



TECHNICAL NOTE 1.0

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SUBJECT	Woking HIF Paramics Modelling	PROJECT NO.	70046150
CLIENT	Woking Borough Council	PREPARED BY	AUTHORISED BY
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APPENDICES

Appendix A – A320 Woking Town Centre Scheme Drawings

Appendix B – Plan of Additional Housing Site Locations

1. INTRODUCTION

- 1.1. WSP has been commissioned by Woking Borough Council (WBC) to undertake microsimulation modelling to support the Housing Infrastructure Fund (HIF) bid to Homes England and MHCLG for the A320 Guildford Road improvement scheme, in Woking town centre. The scheme comprises works underneath the Victoria Arch and the Guildford Road, Victoria Road and Station Approach gyratory.
- 1.2. This technical note provides details of the assessments undertaken to assess the impact of the proposed Guildford Road Highway Works improvement scheme and associated potential additional Local Plan and HIF-related housing developments. The results compare average network performance metrics, average journey times and vehicle speeds across each of the model scenarios.

2. MODEL SCENARIOS

- 2.1. For the purpose of this assessment, six main scenario models have been developed for both the AM and PM peak periods, based on a requirement to develop a 2023 scheme opening year model and a 2038 (plus 15 year) forecast model:
 - 1 Scenario 1: 2014 WSP Revised Base Year with Victoria Square Highway works – includes Victoria Square Highway works; extension of A320 Guildford Road (zone 11) to accommodate additional queueing space; the addition of A320 Guildford Road / Hill View Road junction (zone 26); and additional changes to better reflect existing traffic conditions – audited and agreed with SCC.
 - 2 Scenario 2: 2023 Do Nothing – network as 1 above and matrix includes committed development up to 2023 (matrix development methodology provided in Section 4).
 - 3 Scenario 3: 2023 Do Something – network includes the proposed A320 Woking Town Centre scheme and matrix as provided in scenario 2 above.
 - 4 Scenario 4: 2038 Do Nothing – network as 1 above and the matrix includes background traffic growth (2023 to 2038) (matrix development methodology provided in Section 4)
 - 5 Scenario 5: 2038 Do Something – network includes proposed A320 Woking Town Centre scheme and matrix as provided in scenario 4 above.
 - 6 Scenario 6: 2038 Do Something Housing – network includes proposed A320 Woking Town Centre scheme and matrix includes background traffic growth (2023 to 2038) and additional ‘unlocked’ housing developments up to 2038 (matrix development methodology provided in Section 4)
- 2.2. A summary of the Scenario models is provided in Table 1.

Table 1 – Scenario Models

		Scenario 1	Scenario 2*	Scenario 3	Scenario 4*	Scenario 5	Scenario 6
Network	Do Nothing	X	X		X		
	Do Something			X		X	X
Matrix	2014 Baseline	X					
	2023 Committed		X	X			
	2038 Forecast				X	X	
	2028 Forecast plus Additional Housing						X

Scenario 2 - this model was used to test the level of dependent development with the Local Plan committed 1,251 units included initially. The AM peak model locked up, however, with this level of development and significantly reduced the number of modelled vehicles within the network for the TUBA assessment. A lower number of 938 units was subsequently identified as the number of units that could be delivered before impacting significantly on the model network performance.*

Scenario 4 - As identified above, the 2023 Do Nothing model network locked up with the addition of the background traffic growth. This led to unrepresentative matrix data for the TUBA assessment. In order to address this issue, while still maintaining the additional matrix demand in the model, the frequency of the pedestrian crossing times at the Guildford Road, Victoria Road and Station Road gyratory 'triangle' was reduced to ensure that sufficient trips completed their journey through the network and associated delays in the model were picked up in the matrices for TUBA.*

- 2.3. An additional scenario has been prepared to consider the impacts of providing a 'do less' scheme option which provides the signalised scheme to replace the existing Guildford Road, Victoria Road and Station Road gyratory 'triangle' works but without the Victoria Arch bridge widening scheme. The results from this model test are included in Section 5 alongside the main model scenario results to provide an indication of the level of development that could be delivered with this reduced scheme. Whilst this is the only alternative reduced scheme available there are a number of reasons why this scheme could not be delivered, and further information is provided within the HIF business case (e.g. In Chapter 3, 'Options Appraisal').

3. MODEL NETWORK

- 3.1. Appendix A provides details of the A320 Guildford Road Highway improvement scheme which comprises major improvements to the severely congested section of the A320 just south of the station as well as improvements to Victoria Arch, the road underbridge taking the busy A320 beneath the South Western Main Line at Woking station. With the A320 being the main road corridor through Woking, traffic volumes are already very high and capacity constraints near Victoria Arch exacerbate delays and congestion.

Figure 1 Model Network without the A320 Woking Town Centre Scheme

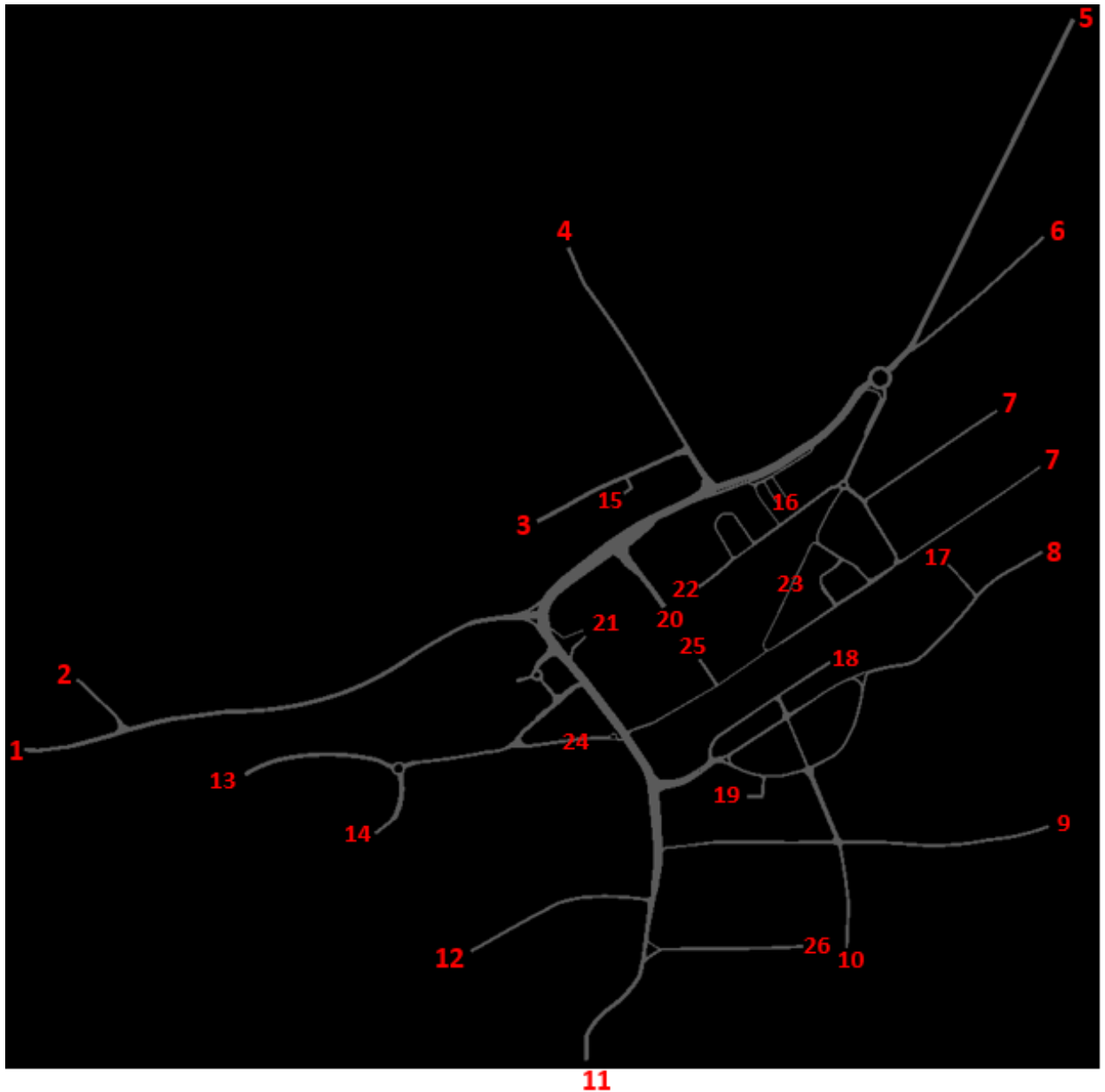


3.2. As shown in Table 1, scenario models 3, 5 and 7 include the Guildford Road Highway Works. The Guildford Road Highway Works consist of removing the gyratory system, and replacing it with two three arm signal junctions. The scheme also consists of improvements to the pedestrian and cycle network, including the provision of segregated footway / cycleways and increased levels of crossing facilities. Drawing No. 70018229-SK-28-H contained in Appendix B illustrates the network changes, which are as follows:

- Shared cycleway/footway from Constitution Hill (at the entrance to Woking Park) northwards;
- Heathside Road between entrance to Woking Police Station and A320 Station Approach changed from one lane in each direction to left-in/left-out access only;
- Separate right turn flare for vehicles turning from the A320 into residential parking area and parking serving The Sovereigns Public House;
- Relocated staggered pedestrian crossing on A320, to the point just north of the junction with Heathside Road;
- A320 Guildford Road northbound between no.11 Guildford Road and no.5 Guildford Road increased to 3 lanes northbound and changed to two lanes southbound;
- Junction of A320 Victoria Road / A320 Guildford Road / A320 Victoria Way converted to three arm signalised junction with lanes in all directions, and pedestrian crossings on the southern and eastern arms;
- Conversion of Station Approach between Heathside Road and Victoria Road to shared cycleway / footpath with a minimum width of 3m, increasing to 4m where adjacent to a building;
- Relocated staggered pedestrian crossing on Station Approach, 11m west of existing crossing outside the Magistrates' Court; and
- New two-way site access onto Station Road, which is to be further developed in conjunction with site proposals.

3.3. The town centre road network, including the proposed Guildford Road improvements and the Victoria Square Highways Works changes are shown in Figure 2 below:

Figure 2 Model network with the A320 Woking Town Centre Scheme



- 3.4. Some of the initial forecast model runs showed certain model zones where traffic queued outside the network, notably zones 1, 9, 10 and 13. This meant that when the matrix data was generated for use in TUBA, trips did not include their full journey time (only the time that they entered the network is recorded in Paramics outputs), therefore the link to these zones has been extended to accommodate the queuing to generate accurate information on trip start times from these zones across all scenarios and to ensure the models are comparable. Zone 5 (Chertsey Road) also experiences queueing into the zone, and this is experienced across all models and is a recognised issue from previous modelling work. Further mitigation measures may be required at this location to further enhance the proposed scheme provisions.
- 3.5. In each of the above model networks the traffic signals have been optimised for the traffic flows.

4. MATRIX SCENARIOS

- 4.1. As shown in Table 1, a number of matrix scenarios have been assessed in the models and the methodology for deriving these is provided in this section. The existing Woking Town Centre Paramics model has been used for this assessment and the model years available from the previous work were 2014 and 2026.

2023 Committed Matrix

- 4.2. The scheme opening year is assumed to be 2023 so a committed development matrix has been generated by reviewing up to date planning and development information provided by Woking Borough Council, alongside the assumptions previously used in the generation of the 2026 matrix which has been used for forecasting purposes in Woking town centre to date.
- 4.3. The 2026 model used development forecasts and existing land use and forecast land use trip rates to establish a net difference in the number of trips for application firstly to the strategic SINTRAM model and also the local town centre Paramics model directly for the town centre developments. This means that the previous modelling work took some account of traffic re-routing associated with proposed development in the area.
- 4.4. For the 2023 model the background traffic growth has been extrapolated from the factor that was derived from the SINTRAM model for application to the Paramics model matrix, assuming that linear growth occurs between 2014 and 2026. Table 2 below compares the growth factor applied in 2023 and 2026.

Table 2 – 2023 Calculated Growth factor VS 2026 SINTRAM Growth Factor

Time Period	Matrix	2026 Growth Factor	2023 Growth Factor
AM	<i>Matrix 1</i>	1.04534	1.033815
	<i>Matrix 2</i>	1.022517	1.016841
PM	<i>Matrix 1</i>	1.035007	1.026142
	<i>Matrix 2</i>	0.994369	0.995773

- 4.5. The committed development sites (up to 2023) that were used in the previous modelling have been reviewed and updated by using the updated local plan document (Appendix 4.docx and Applications btw val date - vars specifications.xlsx) provided by Woking Borough Council (WBC) on 24th October 2018. In the proforma of developments used in the previous modelling work it was notable that a reduced trip rate was used for the Victoria Square development due to the level of congestion that was present in the model. For this new work the trips have been updated to reflect the level of trips provided in the Transport Assessment for this site. The trip rates for most of the other developments were based on TRICS trip rate assumptions.
- 4.6. The Local Plan development information showed that up to 1,251 units could be provided up to 2023, so this level of residential development was included in the initial 2023 committed development matrix for testing in the model. Table 3 compares the matrix difference between the 2014 base and the 2023 committed development models and provides the overall level of growth associated with the committed and expected Local Plan developments.

Table 3 - 3 Hour Paramics Matrix differences – 2014 Base vs 2023 Committed

Time Period	Matrix	2014 Base Model	2023 Committed	Diff	Diff%
AM	<i>Matrix 1</i>	15205	17301	2096	13.78%
	<i>Matrix 2</i>	560	583	23	4.11%
PM	<i>Matrix 1</i>	17880	19757	1877	10.50%
	<i>Matrix 2</i>	552	556	4	0.72%

- 4.7. The initial model run results indicated that the existing model network could not cope with the 2023 committed development matrix, particularly during the AM peak hour. Due to 'level of call' on the pedestrian crossings on the Guildford Road, Victoria Road and Station Road gyratory 'triangle', the majority of model runs completely locked up. This meant that insufficient full trip information was collected during the peak hour from the model which resulted in unreliable data transfer into the TUBA model. A second test was undertaken which provided for 938 dwellings and the reductions were applied to the LGV matrix. This reduction resulted in a reduced matrix 1 (Car, LGV) with a total of 17,092 trips in the 3 hour matrix in the AM peak and in the PM 3 hour matrix a reduced matrix 1 (Car, LGV) with a total of 19,522 trips.

- 4.8. Under this reduced level of development, the majority of model runs did not ‘lock up’ during the peak hours and sufficient trip information was available for input to the TUBA model.
- 4.9. Further information on the data from the analysis of data from the models is provided in Section 5.

2038 Forecast Matrix

- 4.10. The 2038 forecast year matrix has been developed to include local background traffic growth from 2023 to 2038, by applying an adjusted Tempro local growth factor. This was derived by adjusting the planning assumptions included in Tempro to remove the 3,304 additional housing units and the resulting growth factor was 1.0891. This was applied to the AM and PM 2023 committed development matrices. It was necessary to remove the 3,304 units from the Tempro planning assumptions because these developments are added to the matrix individually and this approach therefore ensures no double-counting of the trips. Table 4 provides the change in the 3 hour matrix totals in the Paramics model.

Table 4 - 3 Hour Paramics Matrices – 2023 Committed vs 2038 Forecast

Time Period	Matrix	2023 Committed	2038 Forecast	Diff	Diff%
AM	<i>Matrix 1</i>	17301	18843	1542	8.91%
	<i>Matrix 2</i>	583	635	52	8.91%
PM	<i>Matrix 1</i>	19757	21517	1760	8.91%
	<i>Matrix 2</i>	556	605	48	8.91%

2038 Forecast plus Additional HIF Housing Matrix

- 4.11. Appendix B provides the location and number of units associated with each of the additional ‘unlocked’ HIF related housing sites. These sites have been individually assessed in terms of their trip generation, distribution and assignment before inclusion in the Paramics matrix using the following methodology:
 - Census 2011 data was used to understand the existing trip information related to the site locations by allocating each site to a COA (Census Output Areas used by 2011 census) to establish;
 - The journey to work origin and destination COAs.
 - The mix of development (flats and houses) to assist in the determination of a suitable trip rate.
 - TRICS and/or TA trip information was used to determine a trip rate for each site, based on its location and expected residential type ‘mix’; and
 - A GIS based TomTom dataset was used to understand and predict the trip assignment within the Paramics model network and apply the development trips to the Paramics zones.
- 4.12. For each of the 13 development sites the following trip rate assumptions were applied initially:
 - For sites 1 and 2 the percentage of flats in the COA is less than 50%, so it is assumed that the sites are mixed flat and house sites and the trip rate for mixed flat and house has been applied;
 - For sites 5, 6, 9, 10 and 11, according to census data, the percentage of flats in the COA is more than 80%, so it is assumed that these sites are privately owned flats and so trip rate for flats is applied; and
 - For sites 3, 4, 7, 8, 12 and 13 the trip rates were assumed to be of a similar order to those provided in the TA for Goldsworth Road, due to their proximity to each other.
- 4.13. Table 5 provides details of the trip rates for peak hour applied for the initial ‘unlocked’ housing matrix and the number of dwellings this was applied to. By applying the higher trips rates to the peak hour Car/LGV matrix, in the AM period (07:00-10:00), a total of 2,373 additional trips are generated and in the PM period (16:00-19:00) a total of 2,832 additional trips are generated across the sites. Table 6 provides the number of the trips generated for each site in 3 hours AM and PM period.

Table 5 - Initial Trip Rates for the additional 'unlocked' housing development in 2038 matrix

Site	Number of dwellings	AM Arrival (08:00-09:00)	AM Departure (08:00-09:00)	AM Total	PM Arrival (17:00-18:00)	PM Departure (17:00-18:00)	PM Total
1	112	0.105	0.329	0.434	0.331	0.156	0.487
2	150	0.081	0.286	0.367	0.305	0.137	0.442
3	300	0.063	0.129	0.192	0.084	0.05	0.134
4	552	0.063	0.129	0.192	0.084	0.05	0.134
5	200	0.068	0.147	0.215	0.111	0.079	0.190
6	140	0.068	0.147	0.215	0.111	0.079	0.190
7	210	0.063	0.129	0.192	0.084	0.05	0.134
8	640	0.063	0.129	0.192	0.084	0.05	0.134
9	200	0.068	0.147	0.215	0.111	0.079	0.190
10	200	0.068	0.147	0.215	0.111	0.079	0.190
11	333	0.068	0.147	0.215	0.111	0.079	0.190
12	87	0.063	0.129	0.192	0.084	0.05	0.134
13	180	0.063	0.129	0.192	0.084	0.05	0.134

Table 6 - The initial trips associated with the initial trip rates

SITE	DWELLINGS	AM ARRIVAL (07:00-10:00)	AM DEPARTURE (07:00-10:00)	AM TOTAL	PM ARRIVAL (16:00-19:00)	PM DEPARTURE (16:00-19:00)	PM TOTAL
1	112	34	86	120	102	50	153
2	150	36	106	142	131	59	189
3	300	66	166	232	195	91	286
4	552	121	305	426	359	167	526
5	200	42	65	107	68	43	112
6	140	29	46	75	48	30	78
7	210	46	116	162	137	64	200
8	640	141	353	494	416	194	610
9	200	42	65	107	68	43	112
10	200	42	65	107	68	43	112
11	333	70	109	178	114	72	186
12	87	23	50	72	58	30	88
13	180	47	102	149	120	62	182
Total	3304	739	1634	2373	1884	948	2832

4.14. Due to the high level of additional delay this level of demand generated within the 2038 model it was decided that a lower trip rate would be more appropriate for a number of the sites due to their proximity to the rail station and also the potential for applying reduced parking provision at a number of these town centre locations. The lower trip rate was agreed with Surrey County Council as being appropriate for this development test, which is shown in Table 7. The lower trip rates were applied to the Car / LGV matrix for sites 3 to 13 and resulted in a reduced trip matrix in the AM and PM peak period as provided in Table 8.



Table 7 - Adjusted reduced trip rates for sites 3 to 13 for the additional 'unlocked' housing development 2038

Site Location	AM Peak Hour			PM Peak Hour		
	Arr	Dep	Total	Arr	Dep	Total
East Croydon	0.073	0.045	0.118	0.032	0.02	0.052

Table 8 - The resulting trips associated with the alternative trip rates

Site	Dwellings	<i>AM Arrival (07:00-10:00)</i>	<i>AM Departure (07:00-10:00)</i>	<i>AM Total</i>	<i>PM Arrival (16:00-19:00)</i>	<i>PM Departure (16:00-19:00)</i>	<i>PM Total</i>
1	112	33	86	119	102	50	153
2	150	35	106	142	131	59	189
3	300	66	41	106	29	6	35
4	552	121	75	195	53	11	64
5	200	44	27	71	19	4	23
6	140	31	19	50	13	3	16
7	210	46	28	74	20	4	24
8	640	140	86	227	61	13	74
9	200	44	27	71	19	4	23
10	200	44	27	71	19	4	23
11	333	73	45	118	32	7	39
12	87	19	12	31	8	2	10
13	180	39	24	64	17	4	21
Total	3304	735	603	1338	525	170	695

- 4.15. The GIS based TomTom dataset was used for the assignment of trips to understand routing and assignment within the Paramics model network. The previous modelling work applied the development trips to existing Paramics zones and the same methodology has been applied in these model tests to support the HIF bid. The TomTom data provided zone to zone information for the Paramics model in terms of routing between the origins and destinations identified by the analysis of the census COAs.
- 4.16. Table 9 below compares the 3 hour Paramics matrix totals for the 2038 Forecast, 2038 Forecast + unlocked development with the original trip rate and the 2038 Forecast + unlocked development reduced trip rate.

Table 9 - 2038 Forecast trips with and without amended trip rates

Time Period	Matrix	2038 Forecast	2038 Forecast + unlocked development (original trip rate)	2038 Forecast + unlocked development (reduced trip rate)
AM	<i>Matrix 1</i>	18843	21173	20169
	<i>Matrix 2</i>	635	641	641
PM	<i>Matrix 1</i>	21517	24420	22293
	<i>Matrix 2</i>	605	604	604

5. MODEL ASSESSMENT

- 5.1. The model scenarios have been run and assessed, with average outputs compared. The model outputs that have been assessed are:
- Network performance – including the number of vehicles modelled and the average speed of the vehicles in the network;
 - Journey times across the model network and specific routes; and
 - Queues at key junctions in the model.

- 5.2. All scenario model results are presented in comparison tables to understand the effects of the different scenarios.

NETWORK PERFORMANCE

- 5.3. In order to provide an overall comparison of the whole network performance, both the average speed of vehicles in the modelled peak hour and the total number of vehicles that complete their journey in each of the peak hours has been calculated. Respectively each of these provide the following means of network assessment:
- Average speed – indication of average network congestion levels across the Paramics network;
 - Average distance travelled; and
 - Total Vehicle trips completed – an assessment of network conditions to understand the levels of network congestion.
- 5.4. The above metrics are directly comparable between the models, with all models being set up with the same network characteristics. The differences in the outputs therefore relate directly to either the scheme characteristics or the matrix changes.
- 5.5. For each scenario the model has been run 40 times with a random seed for both the AM and PM peak period (07.00-10.00 and 16.00-19.00). The data has been analysed and presented in this section for the two peak hours (08.00-09.00 and 16.00-17.00).
- 5.6. The first step was to identify the level of development that could be accommodated within the existing network without undue impacts on 'level of service'. A number of iterative tests were carried out to identify the approximate quantum of development that could take place before this occurred.
- 5.7. Initial runs of the Do Nothing network with the full committed development showed that the AM model struggled to accommodate the level of demand and traffic interactions around the Guildford Road, Victoria Road and Station Road gyratory 'triangle'. The model would quickly 'lock up' to a point where traffic could no longer complete its journey through the network. Table 10 below shows the results from these initial model tests. Additional measures in the model were investigated to understand whether this was a 'coding' issue in the model or whether this was something that could occur in reality. A number of alternative coding scenarios were considered including reasonable adjustments to stop lines, link characteristics and priorities. However, none of these alterations prevented the model from 'locking up' in the AM peak hour. It was identified that the frequency of pedestrian calls on the crossings within the Guildford Road, Victoria Road and Station Road gyratory 'triangle' area, along with the changes to the level of traffic demand, was causing the additional demand to have significant implications on the highway network level of service. The pedestrian calls on the traffic signals and crossings at this location were verified through surveys during 2018 when the model was updated to better reflect current conditions.

Table 10 - 2023 Do Nothing Committed Development Dependent Development Tests

	2014 Base	2023 Do Nothing – with full Local Plan Development (1251)	2023 Do Nothing - with reduced Local Plan Development - (934)	2014 Base	2023 Do Nothing with full Local Plan Development (1251)	2023 Do Nothing - with reduced Local Plan Development - (934)
	AM 08.00-09.00	AM 08.00-09.00	AM 08.00-09.00	PM 17.00-18.00	PM 17.00-18.00	PM 17.00-18.00
Total Time Taken	2381164	2015863	2476801	1763200	2102076	2005798
Total Distance (m)	10926580	7875743	10287469	11320955	11697460	11592543
Total Vehicles	6341	4725	6082	7008	7311	7234
Average Time (s) / vehicle	375	414	416	252	288	277
Average Time (s) / mile	351	411	399	251	289	278
Average Distance (m) / vehicle	1723	1620	1687	1615	1600	1602
Average Speed (mph)	10	10	10	14	12	13
Average Speed (kph)	17	15	15	23	20	21

- 5.8. The highlighted cells in Table 10 provide an indication of the congestion issues with the initial modelling scenario that included 1,251 of the residential units during the AM peak hour. The far lower levels of vehicles that are completing their journey during the peak hour is an indication of the increased levels of congestion being experienced during the peak hour.
- 5.9. During the AM peak hour in the 2014 base model it is evident from the average speed of the vehicles travelling through the Paramics network that there is already a significant level of congestion being experienced at key locations. An average speed of 10mph throughout the network highlights that there is already potentially a reduced level of service within the network. In the PM peak hour the congestion issues are less prevalent with the results across the model tests being broadly similar in terms of the number of vehicles completing their journey during the hour. However, network congestion is increased with average speeds falling from 14mph to 12mph for the 1,251 Local Plan units and to 13mph for the reduced 938 Local Plan units.
- 5.10. In the AM peak hour with a reduced level of Local Plan development (938 units), it is clear that the number of vehicles able to complete their journey during the peak hour has increased in comparison to the full Local Plan assessment (1,251 units). It can be seen from the numbers presented in Table 10, however, that the number of completed trips during the hour still falls short of the number of trips included within the demand matrix. There is a slight reduction in the average speed per vehicle in the network and average journey times across all trips are increased by 10% compared with the base model (375 seconds to 414 seconds). This represents an average so there are some locations where the journey time change could be significant.
- 5.11. Therefore, 938 Local Plan units has been identified as the point at which the network performance becomes unreasonable because of the increased journey time and the reduced level of trips completing their journey compared to the base model. For the full Local Plan assessment (1,251 units) the level of delay was significantly increased within the network which led to a sizeable proportion of the demand matrix trips not able to complete their journey within the hour. This lower level of trips would not have been compatible for the TUBA assessment, potentially having an adverse impact on the results.
- 5.12. Table 11 provides the network performance results for the model with the partial HIF scheme ('Do Less' scheme) and full Local Plan development. It compares the model results with Do Nothing and Do Something models. In the AM peak, the Do Less model adopts the signalised scheme to replace the existing Guildford Road, Victoria Road and Station Road gyratory 'triangle'. It can accommodate much more traffic compared with the Do Nothing model in the AM peak. However, the additional flow significantly increases the delays in the network. An average speed of 10mph throughout the network highlights that there is significant congestion within the network. The Do something scheme helps to accommodate more traffic and to overall network performance. Compared with the Do Less model, the average journey times across all trips is reduced by 48% and the speed is increased by 5 kph in Do Something model.

- 5.13. In the PM peak, as the 'lock up' does not occur in the Do Nothing model, all schemes can accommodate similar level of demands. The Do Less model does not significantly improve the network performance with an average speed of 20mph throughout the network, which is the same as the Do Nothing scheme. The Do Something model significantly improves the network performance. The average journey times across all trips is reduced by 15% (294s to 249s) and the speed is increased by 3 kph compared with Do Less model.

Table 11 - 2023 Do Less Tests with the Full Local Plan Development (1251)

	2023 Do Nothing – with full Local Plan Development (1251)	2023 Do Less - with full Local Plan Development (1251)	2023 Do Something - with full Local Plan Development (1251)	2023 Do Nothing – with full Local Plan Development (1251)	2023 Do Less with full Local Plan Development (1251)	2023 Do Something – with full Local Plan Development (1251)
	<i>AM 08.00-09.00</i>	<i>AM 08.00-09.00</i>	<i>AM 08.00-09.00</i>	<i>PM 17.00-18.00</i>	<i>PM 17.00-18.00</i>	<i>PM 17.00-18.00</i>
Total Time Taken	2015863	3009960	2093845	2102076	2143010	1820763
Total Distance (m)	7875743	11601289	11630960	11697460	11500835	11572437
Total Vehicles	4725	6860	6866	7311	7293	7319
Average Time (s) / vehicle	414	438	305	288	294	249
Average Time (s) / mile	411	417	290	289	300	253
Average Distance (m) / vehicle	1620	1691	1694	1600	1577	1581
Average Speed (mph)	10	9	13	12	12	14
Average Speed (kph)	15	14	20	20	20	23

- 5.1. Table 12 provides the network performance results for the Do Less model with the reduced Local Plan development, and compares the results with Do Nothing and Do Something models. In the AM Peak, both Do Less and Do Something models help to accommodate more traffic in the network compared with the Do Nothing model. The Do Something model significantly improves the network performance compared with the Do Nothing and Do Less scenarios. The average journey times across all trips is reduced by 27% (419 seconds to 306 seconds) and the speed is increased by 5 kph compared with the Do Less model.

In the PM peak hour the congestion issues are less prevalent with the results across the model tests being broadly similar in terms of the number of vehicles completing their journey during the hour. The Do Something model improves the network performance with the average journey times across all trips reduced by 10% (269 seconds to 243 seconds) and the average speed increase by 3 kph compared with the Do Less model.

Table 12 - 2023 Do Less Tests with the Reduced Local Plan Development (934)

	2023 Do Nothing – with reduced Local Plan Development (934)	2023 Do Less – with reduced Local Plan Development (934)	2023 Do Something - with reduced Local Plan Development (934)	2023 Do Nothing – with reduced Local Plan Development (934)	2023 Do Less with reduced Local Plan Development (934)	2023 Do Something - with reduced Local Plan Development (934)
	<i>AM 08.00-09.00</i>	<i>AM 08.00-09.00</i>	<i>AM 08.00-09.00</i>	<i>PM 17.00-18.00</i>	<i>PM 17.00-18.00</i>	<i>PM 17.00-18.00</i>
Total Time Taken	2476801	2840024	2082549	2005798	1944975	1767995
Total Distance (m)	10287469	11438208	11549458	11592543	11435699	11535643
Total Vehicles	6082	6769	6805	7234	7235	7287
Average Time (s) / vehicle	416	419	306	277	269	243
Average Time (s) / mile	399	399	290	278	274	247
Average Distance (m) / vehicle	1687	1690	1697	1602	1581	1583
Average Speed (mph)	10	9	13	13	13	15
Average Speed (kph)	15	15	20	21	21	24

- 5.2. Tables 13 and 14 provide the network performance results for the models with the Guildford Road Highway Scheme included compared with the existing road layout. The matrices for 2023 and 2038 are the same for both models.

Table 13 - 2023 & 2038 Do Nothing vs 2023 & 2038 Do Something Scheme – AM Peak Hour

	2023 Do Nothing- with reduced Local Plan Development (934)	2023 Do Something- with reduced Local Plan Development (934)	2038 Do Nothing	2038 Do Nothing (reduced ped call)	2038 Do Something
	<i>AM 08.00-09.00</i>	<i>AM 08.00-09.00</i>	<i>AM 08.00-09.00</i>	<i>AM 08.00-09.00</i>	<i>AM 08.00-09.00</i>
Total Time Taken	2476801	2082549	1541826	4196399	3198466
Total Distance (m)	10287469	11549458	4407398	12603448	12736379
Total Vehicles	6082	6805	2871	7348	7477
Average Time (s) / vehicle	416	306	505	570	428
Average Time (s) / mile	399	290	584	535	404
Average Distance (m) / vehicle	1687	1697	1443	1715	1703
Average Speed (mph)	10	13	8	7	9
Average Speed (kph)	15	20	13	11	14

- 5.3. For the AM peak hour presented in Table 13, the 2023 model shows an improvement over the existing road layout both in terms of the average journey time per vehicle (26% improvement – 306 seconds compared with 416 seconds) and also in terms of the average vehicle speed (13mph instead of 10mph). The number of vehicles increasing their journey during the hour due to the reduced levels of congestion in the network is 723 more in the AM peak with the highway scheme in place.
- 5.4. For the 2038 Do Nothing model with the existing network, it was already evident that severe levels of congestion were occurring in this network based on demand levels for 2023. The third column in the table above shows that the average speed of vehicles in the network during the hour is further reduced with the 2038 demand to 8mph. The number of vehicles completing their trips during the hour is also significantly reduced to 2,871 vehicles. As already identified this level of congestion was associated with the pedestrian crossing calls on the crossings located around the Guildford Road, Victoria Road and Station Road gyratory 'triangle'. In order to provide sensible data for the TUBA appraisal it was necessary to release some of the congestion in the model to achieve comparable trip matrices for the modelled trips between the Do Nothing and Do Something scenarios. Since the models were effectively 'locking up', only a small number of trips were completing their trip through the network and by unlocking some of these trips (by reducing the number of pedestrian calls taking), a better representation of the average speed of vehicles through the congested network is achieved and more directly comparable with the scenario that includes the highway improvement scheme.
- 5.5. The necessity to reduce the frequency of pedestrian calls within the 2038 model in order to achieve a sufficient level of trip information from the model runs, implies that in order to accommodate predicted traffic levels within the existing layout, access through the network for pedestrians and cyclists would be severely compromised.
- 5.6. In the AM peak model under 2038 traffic conditions the average speed per vehicle is increased from 7mph to 9mph and the average journey time per vehicle being reduced by 142 seconds.

Table 14 - 2023 & 2038 Do Nothing vs 2023 & 2038 Do Something Scheme – PM Peak Hour

	2023 Do Nothing-with reduced Local Plan Development (934)	2023 Do Something-with reduced Local Plan Development (934)	2038 Do Nothing	2038 Do Nothing (reduced ped call)	2038 Do Something
	<i>PM 17.00-18.00</i>	<i>PM 17.00-18.00</i>	<i>PM 17.00-18.00</i>	<i>PM 17.00-18.00</i>	<i>PM 17.00-18.00</i>
Total Time Taken	2005798	1767995	2671601	3293146	2596933
Total Distance (m)	11592543	11535643	11877855	12531880	12599053
Total Vehicles	7234	7287	7490	7794	7945
Average Time (s) / vehicle	277	243	355	422	327
Average Time (s) / mile	278	247	361	423	332
Average Distance (m) / vehicle	1602	1583	1583	1607	1586
Average Speed (mph)	13	15	10	9	11
Average Speed (kph)	21	24	16	14	18

- 5.7. In the PM peak the 2023 existing layout (Do Nothing) and the proposed Guildford Road Highway Scheme improvements (Do Something) scenarios show similar levels of traffic through the network, with the average speeds increasing from 13mph to 15mph with the scheme in place. In the 2038 scenario, the reduced pedestrian calls in the PM peak has the effect of not locking up towards the end of the peak hour and maintaining the level of trips that complete their journey to be comparable with the scheme option. In the 2038 ‘with scheme’ scenario (PM peak hour) the average speed increases from 9mph to 11mph and the average journey time reduces by 95 seconds.
- 5.8. Tables 15 and 16 provide the summary modelling results for the 2038 scenarios with and without the Guildford Road Highway Scheme and also with the additional HIF related housing development trips included in the matrix.

Table 15 - 2038 Do Nothing vs 2038 Do Something vs 2038 Do Something with ‘unlocked’ development – AM Peak Hour

	2038 Do Nothing (reduced ped call)	2038 Do Something	2038 Do Something ‘unlocked’ development
	<i>AM 08.00-09.00</i>	<i>AM 08.00-09.00</i>	<i>AM 08.00-09.00</i>
Total Time Taken	4196399	3198466	4117607
Total Distance (m)	12603448	12736379	13214184
Total Vehicles	7348	7477	7929
Average Time (s) / vehicle	570	428	519
Average Time (s) / mile	535	404	501
Average Distance (m) / vehicle	1715	1703	1667
Average Speed (mph)	7	9	7
Average Speed (kph)	11	14	12

- 5.9. During the AM peak hour in 2038 the Guildford Road Highway Scheme is able to accommodate an additional level of traffic demand compared to the scenario without the additional HIF related housing (7,929 compared with 7,477 trips). This indicates that the level of traffic in the model has increased and that the journeys are being completed without the network locking up. The average speed of traffic in the 2038 AM scenario with the additional development included is lower than without the development. This is to be expected with the additional trips.

Table 16 - 2038 Do Nothing vs 2038 Do Something vs 2038 Do Something with 'unlocked' development – PM Peak Hour

	2038 Do Nothing (reduced ped call)	2038 Do Something	2038 Do Something 'unlocked' development
	<i>PM 17.00-18.00</i>	<i>PM 17.00-18.00</i>	<i>PM 17.00-18.00</i>
Total Time Taken	3293146	2596933	2709116
Total Distance (m)	12531880	12599053	12812507
Total Vehicles	7794	7945	8203
Average Time (s) / vehicle	422	327	330
Average Time (s) / mile	423	332	340
Average Distance (m) / vehicle	1607	1586	1562
Average Speed (mph)	9	11	11
Average Speed (kph)	14	18	17

- 5.10. In the 2038 PM peak scenario with the Guildford Road Highway Scheme the average speed of vehicles travelling through the network is only very marginally reduced with the additional HIF related development.

6. MODEL CONCLUSIONS

- 6.1. It is evident from the modelling results that the existing network is very sensitive to increased traffic levels, particularly during the AM peak. The main reason for this level of congestion is the extent of growth and the high level of pedestrian activity in this area, combined with changes to the traffic demand in the forecast models. In the 2038 scenario, the pedestrian provision at this location would need to be severely compromised to accommodate the predicted additional traffic demands.
- 6.2. The results from the Paramics model conclude that it is likely that up to an additional 938 residential units could be accommodated within the existing highway network before severe additional adverse impacts on vehicular traffic are realised. This is related mainly to the AM peak hour traffic levels and interactions.
- 6.3. The proposed Guildford Road Highway Scheme results in significant improvements in traffic capacity within the study area evidenced by a higher level of vehicle trips being able to take place during the assessment hours.

7. TUBA ECONOMICS

- 7.1. Average data from the 40 random seeded runs from each model has been extracted to provide matrices for input to the TUBA model. The matrices generated from the Paramics model are:
- Trips;
 - Time; and
 - Distance.
- 7.2. This data has been extracted from each of the models for the peak hours 08.00-09.00 and 17.00-18.00 for each vehicle type, including buses, for input to the TUBA assessment.
- 7.3. The results from the TUBA model are covered in a separate series of files (including a technical note) that are appended to the business case submission.



Appendix A – Guildford Road Highway Works



Appendix B – Plan of Additional Housing Sites

