radii were measured from the AutoCAD drawing provided by Glanville Group of the proposal. The assumed turning movement of the vehicles was drawn and the radii of the arc extrapolated for each left or right turning movements at the stop line. This has been input into the geometric saturation flow calculation for each movement.

### Changes to AM and PM flows

It was noted that the AM and PM flows were not in line with those provided in the turning count diagrams. As such, Glanville Group have updated the origin destination matrices to be input into the model. In the PM peak this resulted in an increase of flow in the model and in the AM the only amendment was a reduction of 10 PCUs between Chiswell Green and Watford Road south.

### Adjustments to intergreen timings

We undertook measurements of the conflicting movements in the AutoCAD drawing and calculated the intergreen timings between each conflicting movement. These were updated in the model and in some cases increased and in others reduced.

### Demand dependency

It has now been assumed that the pedestrian crossing is demanded every cycle. As a flow of 10 PCUs has been assumed to egress the shops in both peaks at the northern junction, it has been assumed that this stage is demanded 10 times in the AM and 10 in the PM. This is as a robust assessment as it assumes each vehicle arrives at the stop line independently of one another.

The benefit which has been provided to Watford Road if the shops, which runs in stage 4, is not called has been accounted for as a bonus green on the Watford Road approaches to the north junction.

Underutilised green times to account for blocking back

In both the north and southbound direction, traffic traverses three stop lines. LinSig does not account for the fact that although one signal may be on green, the downstream stop line could be on red resulting in the traffic blocking back through the upstream stop line.

In the AM and PM peak periods the mean maximum queue exceeded the length of the link on internal links in the model suggesting that the queue would block back to the upstream stop line. As such, underutilised green time (UGT) would be present whereby the signal were on green but as the downstream was on red the traffic would be stationary after filling the gap between the green and red stop lines.

In a base layout, underutilised green time surveys would be undertaken on site to calculate the level of UGT but as this is a proposed design engineering judgement and experience has been applied to calculate the appropriate values.

This has more greatly been applied in the AM peak period where internal queuing was more severe. In most cases this has reduced the mean maximum queue lengths on the internal links to be lower than the link length, however, the queue for right turning traffic on Arm 7:2 exceeds the link length so therefore additional UGT has been applied to Arm 1:2 where it is anticipated this queue would block back to.

We believe that the LinSig now best replicates the likely operation of the proposed design as best as practicable.

Table 1 below shows the anticipated capacity results for all signalised links.

*Table 1 – Option 1 Chiswell Green Degree of Saturation and MMQ Results*

	Link	Option 1 Degree of Saturation (%)	Option 1 Mean Max Queue (PCUs)
<b>AM</b>			
Watford Road South	Arm 1:1	108.9%	63.4
Chiswell Green Lane	Arm 5:1	100.6%	21.8
Southbound Ahead Exit	Arm 9:1	63.1%	1.4
Southbound RT Exit	Arm 9:2	32.8%	0.6
Internal NB at Ped Nearside	Arm 6:1	59.0%	5.2
Internal NB at Ped Offside	Arm 6:2	19.8%	3.2
Internal SB at Ped Nearside	Arm 8:1	63.1%	4.1
Internal SB at Ped Offside	Arm 8:2	10.7%	1.0
Watford Road North	Arm 2:1	102.3%	45.3
Tippendell Lane	Arm 3:1	102.3%	25.7
Shops	Arm 4:1	7.9%	0.3
Northbound Ahead Exit	Arm 7:1	58.1%	0.7
Northbound RT Exit	Arm 7:2	77.6%	6.3
<b>PM</b>			
Watford Road South	Arm 1:1	76.3%	16.8

Chiswell Green Lane	Arm 5:1	70.9%	6.3
Southbound Ahead Exit	Arm 9:1	48.4%	0.5
Southbound RT Exit	Arm 9:2	48.2%	0.7
Internal NB at Ped Nearside	Arm 6:1	56.6%	2.9
Internal NB at Ped Offside	Arm 6:2	11.3%	1.8
Internal SB at Ped Nearside	Arm 8:1	49.2%	2.3
Internal SB at Ped Offside	Arm 8:2	13.3%	1.2
Watford Road North	Arm 2:1	85.6%	22.4
Tippendell Lane	Arm 3:1	81.5%	10.0
Shops	Arm 4:1	7.1%	0.3
Northbound Ahead Exit	Arm 7:1	61.6%	1.6
Northbound RT Exit	Arm 7:2	53.9%	2.0

The model results demonstrate that the proposal will result in the junction operating over capacity in the AM peak with multiple approaches with degree of saturations greater than 100%. We therefore would not recommend the introduction of this option at this location.

### 3. Recommended Option

On completion of the aforementioned review of Option 1, we have recommended that the straight across crossing in the centre of the junction is relocated to the south of the double junction and converted into a staggered facility. This allows the pedestrian facility to run in parallel with the traffic movements with the ped on the southbound arm running with Chiswell Green Lane and the ped on the northbound arm running with the indicative arrow.

This option allows the pedestrian crossings to run for longer than a minimum period when the traffic phases in their stages operate for longer.

This reduces the number of internal links in the network and therefore the number on incidents in which vehicles could be held within the network.

A design drawing has been provided by Glanville Group for this proposal and transposed into the LinSig modelling. As with Option 1, where appropriate we have added UGT to the Watford Road south approach in the AM to account for any blocking back as the queue discharges northbound at the downstream stop line.

The results for this proposal are shown below in Table 2 with AM running at 88 seconds and the PM at 104.

Table 2 – Staggered Pedestrian Facility Chiswell Green Degree of Saturation and MMQ Results

	Link	Staggered Degree of Saturation (%)	Staggered Mean Max Queue (PCUs)
<b>AM</b>			
Watford Road South	Arm 1:1	94.0%	27.6
Chiswell Green Lane	Arm 5:1	85.0%	13.6

Southbound Ahead Exit	Arm 7:1	62.2%	8.4
Southbound RT Exit	Arm 7:2	34.0%	1.4
Watford Road North	Arm 2:1	87.6%	25.6
Tippendell Lane	Arm 3:1	98.5%	21.5
Shops	Arm 4:1	8.2%	0.3
Northbound Ahead Exit	Arm 6:1	62.5%	6.8
Northbound RT Exit	Arm 6:2	79.3%	8.7
<b>PM</b>			
Watford Road South	Arm 1:1	85.5%	20.3
Chiswell Green Lane	Arm 5:1	64.6%	5.8
Southbound Ahead Exit	Arm 7:1	49.6%	4.3
Southbound RT Exit	Arm 7:2	42.1%	2.2
Watford Road North	Arm 2:1	85.4%	21.9
Tippendell Lane	Arm 3:1	92.3%	12.7
Shops	Arm 4:1	6.9%	0.3
Northbound Ahead Exit	Arm 6:1	59.2%	2.8
Northbound RT Exit	Arm 6:2	46.5%	1.9

The model results show that this option operates at a lower level of capacity to the previously proposed option with all approaches operating with a degree of saturation below 100%. Therefore, this option is recommended at this location.

#### 4. Conclusion and Recommendations

RWA were appointed by Glanville Group and Milestone Transport Planning to provide independent modelling and traffic signal design expertise to support the combined appeal for their respective planning applications in Chiswell Green.

We have reviewed the modelling of the design previously completed by Glanville Group and have made adjustments to the model to ensure it addresses the concerns raised by HCC. We agree that the model did not previously accurately replicate potential blocking back as a result of internal stop lines in the model.

This has now been accounted for by applying underutilised green time as a negative bonus green to the lanes which would experience blocking back. The results presented in this technical note now account for the fact that although the signal may be green the traffic may be held at the stop lines in the model as the downstream links are on red.

The model results for this option show that the junction would likely operate over capacity with excessive queuing and delay on entry links into the model particularly in the AM peak on Chiswell Green Lane, Watford Road and Tippendell Lane.

We have therefore recommended the conversion of the pedestrian crossing to a staggered facility which is included in the operation of the southern junction. The crossing on the southbound will run in parallel with Chiswell Green Lane and the northbound with the right turn indicative arrow. The model results



associated with is proposal show that the junction would allow for all approaches to operate below 100% in both peaks and therefore within a level of capacity acceptable to HCC.