Tunbridge Wells Local Plan

Strategic Transport Assessment – Modelling Appraisal

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Change list

Ver	Date	Description of the change	Reviewed	Approved by
1	April 2024	Initial draft for client review	DH	LP
2	April 2024	Update following client comments	DH	LP

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1 Introduction

1.1 Background

Sweco has been commissioned by Tunbridge Wells Borough Council (TWBC) to undertake further traffic modelling for the TWBC Local Plan submission to assist in addressing Inspector's comments at the Examination in Public (EiP) for the TWBC Local Plan. This work is an update to the work undertaken for the previous Local Plan and focusses on a revision to the proposed development allocations, most notably the removal of the Tudeley Village development strategic site and reduced growth at Paddock Wood, including land at East Capel, and the impacts of this on the need for additional transport infrastructure in the area.

This report has been prepared with reference to the following Post-Initial Findings Evidence Base Documents which are summarised in Section 1.2 below:

- TW Stage 1 Technical Note Review of Strategic Model Methodology and Set Up for Local Plan dated August 2023[1].
- TW Local Plan Stage 2 Reporting[2].
- TW Local Plan Stage 3 Modal Shift Impact Reporting[3].
- Modal Shift Technical Note.

1.2 Modelling Appraisal Methodology

It was agreed with TWBC and key stakeholders Kent County Council (KCC) and National Highways (NH) that the modelling appraisal of the revised Local Plan growth strategy would be undertaken in three stages, based on a sequential approach to scenario testing. The three stages can be summarised as follows:

Stage 1 comprised a review of the previous strategic modelling methodology and set up to demonstrate that the assumptions and data adopted in the Baseline and Reference Case scenarios remain valid and that the Tunbridge Wells Traffic Model (TWTM) is fit for the purpose of assessing the impacts of the revised Local Plan. The primary key tasks were:

- Review of robustness of the Baseline 2018 model in the wake of the Covid-19 pandemic and how flows within the model relate to observed data in 2022 (post-pandemic).
- Assessment of latest National Trip End Model (NTEM) model forecasts to compare impacts of using TEMPro 7.2 housing and growth factors against the recently released TEMPro 8 version.
- Review of Reference Case development and model network against the previous iteration based on the updated data released to ensure the model best represents future conditions.
- Review of proposed development within Paddock Wood to confirm accuracy in key areas around development assumptions.
- Review of performance of Kipping's Cross junction in model compared to observed conditions.

This review concluded that the previously adopted methodology and assumptions continued to provide a robust basis upon which to assess Local Plan growth. This was agreed by KCC and NH who approved the continued use of the TWTM to assess the revised Local Plan development growth scenario.

The findings of Stage 1, and details of the model parameters used, are presented in the Stage 1 Technical Note "Review of Strategic Model Methodology and Set Up for Local Plan".

[1] PS_047-TW-Stage-1-Technical-Note-Review-of-Strategic-Model-Methodology-and-Set-Up-for-Local-Plan.pdf (tunbridgewells.gov.uk)

[2] https://forms.tunbridgewells.gov.uk/__data/assets/pdf_file/0019/455122/PS_048-TW-Local-Plan-Stage-2-Reporting.pdf

[3] https://forms.tunbridgewells.gov.uk/__data/assets/pdf_file/0020/455123/PS_049-TW-Local-Plan-Stage-3-Modal-Shift-Impact-Reporting.pdf

Stage 2 was the undertaking of a new strategic model run of the reduced local plan growth scenario to establish its impacts on the highway network. The analysis of the outputs identified the congestion "hotspots" on the TWBC transport network and around Tonbridge town centre. A comparison with the previous modelling was undertaken to understand where changes to traffic impact have occurred, and thus, where previous congestion issues have either been resolved or remain as congestion hotspots. The conclusions of this analysis formed the basis by which the need for any transport intervention measures were identified.

The results of the Stage 2 strategic modelling, including a list of hotspot locations where the Local Plan would continue to have significant impact, were set out within the Stage 2 Report, "TW Local Plan Stage 2 Reporting".

Stage 3 Part 1 comprised an analysis of the potential for sustainable transport interventions to encourage mode shift away from the car. It included a review of proposed interventions and their likely impact on a reduction in car demand. An additional Local Plan model scenario was created with reduced car demand and the hotspot locations were reviewed.

A revised list of hotspot locations where Local Plan impacts remain was generated. An outline of the methodology and key findings of Stage 3 Part 1 modelling were set out within Sweco's "TW Local Plan Stage 3 Modal Shift Impact Reporting".

Stage 3 Part 2 considers potential highway interventions to mitigate the traffic impacts of the Local Plan at the remaining hotspot locations identified in Part 1. The assessment included concept designs, high-level costs, and an estimate of when the scheme is likely to be needed which was informed by a new intermediate year modelling scenario. Two Local Plan 2038 model scenarios with alternative packages of highway interventions were run to demonstrate the effectiveness of these in mitigating Local Plan impacts on the highway network.

The methodology and outcomes of the Stage 3 Part 2 work are set out within this report.

1.3 Purpose of Report

This report is a culmination of all the work undertaken as part of the strategic modelling appraisal of the revised Local Plan growth scenario, setting out the key outcomes of each stage of the modelling within a single document.

It also details the outcomes of the Stage 3 Part 2 modelling, together with the final conclusions of the strategic transport modelling appraisal.

1.4 Structure of Report

Following this introductory chapter, this report is structured as follows:

- **Chapter 2** details the forecast model scenarios developed to assess the impact of the TWBC Local Plan, and the methodology adopted to derive the traffic flows adopted within each.
- **Chapter 3** presents the model results for the Reference Case and Core Local Plan scenarios. Hotspot junctions where the Local Plan is forecast to have an impact are identified.
- **Chapter 4** examines the potential for modal shift away from cars with the introduction of sustainable transport measures. The results of the model shift scenario model run are presented.
- **Chapter 5** describes the work undertaken to identify highway interventions required to mitigate the traffic impact of the Local Plan development. The results of an additional model run with the identified highway mitigation measures are presented alongside results from the intermediate year model.
- **Chapter 6** sets out the final conclusions.

2 Forecast Modelling

2.1 Introduction

This chapter set out the assumptions and methodology that formed the basis of the updated strategic modelling undertaken to assess the revised TWBC Local Plan Growth. It should be read in conjunction with the Stage 1 Technical Note "Review of Strategic Model Methodology and Set Up for Local Plan" (document PS_047).

2.2 Forecast Scenarios

The forecast model scenarios have all been developed at the 2038 forecast year, i.e. the end of the Local Plan period. To assess the traffic impact of the Local Plan development the following scenarios have been developed:

- Reference Case (RC) – includes developments deemed as committed as summarised in Section 2.2.
- Local Plan Core (LP) – as per Reference Case + Local Plan developments as summarised in Section 2.3.

In addition to the Local Plan Core Scenario, mitigation scenarios have been modelled as follows:

- Local Plan Modal Shift (LPMS) scenario – described further in Chapter 4 of this report.
- 2 x Local Plan Highway Mitigation (LPHM) scenarios – described further in Chapter 5 of this report.

During consultation with KCC and NH on the outcomes of the Stage 3 Part 1 as it was agreed that an intermediate year should be tested, in addition to the 2038 forecasts tested, for the RC and LPMS scenarios. The 2030 intermediate year adopted was established from an analysis of the Reference Case and Local Plan build out rates and included all developments up to 2030. These assignments have been undertaken to help identify the point highway mitigation measures may be required based on the modelling results.

The model scenarios adopted and presented in this report are summarised in **Table 1**.

Table 1 Model Scenarios

Scenario	**2030**	**2038**
Reference Case (RC)	✓	✓
Local Plan Core (LP)		✓
Local Plan Modal Shift (LPMS)	✓	✓
Local Plan Highway Mitigation Option 1 (LPHM1)		✓
Local Plan Highway Mitigation Option 2 (LPHM2)		✓

2.3 Reference Case Development

As detailed within Section 6 of the Stage 1 Technical Note, updated information on extant and completed developments were provided by TWBC in the *'Planning Permission and Completions Data as at 1 April 2022'* spreadsheet which contained the following information:

- Extant Residential Planning Permissions as at 1 April 2022
- Residential Completions Between 1 April 2020 – 31 March 2022
- Extant Commercial Planning Permissions as at 1 April 2022
- Commercial Completions Between 1 April 2020 – 31 March 2022

2.3.1 Residential

A comparison between the number of dwellings previously modelled and the current data is presented in Table 2. There are over 700 additional dwellings within the current data.

Table 2 Reference Case Housing Summary (Dwellings)[4]

	Previous Model	Current Data	Difference
Completions 2020-2022	-	1,206	1,206
Extant planning permissions	3,313	3,123	-190
Windfall allowance	1,670	1,426	-244
Total	**4,983**	**5,755**	**772**

The breakdown of the dwellings by settlement is presented in Table 3. Changes in the majority of settlements are relatively modest. The most notable differences (change of over 100) are Cranbrook and Sissinghurst, Hawkhurst and Paddock Wood. The changes in committed residential development presented below were incorporated within the revised 2038 reference case forecast scenario.

Table 3 Reference Case Housing Summary by Settlement[5]

Settlement	Previous Model	Current Data	Difference
Benenden	81	111	31
Bidborough	27	35	7
Brenchley and Matfield	120	182	62
Capel	52	54	1
Cranbrook and Sissinghurst	415	610	195
Frittenden	29	50	21
Goudhurst	77	93	16
Hawkhurst	258	359	101
Horsmonden	84	146	61
Lamberhurst	34	41	7
Paddock Wood	1,067	1,229	163
Pembury	115	157	42
Royal Tunbridge Wells	2,128	2,174	46
Rusthall	67	46	-21
Sandhurst	36	48	13
Southborough	318	292	-26
Speldhurst	75	127	52
Total	**4,983**	**5,755**	**772**

[4] Table 6 of PS_047-TW Stage 1 Technical Note Review of Strategic Model Methodology and Set Up for Local Plan
[5] Table 7 of PS_047-TW Stage 1 Technical Note Review of Strategic Model Methodology and Set Up for Local Plan

2.3.2 Employment

A comparison between the employment floor areas previously modelled and the current data is presented in Table 4. There is almost 80,000m^2 of additional employment floorspace within the current data.

Table 4 Reference Case Employment Summary (m^2)[6]

	Previous Model	Current Data	Difference
Completions 2020-2022	-	2,472	2,472
Extant planning permissions	-4,645	72,517	77,162
Total	**-4,645**	**74,989**	**79,634**

Further investigation of the data indicates that the difference can largely be attributed to the Land East of Kingstanding Way development which comprises a floorspace of 74,000m^2 and received planning permission in 2021. This development was added to the Reference Case with the trip generation taken from the Transport Assessment submitted in support of the planning application.

2.4 Local Plan Development

As detailed within Chapter 7 of Sweco's Stage 1 Technical Note, updated information on Local Plan developments was provided by TWBC in the *'May 2023 Housing Trajectory Update for Sweco'* spreadsheet for the purposes of transport modelling. This contained the latest Local Plan housing and employment development quantum to be adopted within the revised TWTM.

The Local Plan data used in the modelling was the latest available at the time of the developing the forecasts. It is recognised that there have been some small changes to the allocations since then. Given the changes are largely Local Plan allocations that have received planning permission, the quantum of Local Plan development in the modelling is slightly higher than that now proposed. The modelling therefore provide a robust assessment of the Local Plan impact.

2.4.1 Residential

The TWBC spreadsheet contained housing supply figures up to 2038, 15 years post-adoption. The settlement with the most dwellings is Paddock Wood. This can largely be attributed to *'The Strategy at Paddock Wood'* development which comprises 2,633 dwellings, including land at east Capel in the neighbouring Capel parish. As advised by TWBC these were split across the revised TWTM as follows:

- South-east quadrant (Redrow/Persimmon): 1,284 dwellings
- South-west quadrant (Dandara): 488 dwellings
- North-west quadrant (Crest): 771 dwellings
- North-east quadrant: 90 dwellings

The remaining allocated developments are largely smaller sites of no more than 200 dwellings. Trips from these zones have been assigned to the relevant zone within the existing model structure.

The most notable exclusion since the previous modelling is the removal of the Tudeley Village development which comprised 2,800 dwellings (2,100 within the plan period).

The breakdown of Local Plan dwellings by settlement is presented in Table 5. The numbers from the previous model are also presented for comparison. The removal of the Tudeley Village strategic site results in a large decrease in dwellings within the settlement of Capel. There is also a reduction of approximately 1,000 dwellings in Paddock Wood compared to the previous modelling.

[6] Table 8 of PS_047-TW Stage 1 Technical Note Review of Strategic Model Methodology and Set Up for Local Plan

Table 5 Local Plan Housing Summary by Settlement

Settlement	Previous Local Plan	Revised Allocation
Benenden	92	67
Bidborough	0	0
Brenchley and Matfield	58	15
Capel	2,800	0
Cranbrook and Sissinghurst	244	199
Frittenden	28	0
Goudhurst	0	0
Hawkhurst	99	70
Horsmonden	280	190
Lamberhurst	28	28
Paddock Wood	3,673	2,663
Pembury	349	311
Royal Tunbridge Wells	1,245	1,286
Rusthall	15	15
Sandhurst	26	13
Southborough	26	0
Speldhurst	11	11
TOTAL	**8,974**	**4,868**

2.4.2 Employment

Three employment sites were included in the data provided by TWBC which are summarised in Table 6. A reduced quantum of employment at Paddock Wood is proposed, proportionate to the reduction in housing proposed for the area as part of the revised Local Plan. As advised by TWBC trips for the two Paddock Wood sites have been loaded on to the North-east quadrant. The remaining site was allocated to the relevant model zone within Hawkhurst.

Table 6 Local Plan Employment Sites[7]

Site Address	Settlement	Size (m^2)
Land adjacent to Transfesa Rd	Paddock Wood	17,250
Swatlands Farm	Paddock Wood	18,150
Hawkhurst Station Business Park	Hawkhurst	4,500

2.5 Local Plan Residential Trip Rates

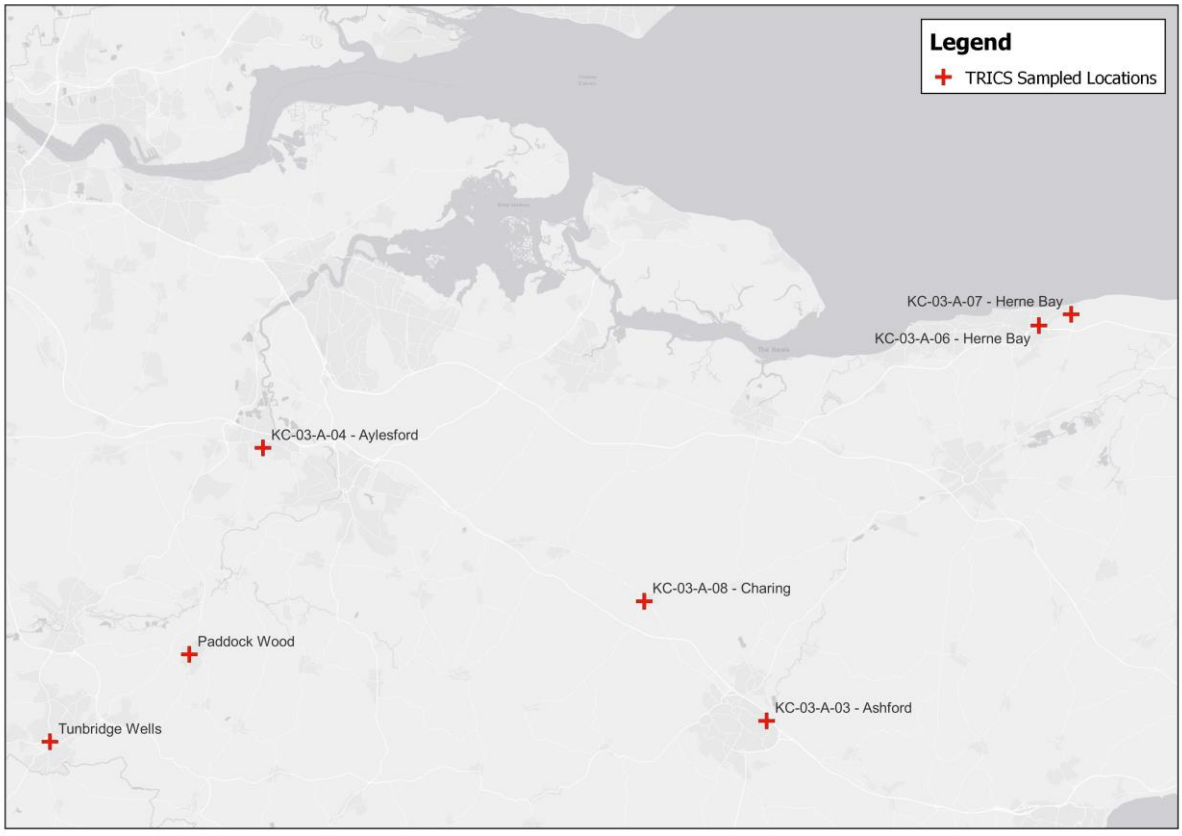
As detailed within Section 8 of Sweco's Stage 1 Technical Note, a review of the Local Plan residential trip rates was undertaken to ensure they are representative of what is expected for similar developments. Table 7 and Figure 1 highlight the locations of the developments used to calculate the TRICS rates for C3 residential developments in the Local Plan modelling.

[7] Table 10 of PS_047-TW Stage 1 Technical Note Review of Strategic Model Methodology and Set Up for Local Plan

Table 7 TRICS Sites used to Establish Tunbridge Wells Local Plan Trip Rates[8]

Site ID	Dev. Type	Location	Postcode	Main Location Type	No. Dwellings	Total Bedrooms	Parking Spaces	Date Surveyed
KC-03-A-03	MIXED HOUSES & FLATS	ASHFORD	TN24 0FR	Suburban Area	51	157	110	July 2016
KC-03-A-04	SEMI-DETACHED AND TERRACED	AYLESFORD	ME20 6FN	Edge of Town	110	330	195	Sep 2017
KC-03-A-06	MIXED HOUSES & FLATS	HERNE BAY	CT6 6DF	Suburban Area	363	1007	789	Sep 2017
KC-03-A-07	MIXED HOUSES	HERNE BAY	CT6 6HZ	Edge of Town	288	934	891	Sep 2017
KC-03-A-08	MIXED HOUSES	CHARING	TN27 0GX	Neighbourhood Centre	159	569	480	May 2018

Figure 1: Locations of TRICS Sites used to Establish Tunbridge Wells Local Plan Trip Rates[9]



The TRICS sites used were selected due to their size and location close to key local centres within the South-East of England. This is seen as representative of the sites proposed in the Tunbridge Wells Local Plan. They are within the boundary of Kent County and are seen as the most representative of available data.

The summary of the TRICS trip rates included in the calculation can be found in Table 8 below.

[8] Table 12 of PS_047-TW Stage 1 Technical Note Review of Strategic Model Methodology and Set Up for Local Plan
[9] Figure 4 of PS_047-TW Stage 1 Technical Note Review of Strategic Model Methodology and Set Up for Local Plan

Table 8: TRICS Trip Rates for Residential Development[10]

Type	TOTAL VEHICLE			
	AM Peak (0800-0900)		PM Peak (1700-1800)	
	Departures	Arrivals	Departures	Arrivals
Residential	0.378	0.146	0.157	0.371

Sweco's Stage 1 Technical Note (reference PS_047) provided evidence that demonstrated that the residential TRICS trip rates adopted within the TWTM were representative[11] and thus would form a robust basis upon which to base the core scenario testing. This conclusion was accepted by KCC and NH, and the above trip rates were also adopted within the revised TWTM. Any potential mitigations that involved changes to trip rates, mode share and / or modal shift were considered within Stage 3, discussed later within this report.

2.6 Matrix Totals

The matrix totals for the Reference Case and Core Local Plan Scenarios are summarised in Table 9. The Local Plan (LP) developments are forecast to add an additional 1,859 and 1,866 vehicle trips in the AM and PM peak hours respectively.

Table 9: Core Model Matrix Totals (PCUs[12])

Description	User Class	AM	PM
Reference Case	Car Business	3,304	2,683
	Car Commute	15,795	11,999
	Car Other	18,902	23,348
	LGV	5,673	5,103
	HGV	2,876	1,388
	Total	**46,551**	**44,521**
Local Plan Core	Car Business	3,456	2,805
	Car Commute	16,946	12,868
	Car Other	19,327	24,059
	LGV	5,795	5,254
	HGV	2,887	1,401
	Total	**48,410**	**46,387**
Change	Car Business	152	122
	Car Commute	1,151	869
	Car Other	425	711
	LGV	122	151
	HGV	11	13
	Total	**1,859**	**1,866**

[10] Table 13 of PS_047-TW Stage 1 Technical Note Review of Strategic Model Methodology and Set Up for Local Plan
[11] Chapter 8 of PS_047-TW Stage 1 Technical Note Review of Strategic Model Methodology and Set Up for Local Plan
[12] Passenger Car Unit

3 Local Plan Core Model Results

3.1 Introduction

The chapter presents the results of the updated Local Plan modelling. It compares results from the Local Plan Core (LP) scenario with the Reference Case (RC) scenario.

3.2 Flow Difference Differences

The impact of the Local Plan development on traffic flows is illustrated in the traffic flow difference plots presented in Figure 2 (AM) and Figure 3 (PM).

Figure 2: Local Plan Core – Reference Case Flow Difference AM

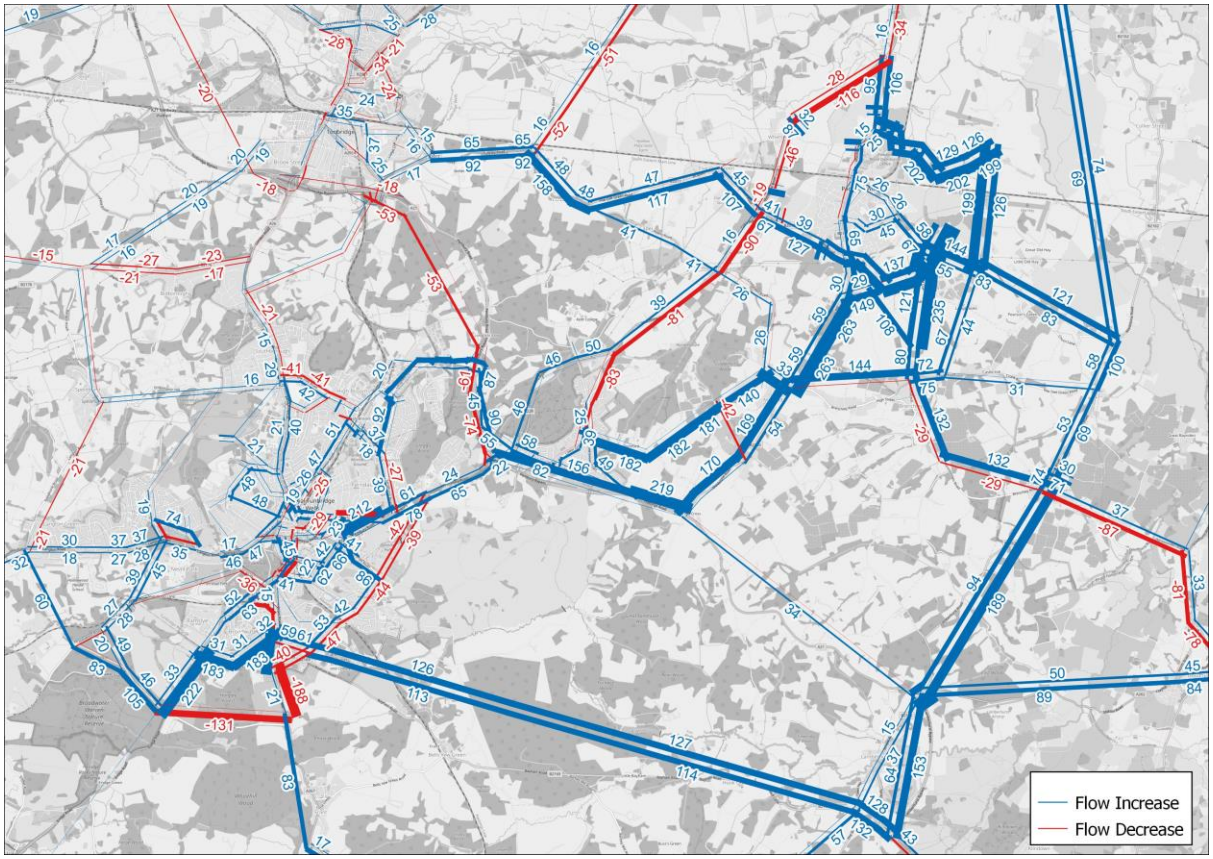
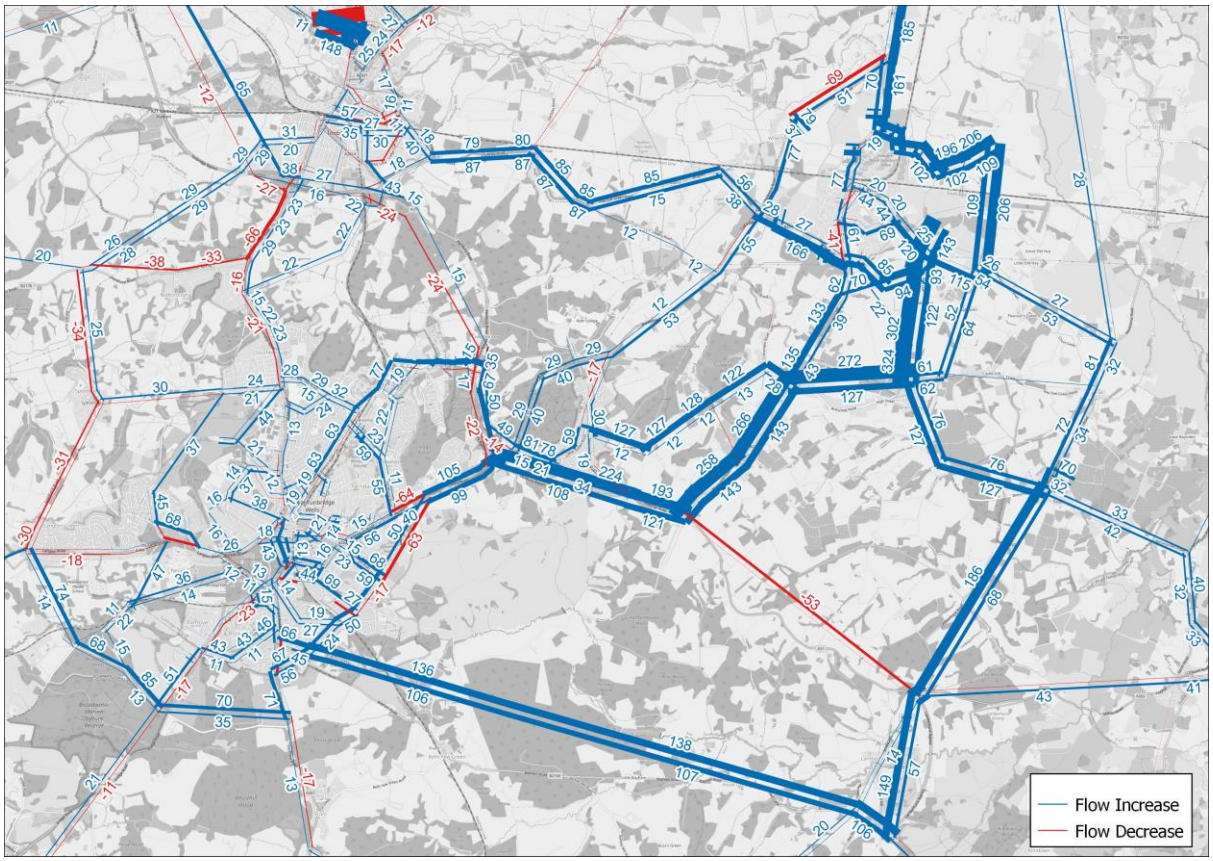


Figure 3: Local Plan Core – Reference Case Flow Difference PM



The above demonstrates increases in traffic flows within Paddock Wood and Royal Tunbridge Wells associated with the additional development in these locations. New trips between these two locations are largely assigning to the B2160 Maidstone Road and routing via Kipping's Cross or Pembury or the longer distance route via Horsmonden and Lamberhurst. There is a limited increase along the A228 which can be attributed to capacity constraints along this corridor, in particular at Badsell Roundabout.

This existing capacity constraints along the A228 corridor are also considered to be contributing to the large volume in vehicles shown to be routing via the B2160 in the Reference Case scenario.

3.3 Hotspot Sifting Methodology

The focus for this Local Plan transport assessment is on transport related issues specifically related to the Local Plan implementation. Though underlying transport issues may be present in the study area, the Local Plan is focussed on mitigating Local Plan impacts back to Reference Case levels.

The analysis of the Local Plan modelling to identify junction capacity hotspots has been based on the following criteria:

- Initial sifting - any junction arm that has a volume over capacity (V/C) over 95% (approaching maximum capacity) is identified as a "hotspot".
- Of the arms over 95% V/C, when they occur within a junction that sees at least 50 additional vehicles pass through in total between the Local Plan scenario and Reference Case they are categorised as being a "Minor" LP Hotspot.
- Of the "minor" hotspots, should any of the arm's V/C in the LP scenario be 5% or greater than its Ref Case equivalent, they are upgraded to be a "Major" LP Hotspot.

3.4 Local Plan Without Mitigation Hotspots

A high-level summary of the analysis of hotspots is provided below:

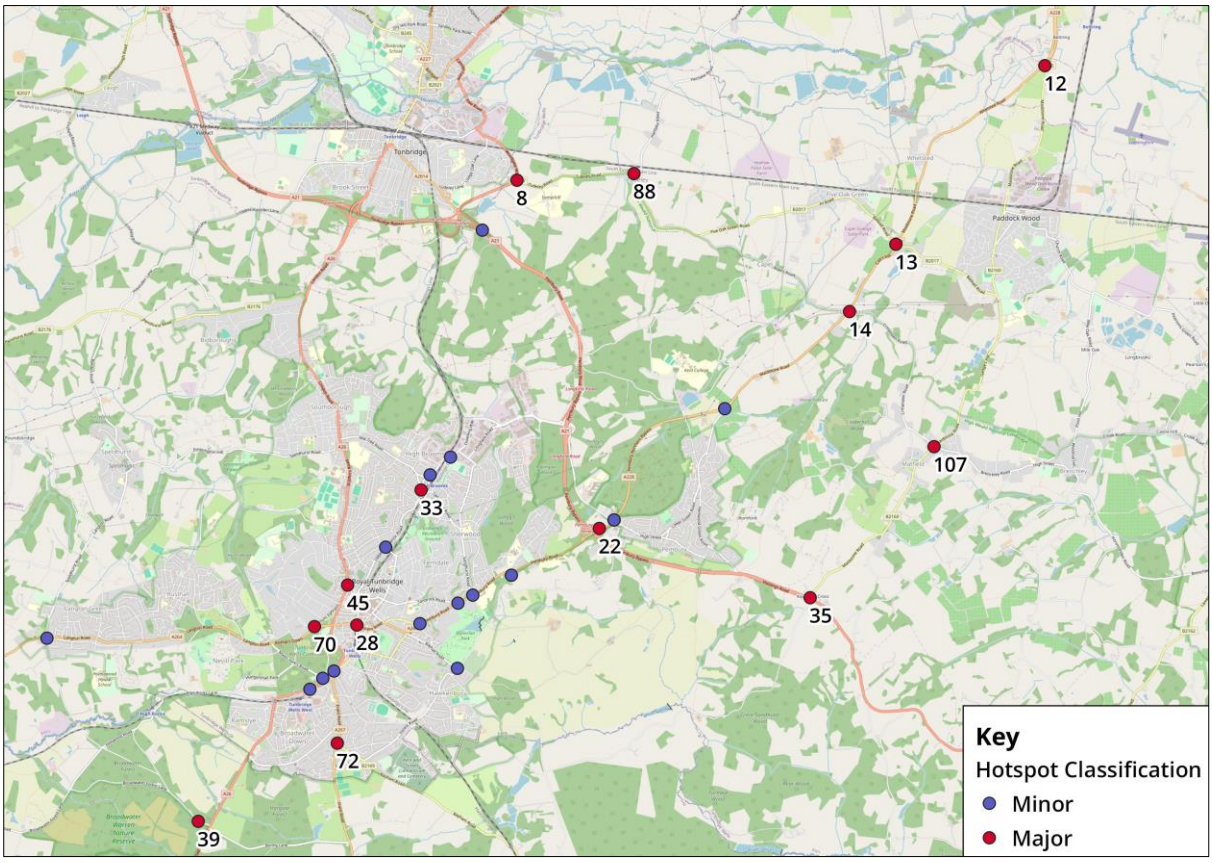
- 16 ‘minor’ hotspot junctions; and
- 14 ‘major’ hotspot junctions.

The primary focus of the analysis is mitigating the ‘major’ hotspots in line with the National Planning Policy Framework (NPPF) and the need to directly mitigate “significant” impacts. The 14 ‘major’ hotspot junctions identified are summarised in Table 10 and illustrated in Figure 4.

Table 10: Major Hotspot Summary – Local Plan Core Scenario

ID	Junction name	Location
8	A26 / B2017 Tudeley Road (Somerhill Roundabout)	Tudeley
12	A228 / B2160 Maidstone Road (Hop Farm Roundabout)	Paddock Wood
13	A228 / B2017 (Badsell Roundabout)	Paddock Wood
14	A228 / Alders Road / Crittenden Road	Paddock Wood
22	A228 / A264 / A21 SB slips	Pembury
28	A264 / Mount Pleasant Road	Royal Tunbridge Wells
33	North Farm Road / Upper Grosvenor Road / Sandhurst Road	Royal Tunbridge Wells
35	A21 / B2160 Maidstone Road (Kipping’s Cross)	Kipping's Cross
39	A26 / Bunny Lane / Broadwater Forest Lane	Royal Tunbridge Wells
45	A26 / Grosvenor Road	Royal Tunbridge Wells
70	A264 / Mount Ephraim	Royal Tunbridge Wells
72	A267 / B2169 Birling Road	Royal Tunbridge Wells
88	B2017 / Hartlake Road	Tudeley
107	B2160 / Chestnut Lane / Brenchley Road (Matfield Crossroads)	Matfield

Figure 4: Hotspot Junction Locations – Local Plan Core Scenario



The objective of the study has been to mitigate the 'major' Local Plan impacts in order to create a delivery plan with viable and supported transport measures that offset the significant Local Plan issues generated. In line with NPPF and Circular 01/22 guidance, the initial priority is on maximising sustainable transport measures to minimise the level of new private vehicle trips on the highway network. Where the analysis has indicated residual hotspot locations remain after the implementation of sustainable transport measures, focused highway mitigation schemes have been developed to remove residual impacts on the highway network.

4 Modal Shift Assessment

4.1 Background

The proposed future sustainable transport interventions, and their potential to induce modal shift, are discussed in Sweco's Modal Shift Note. The modal shift assessment considers the following future interventions:

- Paddock Wood Orbital Bus Service
- Network Wide Bus Service Upgrades
- Phase 2 of the Local Cycling and Walking Infrastructure Plan (LCWIP)

In terms of impact of traffic flows the note considers High, Medium and Low mode shift scenarios. The Local Plan Modal Shift (LPMS) scenario discussed in this report is the High level of modal shift.

4.2 Matrix Totals

The matrix totals for the LPMS scenario are compared against the LP core scenario in Table 11. There is a reduction of 819 and 844 vehicle trips in the AM and PM peak hours respectively.

Table 11: Local Plan Modal Shift Scenario Matrix Totals (PCUs)

Description	User Class	AM	PM
Local Plan Core	Car Business	3,456	2,805
	Car Commute	16,946	12,868
	Car Other	19,327	24,059
	LGV	5,795	5,254
	HGV	2,887	1,401
	Total	**48,410**	**46,387**
Local Plan Modal Shift	Car Business	3,396	2,754
	Car Commute	16,662	12,699
	Car Other	18,851	23,435
	LGV	5,795	5,254
	HGV	2,887	1,401
	Total	**47,591**	**45,543**
Change	Car Business	-59	-51
	Car Commute	-284	-170
	Car Other	-476	-624
	LGV	0	0
	HGV	0	0
	Total	**-819**	**-844**

4.3 Model Results

4.3.1 Traffic Flow Differences

The impact of the sustainable transport intervention on traffic flows is illustrated in the traffic flow difference plots presented in Figure 5 (AM) and Figure 6 (PM). They compare the LPMS scenario with the LP core scenario.

Figure 5: Local Plan Modal Shift – Local Plan Core Flow Difference AM

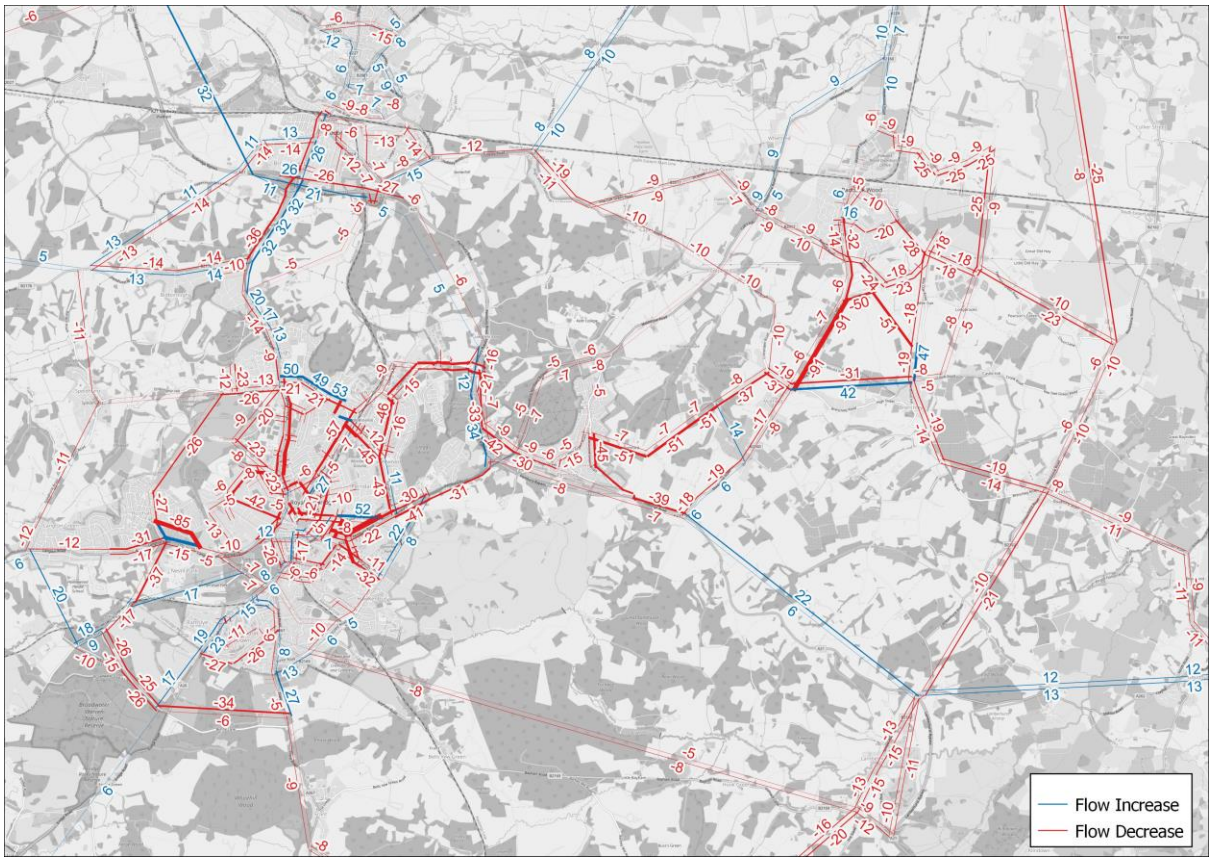
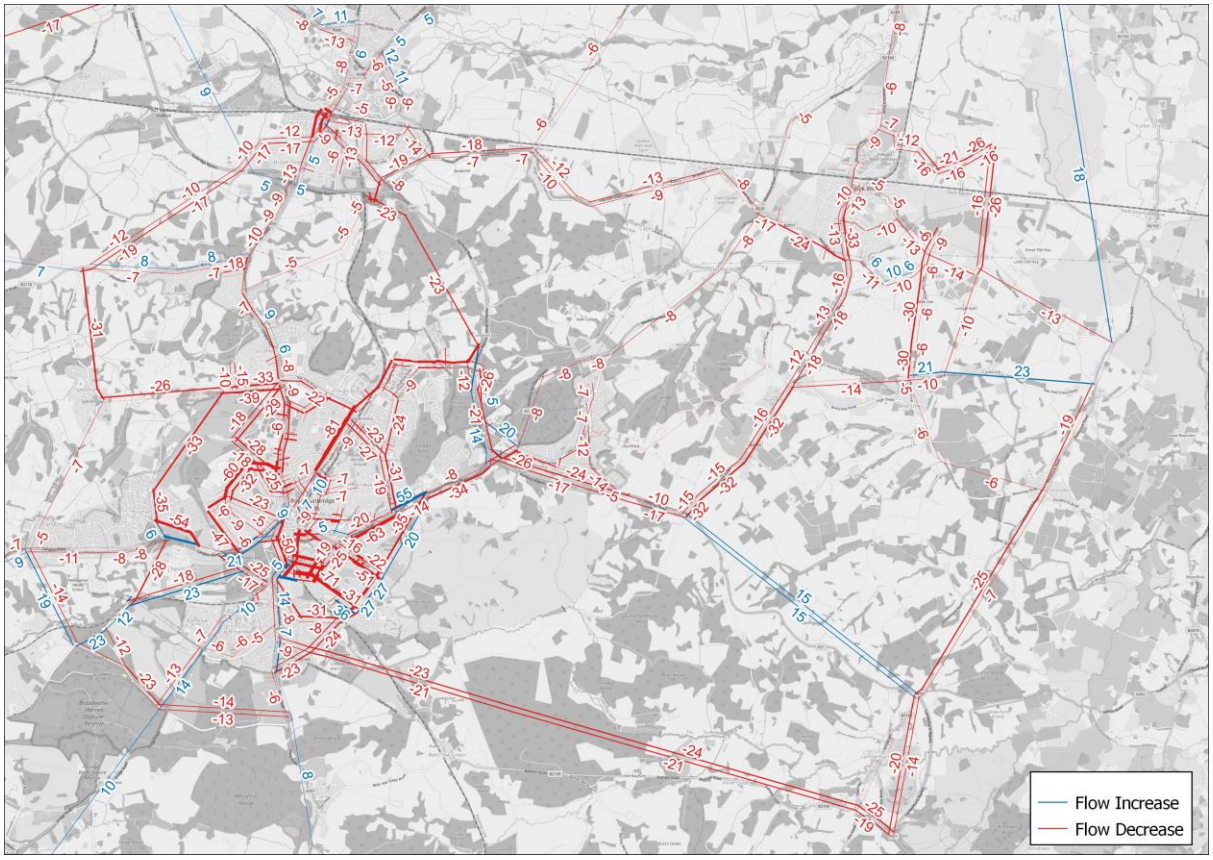


Figure 6: Local Plan Modal Shift – Local Plan Core Flow Difference PM



The above demonstrates a modest decrease in traffic flows associated with the sustainable transport interventions. The largest decreases are shown to be within, and on the key routes between, Paddock Wood, Royal Tunbridge Wells, Pembury and Tonbridge, where the measures are focussed.

4.3.2 Hotspots

The identification of hotspots for the LPMS scenario follows the same methodology as the LP Core scenario, as discussed in Section 3.3 above. The analysis has identified the following high-level summary:

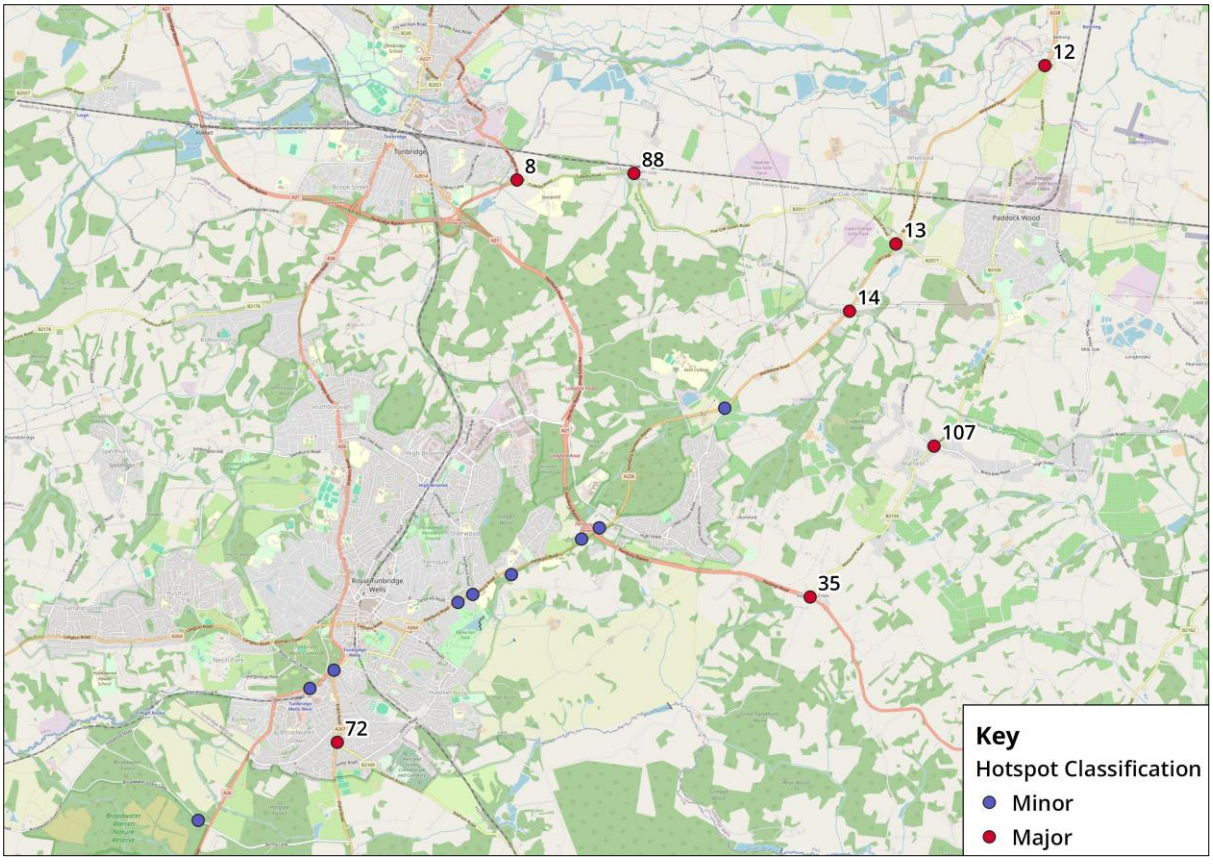
- 9 'minor' hotspot junctions - a reduction from 21 in the LP core scenario.
- 8 'major' hotspot junctions - a reduction from 14 in the LP scenario.

The remaining 'major' hotspots are summarised in Table 12 and illustrated in Figure 7.

Table 12: Major Hotspot Summary – Local Plan Modal Shift Scenario

ID	Junction name	Location
8	A26 / B2017 Tudeley Road (Somerhill Roundabout)	Tudeley
12	A228 / B2160 Maidstone Road (Hop Farm Roundabout)	Paddock Wood
13	A228 / B2017 (Badsell Roundabout)	Paddock Wood
14	A228 / Alders Road / Crittenden Road	Paddock Wood
35	A21 / B2160 Maidstone Road (Kipping's Cross)	Kipping's Cross
72	A267 / B2169 Birling Road	Royal Tunbridge Wells
88	B2017 / Hartlake Road	Tudeley
107	B2160 / Chestnut Lane / Brenchley Road (Matfield Crossroads)	Matfield

Figure 7: Hotspot Junction Locations – Local Plan Modal Shift Scenario



Of the 6 junctions falling out of the 'major' hotspot list, 5 of these are located within Royal Tunbridge Wells. This area is urban in nature and there is limited scope for highway interventions without reducing space for pedestrians e.g. by widening approach lanes and reducing footways. Interventions of this nature would be contradictory to the approach of encouraging modal shift away from car. The LPMS scenario results therefore demonstrate the potential for modal shift measures to mitigate the Local Plan impact at such locations.

The other junction that falls out of the 'major' hotspot list is the northern roundabout (Junction 22) at the A21 / A228 dumbbell roundabout junctions. Whilst the dumbbell roundabout junctions are both categorised as 'minor' hotspots in the LPMS scenario, these junctions are still considered for further highway mitigation in the following chapter. It is considered capacity improvements on the A228 Pembury Road corridor, including the dumbbell roundabouts, will have the potential to divert traffic away from the B2160 Maidstone Road corridor and thus mitigate the Local Plan impact at Kipping's Cross Roundabout (Junction 35) and the Matfield Crossroads (Junction 107).

In addition to the junctions on the A228 Pembury Road corridor, highway interventions are considered at the following 4 'major' hotspot junctions in the following chapter:

- Junction 8: Somerhill Roundabout
- Junction 12: Hop Farm Roundabout
- Junction 13: Badsell Roundabout
- Junction 35: Kipping's Cross Roundabout

Highway mitigation measures were not considered at the remaining 4 'hotspot' locations for the following reasons:

- **Junction 14: A228 / Alders Road / Crittenden Road**
  - This junction is located close to the southern end of the proposed Colts Hill Bypass. It is anticipated that the emerging design for the bypass will reconfigure this junction therefore no additional mitigation has been considered as part of this study.
- **Junction 72: A267 / B2169 Birling Road**
  - This junction is located within Royal Tunbridge Wells and has the same limitations in terms of highway improvements as the other Royal Tunbridge Wells junctions described above. It is recommended that this junction is taken account of in the Monitor and Manage plan for the Local Plan traffic impacts and assessed as part of relevant nearby planning applications with a view to investigating mitigation measures, if necessary, e.g. signalisation.
- **Junction 88: B2017 / Hartlake Road**
  - Further investigation into the modelling results at this priority-controlled junction show that it is the minor arm (Hartlake Road) that is forecast to be over-capacity in the AM peak hour due to the increase in traffic on the B2017 mainline. Hartlake Road is rural in nature and is single track in parts. Traffic flows are relatively low. It may be disproportionate to undertake significant highway works to benefit such a small amount of traffic. It is also recommended that this junction is taken account of in the Monitor and Manage plan with a view to investigating mitigation measures as part of relevant planning applications.
- **Junction 107: Matfield Crossroads**
  - As described above the Local Plan impact at this junction could be mitigated by diverting traffic to the A228 Pembury Road corridor. No mitigation at this junction has therefore been considered as part of this study with the focus being in improving the A228 Pembury Road corridor.

5 Highway Mitigation

5.1 Introduction

Following completion of the Local Plan Modal Shift LPMS scenario, the following junctions were identified as 'Major' hotspots which require further mitigation:

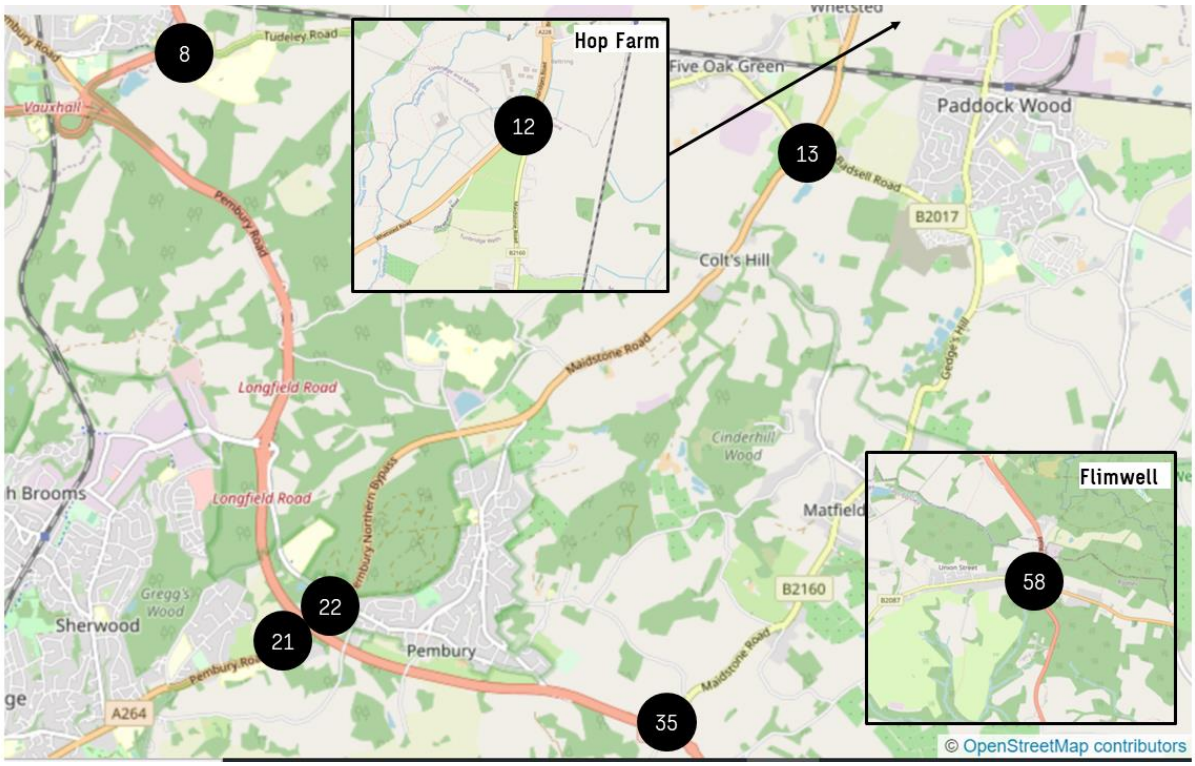
- Junction 8: Somerhill Roundabout
- Junction 12: Hop Farm Roundabout
- Junction 13: Badsell Roundabout
- Junction 35: Kipping's Cross Roundabout

In addition, National Highways has raised queries around three specific junction locations. These locations are:

- Junction 21: A21 / Pembury Road flyover South West Dumbbell
- Junction 22: A21 / Pembury Road flyover North East Dumbbell
- Junction 58: Flimwell Crossroads

The locations of the junctions are shown in Figure 8.

Figure 8 Hotspot Junction Locations Considered for Highway Mitigation



This Chapter sets out potential mitigation measures for each of the four 'Major' hotspot locations to remove any remaining residual impacts the Local Plan is creating in terms of additional congestion and delay at these locations, in comparison with the Reference Case (RC).

The A21 Pembury Road dumbbell roundabout junctions are currently part of a study by Stantec to look at potential capacity interventions along Pembury Road corridor. It is considered that improvements to this corridor would have the potential to reroute traffic away from B2160 Maidstone Road corridor, including Kipping's Cross roundabout. The impact of potential improvements along the Pembury corridor has also been considered in this Chapter.

Two Local Plan Highway Mitigation scenarios, which include alternative highway mitigation measures, have been run in the TWTM. These scenarios are introduced in Section 5.9

5.2 Review of Key Strategic Model Outputs

5.2.1 Junction Flow Changes

This is a high-level summary of the junction flows at the key junction locations identified in Section 5.1. The analysis includes total flow analysis for each junction based on the AM and PM Peaks. The scenarios presented are the Base Case (2018), Reference Case (RC), and Local Plan Modal Shift (LPMS). The colours in the table denote the scale of flows and change with green showing lower levels of flow or flow differences between scenarios whilst red denotes large amounts of flow or large changes in flow differences between scenarios.

Table 13 Key junction flow changes between Base Case, Reference Case, and Local Plan

		Base Case (BC)		Ref Case (RC)		Local Plan Modal Shift (LPMS)		BC vs RC		RC vs LPMS	
Model ID	Junction	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
8	A26 / B2017	2,639	2,520	3,586	3,067	3,743	3,156	36%	22%	4%	3%
12	A228 / B2160	3,263	2,874	3,699	3,286	3,817	3,536	13%	14%	3%	8%
13	A228 / B2017	2,512	2,493	3,088	3,011	3,806	3,586	23%	21%	23%	19%
22	A21 SB / A228 / A264	1,586	2,193	2,351	2,908	2,571	3,037	48%	33%	9%	4%
21	A21 NB / A228 / A264	2,344	2,502	3,695	3,533	3,871	3,735	58%	41%	5%	6%
35	A21 / B2160	2,967	2,644	3,342	3,327	3,484	3,523	13%	26%	4%	6%
58	A21 / A268 / B2087	1,947	1,662	2,340	1,993	2,371	2,028	20%	20%	1%	2%

The key metric is the comparison between Reference Case and Local Plan Modal Shift in terms of where the most significant demand growth occurs as an indication of where mitigation may be required. For all junctions except the A228/ B2017 (Badsell roundabout) junction, the level of growth observed is less than 10%. The growth observed for this comparison is lower than the growth observed between BC and RC, often a multiple of this rate.

The data shows that for Flimwell Crossroads (junction 58 A21 / A268 / B2087) there is not projected to be a significant increase in highway flows as a result of Tunbridge Wells borough Local Plan development growth.

5.2.2 Link Capacity Review

A high-level analysis has been undertaken to understand the impact of Local Plan development demand on key links close to Paddock Wood on the A228 and B2017. A summary of the Volume over Capacity (V/C) analysis is presented below.

***Table** 14: A228 and B2017 link capacity analysis*

A228 Maidstone Road (north of Badsell Junction)

Scenario	AM				PM			
	northbound		southbound		northbound		southbound	
	Demand	V/C	Demand	V/C	Demand	V/C	Demand	V/C
2018 Base	734	46	1,039	65	964	61	644	41
2038 Ref Case	959	60	1,145	72	1,027	65	877	55
2038 Local Plan Modal Shift (LPMS)	1,067	67	1,363	86	1,112	70	1,012	64

A228 Maidstone Road (Colts Hill)

Scenario	AM				PM			
	northbound		southbound		northbound		southbound	
	Demand	V/C	Demand	V/C	Demand	V/C	Demand	V/C
2018 Base	677	66	915	90	920	90	670	66
2038 Ref Case	830	81	1,127	111	990	97	882	86
2038 Local Plan Modal Shift (LPMS)	955	94	1,306	128	1,115	109	1,160	114

A228 Maidstone Road (Colts Hill) New Road

Scenario	AM				PM			
	northbound		southbound		northbound		southbound	
	Demand	V/C	Demand	V/C	Demand	V/C	Demand	V/C
2018 Base	677	43	915	58	920	58	670	42
2038 Ref Case	830	52	1,127	71	990	62	882	55
2038 Local Plan Modal Shift (LPMS)	955	60	1,306	82	1,115	70	1,160	73

B2017 Badsell Road (Five Oak Green)

Scenario	AM				PM			
	eastbound		westbound		eastbound		westbound	
	Demand	V/C	Demand	V/C	Demand	V/C	Demand	V/C
2018 Base	282	31	416	46	512	57	331	37
2038 Ref Case	455	51	615	68	644	72	405	45
2038 Local Plan Modal Shift (LPMS)	509	57	898	100	832	92	481	53

The V/C is based on the strategic model link flows divided by the overall identified link capacity, based on the descriptions provided by National Highways in the Design Manual for Roads and Bridges (DMRB) TA 79/99.

A228

The data analysis shows that there is a significant capacity issue on the A228 link through Colts Hill, south of the Badsell Roundabout junction with the B2017. As part of the Local Plan Highways Mitigation scenario the model was updated with a higher capacity link that replicates building a new road to modern standards with wider lanes and pavements provided. The analysis in the table for *'New Road'* shows that this new link will alleviate the V/C issues along this link. Stantec have designed up the Colts Hill Bypass link for the area that links into an expanded Badsell Roundabout. The trigger point is estimated to be approximately 2,000 dwellings.

The data shows that the link to the north of the Badsell Roundabout is projected to remain within capacity over the Local Plan period.

B2017 (Five Oak Green)

Although the data analysis shows that congestion rises along the B2017 through Five Oak Green link in the Local Plan scenario, the demand is not seen as being of a level to justify a major expansion in link capacity or a new link road such as the Five Oak Green bypass that was previously considered. However, it is recommended that consideration be given to the implementation of enhanced traffic management through the area to better support the flow of vehicles whilst also integrating this with enhanced infrastructure for people walking, wheeling and cycling in the area to enable them to safely travel along and across the link. More broadly the sustainable transport measures should be designed to maximise accessibility to Paddock Wood rail services to reduce the need for car travel on this link. The design and implementation of such measures would be expected to be linked to Travel Plans and Monitor and Manage agreements for all major Local Plan developments in the wider Paddock Wood area.

5.3 Junction Modelling Methodology

The findings from the local junction modelling have been used to confirm potential mitigation solutions at the key hotspots with the aim to produce nil detriment to the junction's capacity performance when compared to the Reference Case scenario. The junctions have been modelled using industry standard software. Junctions 10 software has been used for modelling roundabouts, specifically the ARCADY model for roundabouts. The traffic signal junctions have been modelled using LinSig3 software.

5.3.1 Junction Capacity Appraisal – Definition of Modelling Terms

Volume to Capacity ratio (V/C) – This comes from the Strategic Saturn highway model. It is a measure of the performance of a junction – over 95% a junction is generally agreed to be operating above practical capacity. There are a number of junctions with Volume / Capacity close to or greater than 95% in the RC. Where the Volume / Capacity is similar or at a lower level in the Local Plan scenario, mitigation measures are not put forward. The Transport Assessment for the Local Plan focuses on identifying potential measures that may need to be secured to address severe impacts occurring as a result of the allocated development sites only.

ARCADY LOS = Level of Service – The Junction modelling software refers to Level of Service values contained in the Highway Capacity Manual (HCM 2000). In this instance, model outputs show the unsignalised level of service values for each peak hour, based on the average delay per arriving vehicle. The LOS system uses the following alphabetised categories:

- A = Free flow
- B = Reasonably free flow
- C = Stable flow
- D = Approaching unstable flow
- E = Unstable flow
- F = Forced or breakdown flow

Queue Length – The queue lengths stated in the capacity assessment results represent the average maximum queue lengths in Passenger Car Units (PCUs) on each approach arm across the peak hour. They are therefore indicative of queuing extents at the busiest point of the peak hour and are not representative of average conditions. This applies to all models used.

ARCADY RFC = Ratio of Flow to Capacity – The ratio of flow to capacity provides a measure of the utilised capacity of a junction approach arm. Arms exceeding a ratio of 0.85 (i.e. 85% capacity utilised) are considered to be approaching capacity and characteristically have light-to-moderate levels of queued traffic flow. Arms exceeding a ratio of 1.00 (i.e. 100% capacity utilised) are considered to be over capacity and are characterised as having heavy volumes of queued traffic.

ARCADY results that exceed RFCs of 1.00 generate queue lengths that are subject to exponential growth. For this reason, queue lengths attributed to overcapacity approach arms should be seen as indicative rather than representative. The capacity assessment tables within this technical note use a colour-coding system to assist in appraisal:

- Arms with an RFC of less than 0.85 are coloured green.
- Arms with an RFC between 0.85 and 0.99 are coloured amber.
- Arms with an RFC of 1.00 or more are coloured red.

LINSIG DOS = Degree of Saturation – The degree of saturation is an output from LINSIG which provides a measure of the utilised capacity of a signalised junction approach lane. It is directly comparable to the RFC outputs obtained from ARCADY assessments (see above). The colour-coding system used to categorise DOS in the model results tables is as follows:

- Lanes with a DOS of less than 85% are coloured green.
- Lanes with a DOS between 85% and 99% are coloured amber.
- Lanes with a DOS of 100% or more are coloured red.

5.3.2 Derivation of Localised Modelling

The list of schemes agreed and set out in Section 3 onwards of this Technical Note for localised modelling was agreed with TWBC as a result of Stage 3 Part 1 Modelling analysis.

Traffic Flows for Localised Models

Strategic modelling has initially been used as an indicator to identify junctions that could be over capacity. Where a potential need for mitigation has been identified, the traffic flows for the localised traffic model of the identified junctions have been derived as follows:

1. Extract traffic flows from the strategic model for Reference Case and Local Plan scenarios.
2. Input strategic model flows into the localised junction models. This will mean both traffic growth and any changes in network assignment will be taken into account.

This method has been adopted upon previous consultation with KCC and NH to ensure accuracy on future year junction demand.

Layout

There are no topographical surveys available for this analysis. As a result, Ordnance Survey mapping has been used to identify the geometric configuration for the mitigation solutions outlined within this Note.

5.4 Junction 8: Somerhill Roundabout

5.4.1 Summary of Strategic Modelling Results and Reason for Mitigation

The data shows that even with high modal shift alongside the local plan growth, demand through this junction will increase. Cumulatively there is approximately an additional 150 vehicles through the junction in the Local Plan scenarios. In the Local Plan Modal Shift scenario without any highway changes, the highest Volume-to-Capacity ratio (V/C) is 101% in the AM peak and 96% in the PM peak, as summarised in the table below.

Table 15: Strategic Highway Modelling outputs for Junction 8 A26 / B2017

ID Junction	Description	2038 Reference Case (RC)					Local Plan Modal Shift (LPMS)				
		V/C	Flow pcu	Jct V/C	Avg Q (pcu)	Delays (sec)	V/C	Flow pcu	Jct V/C	Avg Q (pcu)	Delays (sec)
AM	A26 Woodgate Way (N)	99	1,307	94	4	86	100	1,315	98	6	95
	B2017 Tudeley Road (E)	91	931	94	2	52	102	1,066	98	18	114
	A26 Woodgate Way (SW)	96	1,118	94	4	55	99	1,133	98	6	64
	Tudeley Lane (W)	63	231	94	1	25	65	228	98	1	27
PM	A26 Woodgate Way (N)	93	1,161	83	2	46	96	1,182	85	3	52
	B2017 Tudeley Road (E)	41	461	83	0	17	44	512	85	0	19
	A26 Woodgate Way (SW)	96	1,275	83	1	74	97	1,292	85	2	83
	Tudeley Lane (W)	36	170	83	0	17	38	171	85	0	17

From the above table it can be seen that the SATURN Strategic modelling indicates that this junction would operate close to capacity in the Local Plan scenario tested. The three key arms in the junction, A26 Woodgate Way (N) arm, the A26 Woodgate Way (SW) arm, and the B2017 Tudeley Road (E) arm see the biggest delays in the AM Peak, with the B2017 Tudeley Road (E) arm in particular impacted by Local Plan demand changes, jumping from 91% V/C to 102% V/C. As a result, a requirement to undertake localised junction modelling to identify a junction mitigation has been identified.

5.4.2 Localised Junction Model – Existing Junction Layout

Sweco have developed an ARCADY junction model to test the existing junction layout against future highway demand projections within the 2038 Reference Case and 2038 Local Plan scenarios, and then develop mitigation concept design to address the identified capacity issues. The concept design is then modelled in order to demonstrate the effectiveness of the mitigation solution.

The ARCADY model outputs for the current junction layout are set out in ***Figure 9*** below.

Figure 9: Arcady Results – Current Junction Layout and Future Year Demand (2038)

	AM				PM			
	Queue (PCU)	Delay (s)	RFC	LOS	Queue (PCU)	Delay (s)	RFC	LOS
	Ref Case 2038							
1 - A26 North	3.1	8.01	0.74	A	2.5	7.02	0.69	A
2 - B2017 Tudeley Rd	22.9	80.67	1	F	0.9	6.36	0.45	A
3 - A26 south	4.5	13.72	0.81	B	3.5	9.22	0.77	A
4 - Five Oak Green Rd	0.7	10.41	0.4	B	0.3	6.43	0.23	A
	Local Plan Modal Shift (LPMS) 2038							
1 - A26 North	3.3	8.31	0.75	A	2.7	7.7	0.72	A
2 - B2017 Tudeley Rd	71.6	198.89	1.12	F	1	6.67	0.49	A
3 - A26 south	4.6	13.87	0.82	B	3.9	10.13	0.78	B
4 - Five Oak Green Rd	0.7	10.22	0.39	B	0.4	6.77	0.24	A

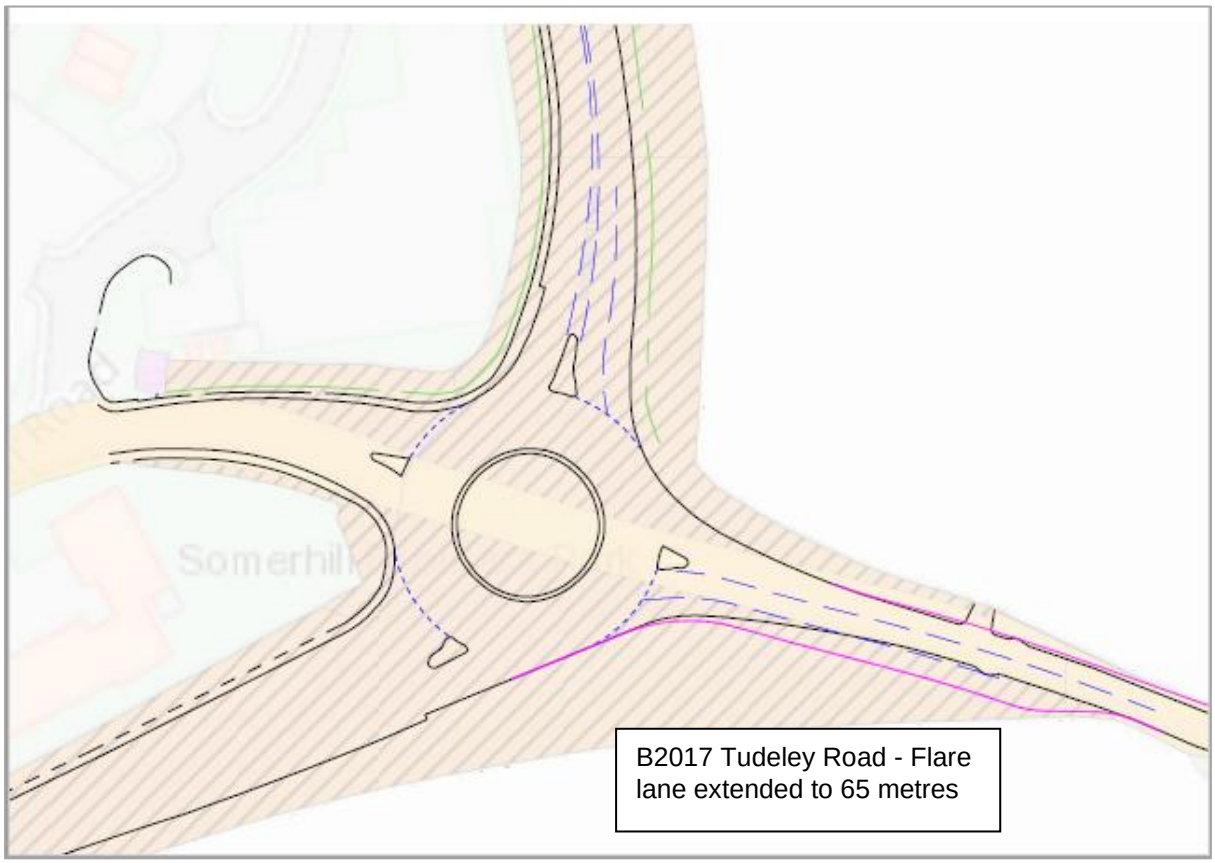
The results show that in the PM peak, there are no capacity issues predicted at this junction with a Level of Service (LoS) of 'A' recorded in all scenarios, except the A26 south arm with a LoS of 'B'. However, the arm is still considered to be reasonably free flowing.

In the AM Peak, the B2017 Tudeley Road is shown to be operating at capacity in the RC and over capacity with an RFC over 100% in the Local Plan scenario, as highlighted in the LoS of 'F' for this arm.

5.4.3 Potential Mitigation and Boundary Analysis

The mitigation measure identified to deliver improved infrastructure performance when considering additional future growth is to provide additional capacity on the B2017 Tudeley Road approach to the junction. The potential mitigation solution identified is the provision of a second lane on the approach to the roundabout. The resultant concept design is illustrated in **Figure 10** below.

Figure 10: Junction 8 – A26 / B2017 Mitigation Concept Design



The orange shaded area denotes land owned and publicly maintainable by KCC Highways, as obtained from KCC. As indicated on the drawing above, the carriageway widening that could be achieved on Tudeley Road, within the existing highway boundary, is a 65m flare. The running lanes on Tudeley Road have been assumed to be 3.65m each, and the westbound lane has been widened marginally on the north side to achieve 3.65m. The above concept design has been assessed in an ARCADY junction model as discussed below.

5.4.4 Localised Junction Model – Mitigation Solution

The result of the ARCADY model of the mitigation solution outlined above is summarised in **Figure 11.**

Figure 11: Arcady Results - Mitigation Junction Layout (2038 Future Year Demand)

	AM				PM			
	Queue (PCU)	Delay (s)	RFC	LOS	Queue (PCU)	Delay (s)	RFC	LOS
	Local Plan Modal Shift (LPMS) 2038							
1 - A26 North	3.3	8.31	0.75	A	2.7	7.7	0.72	A
2 - B2017 Tudeley Rd	4	12.73	0.79	B	0.6	3.79	0.35	A
3 - A26 south	5.6	16.99	0.85	C	3.9	10.11	0.78	B
4 - Five Oak Green Rd	0.8	11.72	0.43	B	0.4	6.77	0.24	A

The Tudeley Road arm LoS has fallen to 'B', with an RFC of 79 and a queue of just 4 PCUs. This represents a significant reduction in queueing and delay on the B2017 arm to below RC levels. There are marginal increases in RFC on the other arms, however these are considered negligible. Therefore, our analysis shows that the suggested concept design would lead to 'nil-detriment' in the area.

The junction modelling analysis indicates that a 65 metre flare will be sufficient to deliver the benefit required to bring this junction performance back to RC levels.

5.4.5 DMRB Design Compliance

The identified mitigation measure would be designed in accordance with CD 116 – Geometric design of roundabouts. These works are very minor and therefore, departures from standards are not anticipated. The initial feasibility layout is largely limited to the westbound approach to the roundabout on the Tudeley Road arm, with the immediate approach flare retained.

5.4.6 Safety Review

The highway improvement works are minor in nature. The primary safety consideration would be securing adequate visibility towards and through the junction. It is considered that these can be easily provided. Furthermore, as there are no existing or proposed pedestrian movements crossing or travelling along the southern edge of Tudeley Road, these highway improvement works would not negatively impact pedestrian safety.

5.4.7 Cost and Budget

A high-level cost estimate is expected to be approximately £500,000. This would be within the identified Stantec proposed masterplan budget (as part of the Strategic Sites Infrastructure Plan) for a mitigation at this location of £1,000,000. The Infrastructure Delivery Plan has identified a cost of £1,500,000 for the wider works.

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5.5 Junction 12 Hop Farm Roundabout

5.5.1 Summary of Strategic Modelling Results and Reason for Mitigation

As illustrated by the SATURN modelling results summarised below, the greatest impact of the Local Plan on this junction are experienced in the AM Peak as a result of additional traffic on the B2160 and A228 SW approach arms. As a result, a requirement to undertake localised junction modelling to identify a junction mitigation has been identified.

Table 16: Strategic Highway Modelling outputs for Junction 12 A228 / B2160

ID Junction	Description	2038 Reference Case (BAA)					2038 Local Plan with A228 upgrades (EAB)				
		V/C	Flow pcu	Jct V/C	Avg Q (pcu)	Delays (sec)	V/C	Flow pcu	Jct V/C	Avg Q (pcu)	Delays (sec)
AM	A228 Branbridges Road (NE)	100	2,116	98	3	34	103	2,128	102	33	80
	B2160 Maidstone Road (SE)	105	587	98	22	170	108	615	102	31	219
	A228 Whetsted Road (SW)	92	958	98	3	50	99	1,035	102	6	67
	Unnamed Road (NW)	15	39	98	0	24	16	39	102	0	25
PM	A228 Branbridges Road (NE)	70	1,493	84	0	13	79	1,674	91	0	15
	B2160 Maidstone Road (SE)	85	667	84	2	46	101	754	91	12	95
	A228 Whetsted Road (SW)	107	1,032	84	44	201	109	1,012	91	54	243
	Unnamed Road (NW)	42	93	84	1	30	43	96	91	1	31

5.5.2 Localised Junction Model – Existing Junction Layout

Sweco have developed an ARCADY junction model to test the existing junction layout against future highway demand projections within the Reference Case and Local Plan scenarios. On the results of the ARCADY model, a mitigation concept design to address the identified capacity issues has been identified. The concept design is then modelled in order to demonstrate the effectiveness of the mitigation solution.

The ARCADY model outputs for the current junction layout are set out in ***Figure 12*** below.

Figure 12: Arcady Results - Current Junction Layout and Future Year Demand (2038)

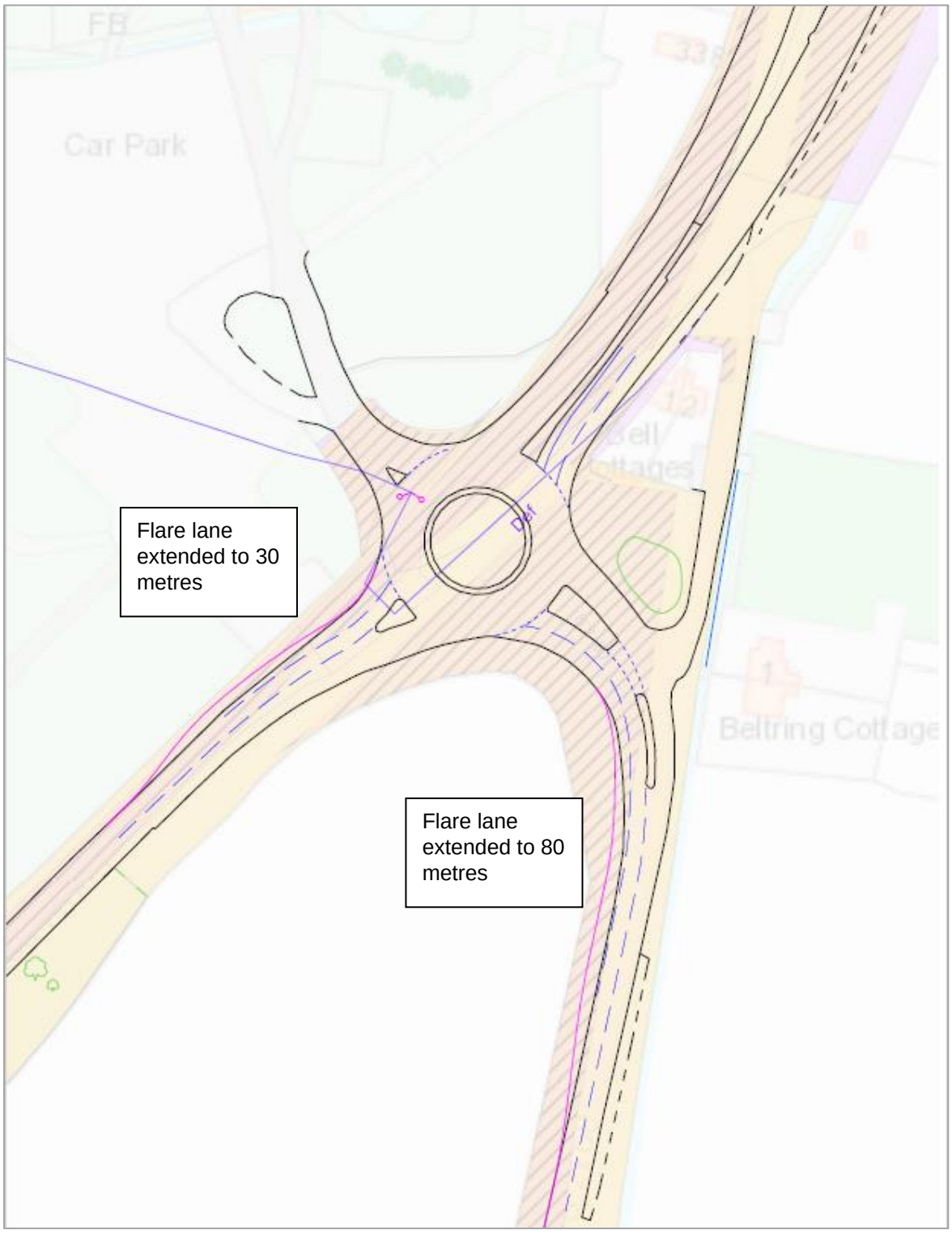
	AM				PM			
	Queue (PCU)	Delay (s)	RFC	LOS	Queue (PCU)	Delay (s)	RFC	LOS
	Ref Case 2038							
1 - A228 Branbridges Road	22.1	35.88	0.97	E	2.4	5.28	0.69	A
2 - B2160 Maidstone Road	10.8	63.67	0.94	F	4.9	25.2	0.83	D
3 - A228 Whetsted Road	7.8	28.51	0.89	D	23.5	74.71	1	F
4 - Hop Farm Village	0.1	9.27	0.08	A	0.4	14.2	0.27	B
	Local Plan Modal Shift (LPMS) 2038							
1 - A228 Branbridges Road	29.4	46.14	0.99	E	3.6	7.23	0.77	A
2 - B2160 Maidstone Road	17.4	93.12	1	F	15.6	70.36	0.97	F
3 - A228 Whetsted Road	15.4	51.15	0.96	F	24.3	78.14	1	F
4 - Hop Farm Village	0.1	10.37	0.1	B	0.4	15.09	0.29	C

The results show that in the RC scenario, the junction approaches capacity in the AM Peak on the three key arms of the A228 North and South arms, and the B2160 arm. In the PM Peak, the B2160 arm and A228 South arm (Whetsted Road) are also shown to be operating at capacity with a LoS of 'F'.

5.5.3 Potential Mitigation and Boundary Analysis

The mitigation measure identified to ensure better junction performance when considering additional future growth is to provide additional capacity on both the A228 SW approach arm, and the B2160 approach arm. This would be achieved through the provision of extended flare lengths to accommodate 2 lanes on each. The concept design of this measure is illustrated in **Figure 13** below.

Figure 13: Junction 12 A228 / B2160 Mitigation Concept Design



The mitigation solution includes the provision of an additional 30 metres of extra flare lane on the A228 (SW) arm approaching the roundabout, whilst the flare on the B2160 approach arm to roundabout would be extended by 80 metres. As illustrated, the full extent of these works can be accommodated within existing public highway and thus, this mitigation solution would be wholly achieved within highway land. The geometry of the roundabout and other approaches remains the same, whilst no additional crossings are included.

5.5.4 Localised Junction Model – Mitigation Solution

The result of the ARCADY model of the mitigation layout outlined above is summarised in **Figure 14** below.

Figure 14: Arcady Results - Mitigation Junction Layout (2038 Future Year Demand)

	AM				PM			
	Queue (PCU)	Delay (s)	RFC	LOS	Queue (PCU)	Delay (s)	RFC	LOS
	Local Plan Highways (LPH) 2038							
1 - A228 Branbridges Road	29.6	46.35	0.99	E	3.6	7.23	0.77	A
2 - B2160 Maidstone Road	2.8	15.2	0.72	C	2.9	13.05	0.73	B
3 - A228 Whetsted Road	3.8	12.36	0.78	B	4.4	14.78	0.81	B
4 - Hop Farm Village	0.1	10.92	0.1	B	0.5	16.69	0.31	C

The output shows that the mitigation solution assessed would resolve the issues on the B2160 and A228 South arms in both AM and PM Peak. The respective LoS for each arm respectively falls from levels of 'F' in the Local Plan scenario without highway changes to LoS 'B' or 'C'.

The A228 Branbridges Road arm that was an issue in the RC scenario with LoS 'E' in the AM Peak, remains at LoS 'E'. The queue for this arm rises by approximately 7 PCUs and delay in seconds increases by approximately 11 seconds in the AM Peak. Though this is an issue to be considered from a junction performance perspective, these impacts are not seen as severe enough to warrant further Local Plan led junction improvement works or mitigation.

5.5.5 DMRB Design Compliance

The identified mitigation measure would be designed in accordance with CD 116 – Geometric design of roundabouts. These works are very minor, fitting within highway land with no CPO needed, and therefore, departures from standards are not anticipated. The initial feasibility layout is largely limited to the southeast and southwest approaches to the roundabout on the A228 Whetsted Road and B2160 Maidstone Road arms respectively, with the immediate approach flares and roundabout geometry retained.

5.5.6 Safety Review

The highway improvement works are minor in nature. The primary safety consideration would be securing adequate visibility towards and through the junction. It is considered that these can be easily provided without the need for third party land.

5.5.7 Cost and Budget

A high-level cost estimate is expected to be approximately £250,000. This is within the identified Stantec proposed masterplan budget and Infrastructure Delivery Plan estimate of £1,000,000 for mitigation at this location. As a result, there is no additional funding requirement identified for this location.

5.6 Junction 13: Badsell Roundabout

5.6.1 Summary of Strategic Modelling Results and Reason for Mitigation

The table below sets out key information from the strategic model in terms of delay and flows when comparing the RC scenario with the LPMS scenario at the A228 / B2017 junction.

Table 17: Strategic Highway Modelling outputs for Junction 13 A228 / B2017 prior to A228 layout changes

ID Junction	Description	2038 Reference Case (RC)					Local Plan Modal Shift (LPMS) pre A228 changes				
		V/C	Flow pcu	Jct V/C	Avg Q (pcu)	Delays (sec)	V/C	Flow pcu	Jct V/C	Avg Q (pcu)	Delays (sec)
AM	A228 Maidstone Road (N)	111	1,194	99	68	239	113	1,192	104	77	273
	B2017 Badsell Road (E)	108	619	99	31	198	116	676	104	56	346
	A228 Maidstone Road (S)	94	825	99	3	35	102	842	104	13	79
	B2017 Badsell Road (NW)	66	450	99	1	22	71	486	104	1	24
PM	A228 Maidstone Road (N)	94	893	93	2	26	101	965	101	14	69
	B2017 Badsell Road (E)	68	484	93	1	17	85	590	101	2	23
	A228 Maidstone Road (S)	100	993	93	5	50	104	984	101	28	132
	B2017 Badsell Road (NW)	102	641	93	13	92	110	689	101	40	244

The RC shows underlying issues on all arms. Of particular note are the A228 North arm and B2017 East arm in the AM Peak, and the A228 South arm and B2017 North West arm in the PM Peak.

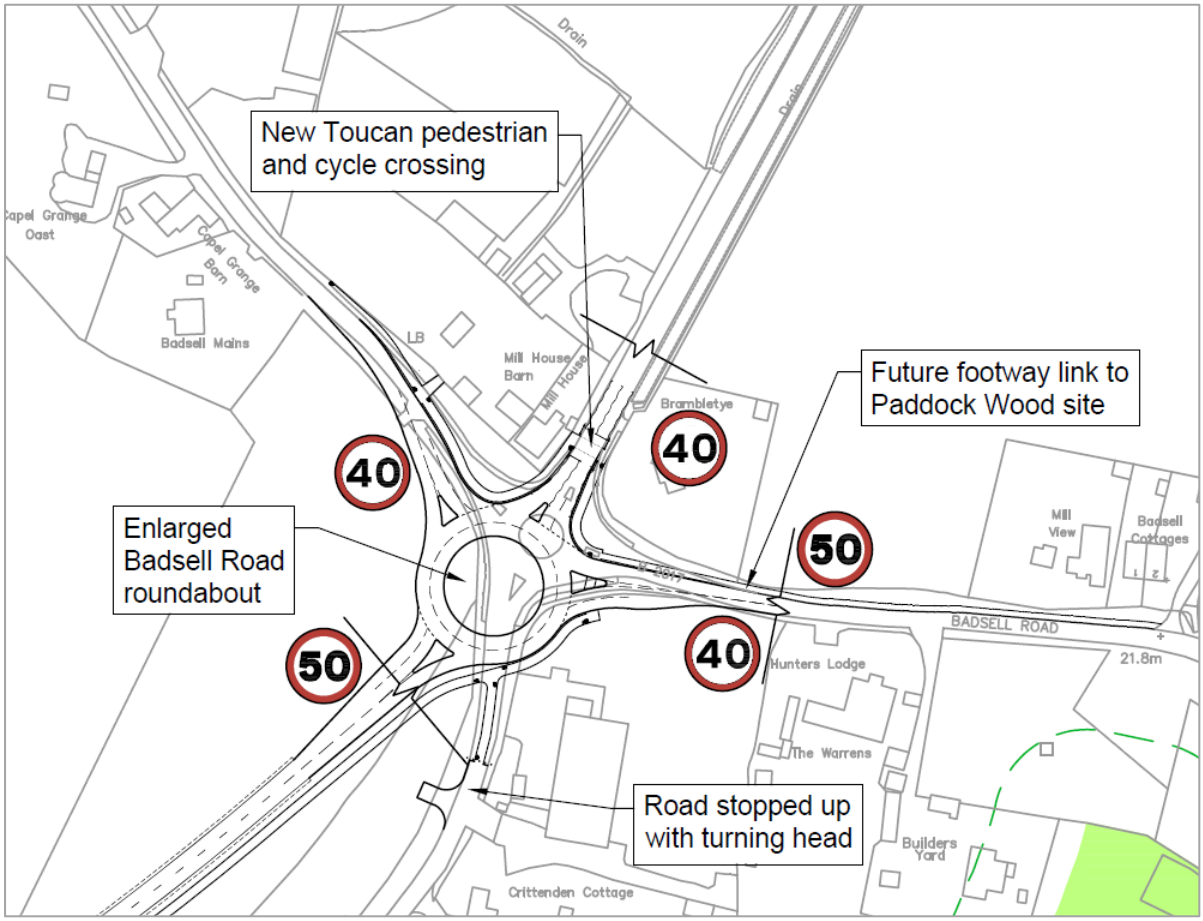
When Local Plan demand is added, without changing the junction or link layout along the A228 corridor, it can be seen that the junction fails to function properly, with significant congestion experienced on all arms in both the AM and PM Peaks. This highlights the need for additional capacity at the junction.

A scheme is being developed by Stantec on behalf of developers in the area. Following initial discussions with Stantec, Sweco has sought to replicate the overall principles of the Stantec proposals in the localised junction modelling for this junction without the ability to directly test the final design. The changes made have been:

- Increase the size of the roundabout with two lane approaches on all arms as well as two lanes around the roundabout.
- Additional capacity on the A228 south of the roundabout around Colts Hill to take account of the proposed Colts Hill bypass being designed by Stantec.

The proposed scheme considered within the mitigation modelling is shown in **Figure 15** below.

Figure 15: Junction 13 A228 / B2017 Mitigation Concept Design



The results of the revised Strategic Highway model run with the changes at Badsell Roundabout and A228 Colts Hill represented in the model are set out below.

Table 18: Strategic Highway Modelling outputs for Junction 13 A228 / B2017 after A228 layout changes

ID Junction	Description	2038 Reference Case (RC)					Local Plan Modal Shift (LPMS) post A228 changes				
		V/C	Flow pcu	Jct V/C	Avg Q (pcu)	Delays (sec)	V/C	Flow pcu	Jct V/C	Avg Q (pcu)	Delays (sec)
AM	A228 Maidstone Road (N)	111	1,194	99	68	239	103	1,373	88	31	148
	B2017 Badsell Road (E)	108	619	99	31	198	106	1,001	88	38	157
	A228 Maidstone Road (S)	94	825	99	3	35	70	933	88	1	29
	B2017 Badsell Road (NW)	66	450	99	1	22	43	498	88	0	20
PM	A228 Maidstone Road (N)	94	893	93	2	26	77	1,026	73	1	23
	B2017 Badsell Road (E)	68	484	93	1	17	54	664	73	1	15
	A228 Maidstone Road (S)	100	993	93	5	50	81	1,073	73	1	35
	B2017 Badsell Road (NW)	102	641	93	13	92	71	824	73	1	31

The Sweco LPMS model run with changes to the A228 network included shows that all arms perform better in the AM and PM peaks compared to their equivalent in the RC. In the PM Peak all arms work within capacity as well as the A228 South arm and B2017 North West arm in the AM Peak. Congestion remains on the A228 North and B2017 East arms, albeit these levels of congestion are a reduction on the projected RC levels.

The flows have been shared with Stantec for them to undertake further model runs as part of the masterplan work to finalise the design required for the junction to operate with the Local Plan growth.

5.7 Junction 35: Kipping's Cross Roundabout

5.7.1 Summary of Modelling Results and Reason for Mitigation

The data below highlights the expected demand increase through Kipping's Cross as a result of the new Local Plan development growth strategy in Tunbridge Wells borough.

Table 19: Strategic Highway Modelling Outputs for Junction 35 A21 / B2160

	Description	2038 Reference Case (RC)					Local Plan Modal Shift (LPMS)				
		V/C	Flow pcu	Jct V/C	Avg Q (pcu)	Delays (sec)	V/C	Flow pcu	Jct V/C	Avg Q (pcu)	Delays (sec)
AM	B2160 Maidstone Road (N)	104	833	90	23	122	108	827	93	41	208
	A21 (E)	114	1,161	90	85	358	117	1,189	93	102	419
	Dundale Road (S)	14	27	90	0	30	14	27	93	0	30
	A21 Hastings Road (W)	61	1,321	90	0	13	66	1,441	93	0	14
PM	B2160 Maidstone Road (N)	70	394	81	1	27	74	435	86	1	28
	A21 (E)	69	922	81	1	49	72	957	86	1	53
	Dundale Road (S)	24	86	81	0	20	26	89	86	0	21
	A21 Hastings Road (W)	92	1,924	81	0	21	97	2,042	86	1	27

The output data shows that during the AM Peak there are significant underlying issues in terms of queue and delay on the B2160 North and A21 East arms as shown in the RC. These existing issues are slightly exacerbated as a result of additional Local Plan demand, as shown in the LPMS scenario. This is replicated in the PM Peak with the A21 west arm.

It should also be noted that the model analysis relates to junction arm approaches, and so it does not take account of exit issues, namely the A21 exit towards Blue Boys Roundabout, where the A21 narrows from dual carriageway to single carriageway. Congestion and delay issues have been observed when the link demand is highest along the A21 towards Hastings (eastbound) as a result.

Localised junction modelling to identify and test junction mitigation options was undertaken, as discussed below.

5.7.2 Localised Junction Model – Existing Junction Layout

Sweco have developed an ARCADY model to test the existing junction layout against future highway demand projections within the Reference Case and Local Plan scenarios. The results of this analysis are presented in **Figure 16** below.

Figure 16: Arcady Results - Existing Kipping's Cross Junction

	AM				PM			
	Queue (PCU)	Delay (s)	RFC	LOS	Queue (PCU)	Delay (s)	RFC	LOS
	Ref Case 2038							
1 - B2160	10.8	45.32	0.93	E	1.5	12.33	0.58	B
2 - A21 east	45.3	117.36	1.05	F	2.2	7.87	0.67	A
3 - Dundale Road	0.3	39.43	0.23	E	0.2	8.79	0.18	A
4 - A21 west	2.5	6.16	0.69	A	55.4	87.44	1.03	F
	Local Plan Modal Shift (LPMS) 2038							
1 - B2160	15	62.19	0.96	F	1.5	11.32	0.58	B
2 - A21 east	67.9	167.49	1.1	F	2.5	8.72	0.7	A
3 - Dundale Road	0.3	43.93	0.25	E	0.3	9.51	0.19	A
4 - A21 west	3.4	7.76	0.76	A	110.2	156.68	1.09	F

When reviewing the junction in isolation, the junction model output confirms what has been observed from the strategic junction model in terms of arms with delay that require mitigation. The key arms in need of mitigation in the AM Peak are the B2160 North and A21 East arms, whilst the A21 West arm in the PM Peak requires mitigation.

5.7.3 Option Development

Based on the results of the ARCADY model, a mitigation concept design development process to identify an appropriate mitigation scheme to address identified capacity issues has been undertaken. Table 20 describes the mitigations considered to date as part of this assessment and why they have either not resolved the capacity issues (highlighted red) or have not been acceptable to key stakeholders (highlighted orange). The end of the table identifies two options in green that have the potential to be taken forward as part of the Local Plan mitigation strategy.

Table 20: Kipping's Cross Mitigation Options Investigated to Date as Part of this Assessment

ID	Status	Option	Description	Pros	Cons	Stakeholder Feedback
KX1	Dismissed	Partial signalisation Option 1	Signal control of B2160 with stop line/ signal on adjacent circulatory area.	Deliverable within existing highway footprint. Allows traffic to clear roundabout and exit B2160.	Potential queueing on roundabout blocking wider movements Requires ongoing revenue for signals management.	Not favoured by KCC or NH due to potential queueing issues.
KX2	Dismissed	Partial signalisation Option 2	Signal control of the eastbound A21 and B2160 with stop lines/ signals on immediately adjacent circulatory area.	Deliverable within existing highway footprint. Allows traffic to clear roundabout and exit B2160.	Requires ongoing revenue for signals management.	Not favoured by KCC or NH due to potential queueing issues.
KX3	Dismissed	Indirect signals	Signal control of eastbound A21 and B2160 with stop lines at least 20 metres in advance of roundabout to hold traffic back which allows normal roundabout function to continue.	Roundabout operates more efficiently as queuing held back from junction. Deliverable within existing highway footprint.	Queueing on approach roads leading to delays. Marginal reduction in road safety (5% increase in risk score). Requires ongoing revenue for signals management.	Not favoured by KCC or NH due to potential safety issues.
KX4	Dismissed	Narrowing B2160 approach	Narrowing of the B2160 approach to Kipping's Cross so that the traffic flow from this link will be constrained to reduce its attractiveness as a route.	Deliverable within existing highway footprint.	Significant impact on queues on B2160 arm.	Not favoured by KCC or NH due to local opposition.
KX5	Dismissed	Redistributing B2160 traffic	Traffic is redistributed over the wider network away from the roundabout due to wider changes to the local road network.	No physical works at the roundabout are required.	Needs detailed wider traffic management works	Unlikely to be acceptable to local groups.

KX6	Unlikely to be accepted	Lane drop eastbound A21	Drop a lane a few hundred metres in advance of the roundabout to reduce entry flows from western arm of A21	Deliverable within existing highway footprint. Throttles traffic entry onto roundabout. No traffic control required. Queueing managed where there are few receptors	Queueing will be certain at peak times. Additional road safety risk at merge.	Unlikely to be acceptable to local groups.
KX7	Unlikely to be accepted	Nearside lane on eastbound A21 made left only.	Nearside lane becomes left turn in advance of junction for western arm of A21. Ahead/ right traffic stay in offside lane.	Deliverable within existing highway footprint. Throttles traffic entry onto roundabout. No traffic control required. Queueing managed where there are few receptors	Queueing will be certain at peak times. Additional road safety risk with drivers ignoring lane control.	Unlikely to be acceptable to local groups.
KX8	Unlikely to be accepted	Widening A21 east of junction	Widening eastern arm A21 for a section to move merge point further east; potentially to Blue Boys Roundabout.	Additional stacking space to east of junction will help keep roundabout clear.	If queueing does take place, it will impact local receptor fronting road. Risk of induced demand and queueing returning through roundabout after a relatively short time.	Unlikely to work as a standalone option.
KX9	Unlikely to be accepted	Cross roads and signalisation	Replace roundabout with a signalised crossroads.	Deliverable within existing highway footprint. Control over flows. Detection can be used to hold eastbound A21 traffic to allow roundabout to clear. Better access for NMUs.	Costly and requires ongoing revenue for signals management. Queueing on western arm of A21 still likely.	Indicative junction modelling shows significant delay and congestion issues retained.

KX10	Potential to be taken forward	Modified roundabout layout to achieve the following: Left turn bypass from A21 to B2160 Widening on entry on B2160 Widening on A21 westbound entry	Modification to roundabout to provide a bypass for left turning traffic to the B2160. Increasing the width of the B2160 so there are two lanes on the approach to the roundabout. Both lanes would be right turns to the A21	Removes left turners from roundabout allowing more stacking space for traffic staying on A21. Increases capacity for traffic leaving B2160 Increased capacity for traffic heading west on A21	Costly and requires third party land, including removal of a barn to the north of junction. Queueing on western arm of A21 still likely as this is affected by the blocking back from Blue Boys roundabout	The roundabout exit eastbound could be widened so that the merge to one lane is improved and reduces the risk of blocking back into the roundabout circulatory. Would also require third party land.
KX11	Potential to be taken forward	Full signalisation of the roundabout	Increase size of circulatory area to provide internal stacking space for full signalisation. Layout may be more oval than circular to fit mostly within existing junction footprint	Control over flows. Detection can be used to hold eastbound A21 traffic to allow roundabout to clear.	Requires ongoing revenue for signals management. Queueing on western arm of A21 still likely.	Depending on level of stacking space to be created there is potential for this option based on previous partial signalisation roundabout modelling results. Could be combined with widening A21 east of junction for extra merge capacity.

5.8 Pembury Road Corridor

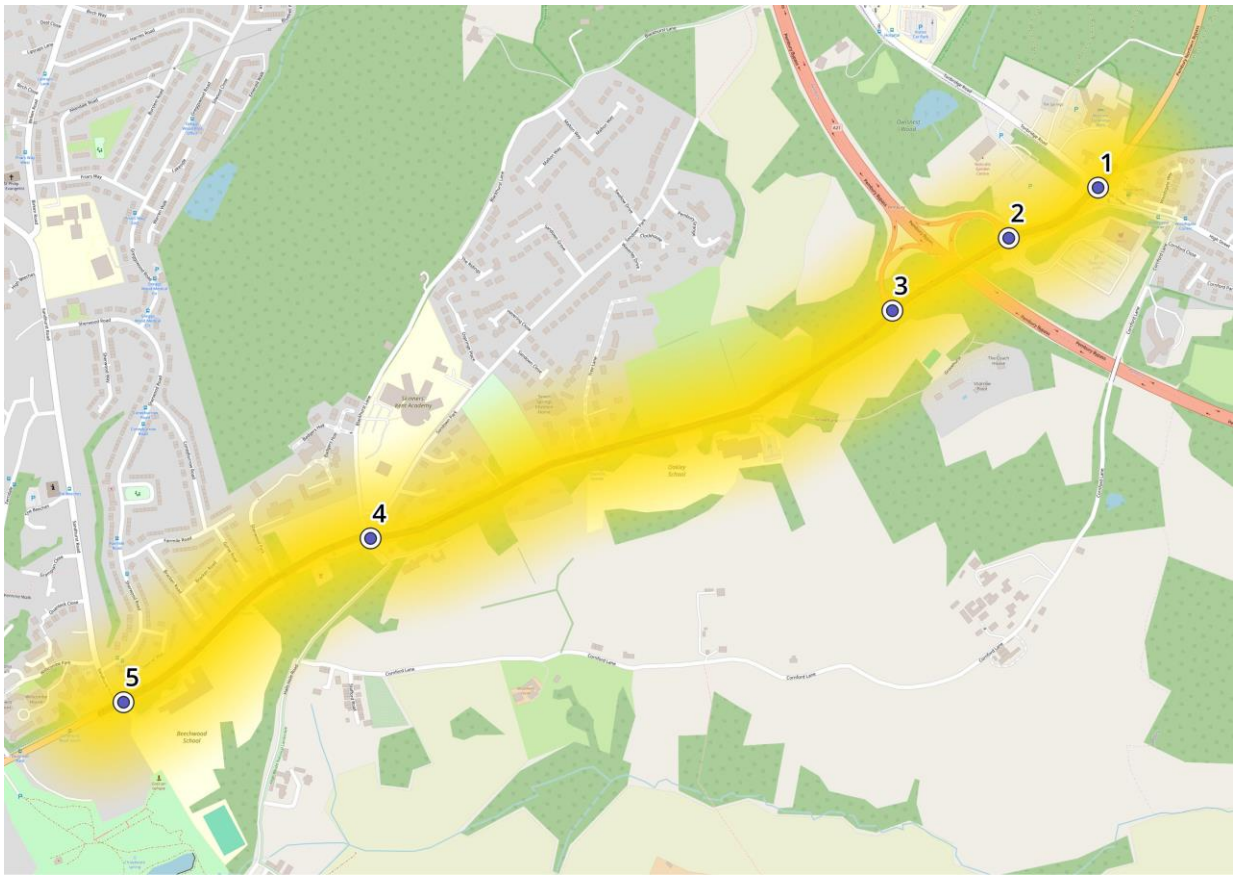
At a meeting on 8th February 2024 between Sweco, TWBC, KCC and NH, the potential improvement options at Kipping's Cross were discussed. It was accepted that it will be difficult to deliver a highway scheme without significant costs and land take. It was therefore agreed to also consider an alternative strategy.

An alternative option for highway mitigation would be to improve the Pembury Road corridor to reroute traffic away from Kipping's Cross. Whilst the Badsell Road roundabout improvements and Colts Hill Bypass will improve this corridor to the north, it was discussed that improvements will also be needed at the A21 / A228 Pembury Interchange dumbbell roundabouts and potentially the Tonbridge Road signalised junction to the north.

Stantec has been commissioned by TWBC to consider capacity interventions along the Pembury Road corridor. It is understood the study area includes the following junctions:

1. A228 Pembury Road / Tonbridge Road
2. A228 Pembury Road A21 flyover North East Dumbbell
3. A228 Pembury Road A21 flyover South West Dumbbell
4. A264 Pembury Road / Hall's Hole Road
5. A264 Pembury Road / Sandhurst Road

Figure 17: Pembury Road Junctions



It is expected that increasing capacity on the A228 will make this corridor a more attractive route option, in turn reducing pressure on the B2160 corridor and in particular Kipping's Cross Roundabout. Given Stantec are currently looking at options for the corridor, no additional optioneering work has been undertaken by Sweco. To reflect an emerging scheme along the corridor, the strategic modelling has assumed an uplift in capacity of 10% at the five junctions described above. These assumptions will be reviewed following the completion of the optioneering work undertaken by Stantec with a view to undertaking a further model run to test effectiveness, if required.

5.9 Local Plan Highway Mitigation - Strategic Model Scenarios

Two Local Plan Highway Mitigation (LPHM) model scenarios have been created; Option 1 (LPHM1) and Option 2 (LPHM2). They build upon the LPMS scenario, and both add the following highway interventions:

- Colts Hill bypass (see Section 5.2.2) and associated junction improvements at Badsell Roundabout (Section 5.6)
- Somerhill Roundabout improvements (Section 5.4)
- Hop Farm Roundabout improvements (Section 5.5)

In addition, they include alternative strategies for mitigating the Local Plan impact at Kipping's Cross roundabout as follows:

- LPHM1 includes the capacity interventions at Kipping's Cross roundabout (Section 5.7)
- LPHM2 includes the highway capacity enhancements on the Pembury Road corridor (Section 5.8)

The interventions included in each LPHM scenario are summarised in Table 21.

Table 21: Local Plan Highway Mitigation Model Scenarios

Mitigation	**LPHM1**	**LPHM2**
Sustainable Transport Interventions (see Chapter 4)	✓	✓
Colts Hill Bypass	✓	✓
Badsell Roundabout Improvements	✓	✓
Somerhill Roundabout Improvements	✓	✓
Hop Farm Roundabout Improvements	✓	✓
Kipping's Cross Roundabout Improvements	✓	
Pembury Road Capacity Improvements		✓

5.10 Local Plan Highway Mitigation Option 1 - Strategic Model Results

5.10.1 Traffic Flow Differences

The impact of the highway mitigation interventions on traffic flows is illustrated in the flow difference plots presented in Figure 21 (AM) and Figure 22 (PM). These compare the LPHM1 scenario with the LPMS scenario.

Figure 18: Local Plan Highway Mitigation Option 1 – Local Plan Modal Shift Flow Difference AM

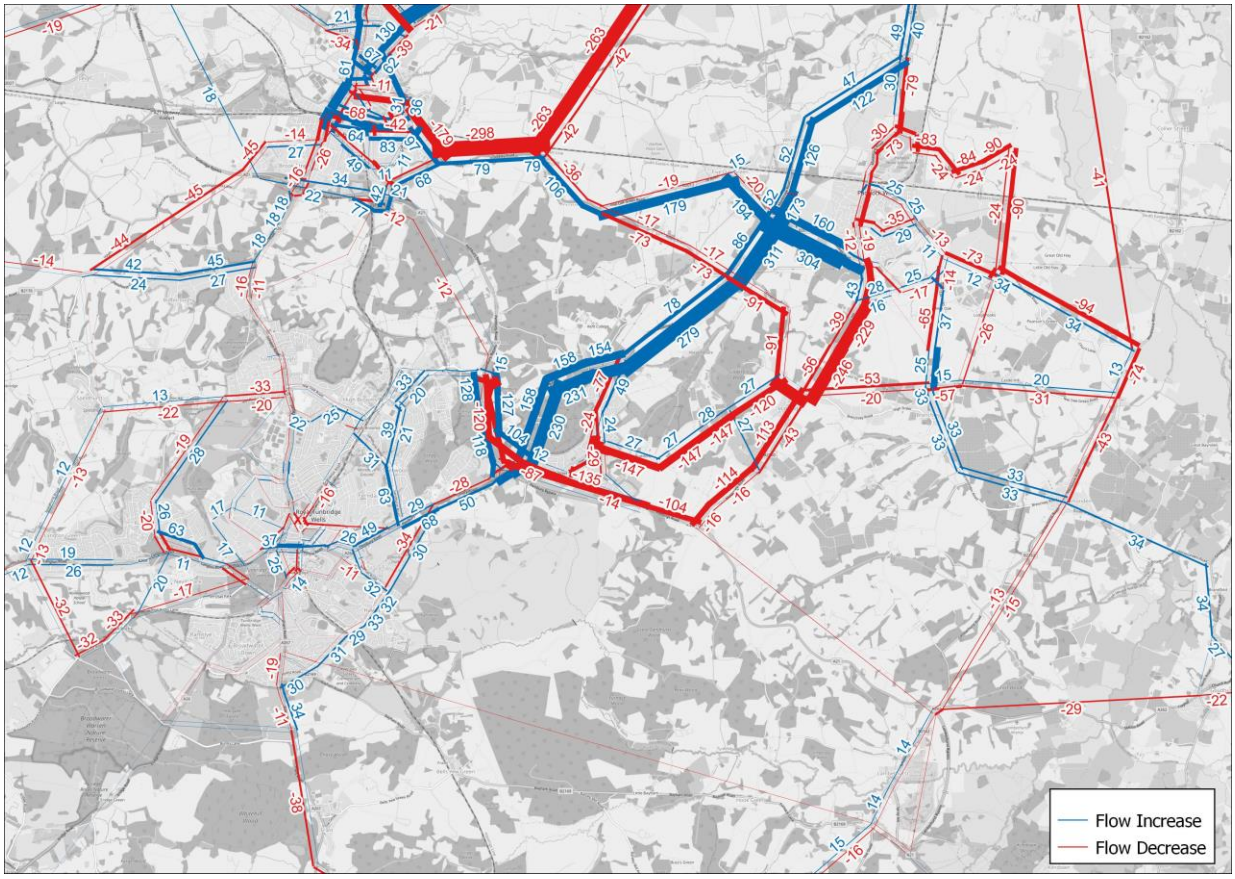
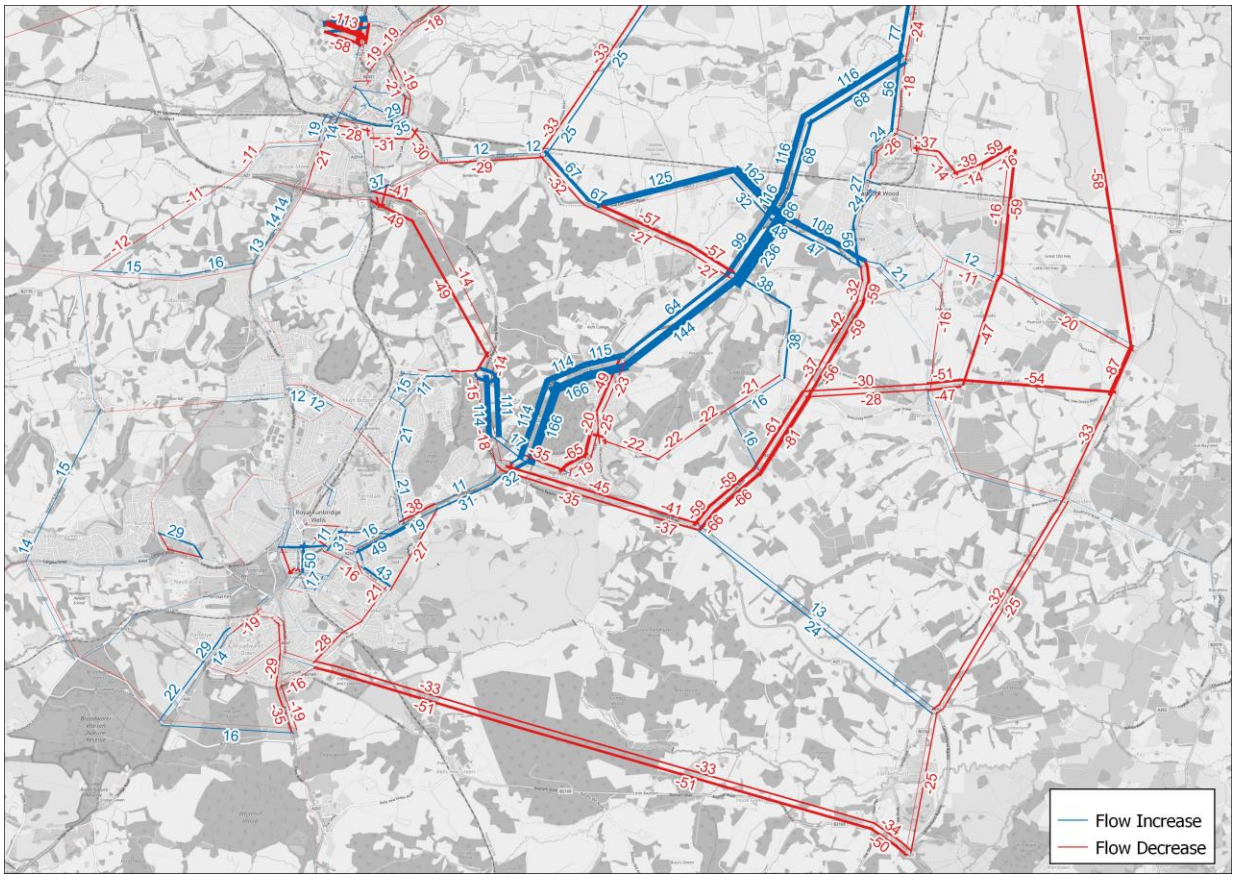


Figure 19: Local Plan Highway Mitigation Option 1 – Local Plan Modal Shift Flow Difference PM



The above demonstrates a notable increase in traffic on the A228 corridor. This can be attributed to the Badsell Roundabout and Colts Hill Bypass Schemes. There are corresponding decreases on the alternative routes via Kipping's Cross and Pembury.

5.10.2 Hotspots

The identification of hotspots for the LPHM1 scenario follows the same methodology as the LP Core and LPMS scenarios, as discussed in Section 3.3. The analysis has identified the following high-level summary:

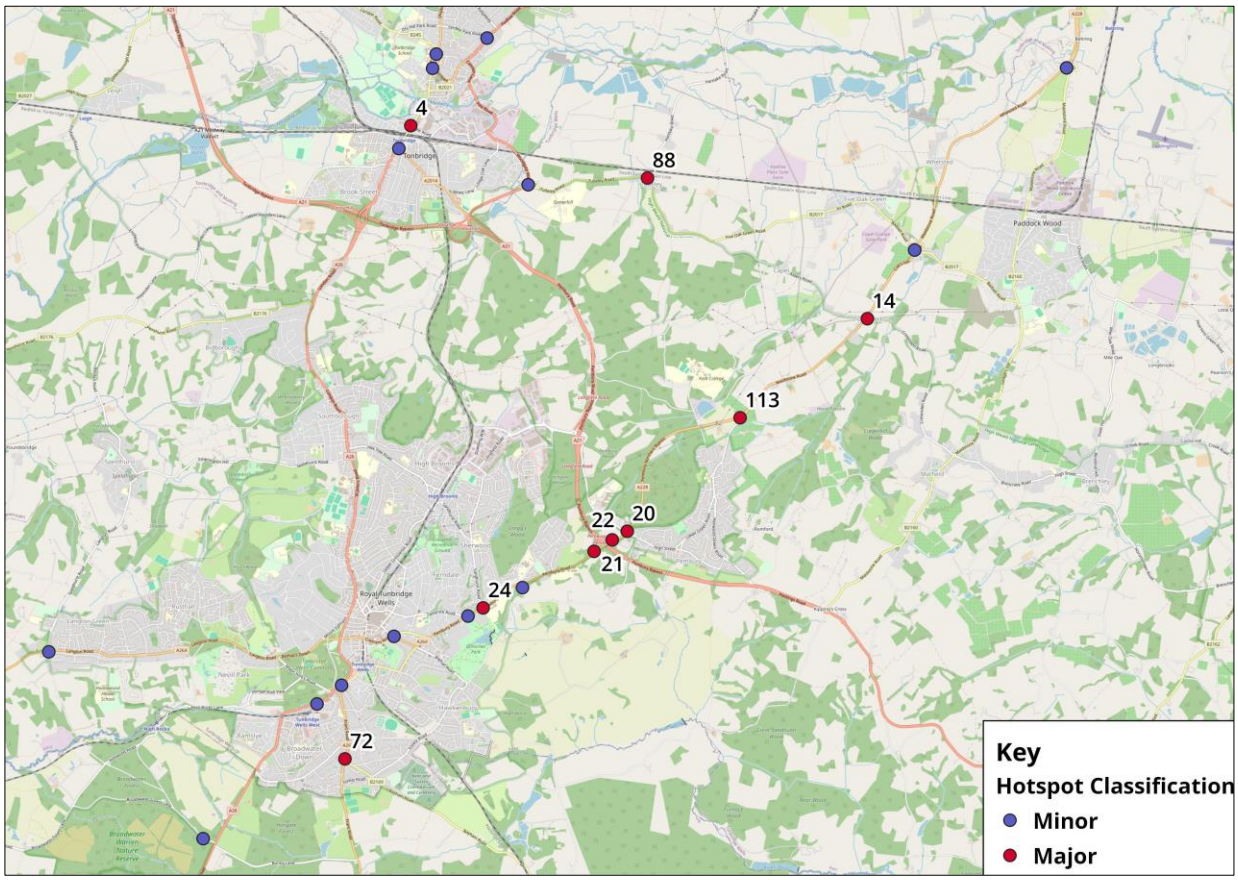
- 11 'minor' hotspot junctions – a slight increase from 9 in the LPMS scenario. It should be noted that 3 of these junctions were classed as 'major' hotspots in the LPMS scenario.
- 8 'major' hotspot junctions – remains the same as the LPMS scenario. These comprise of 3 that remain from the LPMS scenario and 5 additional locations.

The 'major' hotspots are summarised in Table 23 and illustrated in Figure 23.

Table 22: Major Hotspot Summary – Local Plan Highway Mitigation Option 1

ID	Junction name	Location
14	A228 / Alders Road / Crittenden Road	Paddock Wood
20	A228 Pembury Road / Tonbridge Road	Pembury
21	A228 Pembury Road A21 flyover South West Dumbbell	Pembury
22	A228 Pembury Road A21 flyover North East Dumbbell	Pembury
24	A264 Pembury Road / Sandhurst Road	Royal Tunbridge Wells
72	A267 / B2169 Birling Road	Royal Tunbridge Wells
88	B2017 / Hartlake Road	Tudeley
113	A228 / Maidstone Road	Pembury

Figure 20: Hotspot Junction Locations – Local Plan Highway Mitigation Option 1



A total of 5 junctions fall out of the 'major' hotspot list from the LPMS scenario, of which 4 are as a direct result of the highway mitigation measures included in the model as follows:

- Junction 8: Somerhill Roundabout
- Junction 12: Hop Farm Roundabout
- Junction 13: Badsell Roundabout
- Junction 35: Kipping's Cross Roundabout

Matfield Crossroads (107) also falls out of the 'major' hotspot list resultant from the Colts Hill Bypass and Badsell Roundabout improvements, which divert traffic away from B2160 Maidstone Road.

Of the outstanding 8 'major' hotspots the following 3 junctions have not been considered for highway interventions for the reasons set out in Section 4.3.2:

- Junction 14: A228 / Alders Road / Crittenden Road
- Junction 72: A267 / B2169 Birling Road
- Junction 88: B2017 / Hartlake Road

The remaining 5 'hotspot' junctions are all additional to those identified in the LPMS scenario. It is notable that they are located on the Pembury Road corridor. Flows on this corridor are forecast to increase due to the introduction of the Colts Hill Bypass and Badsell Roundabout improvements to the north. It is evident that these improvements will have a knock-on effect on junctions further south on the corridor. Of these additional 5 junctions, 4 are considered within the Pembury Road capacity improvements included in the LPHM2 scenario described in the following chapter.

5.11 Local Plan Highway Mitigation Option 2 - Strategic Model Results

5.11.1 Traffic Flow Differences

The impact of the highway mitigation interventions on traffic flows is illustrated in the flow difference plots presented in Figure 21 (AM) and Figure 22 (PM). These compare the LPHM scenario with the LPMS scenario.

Figure 21: Local Plan Highway Mitigation Option 2 – Local Plan Modal Shift Flow Difference AM

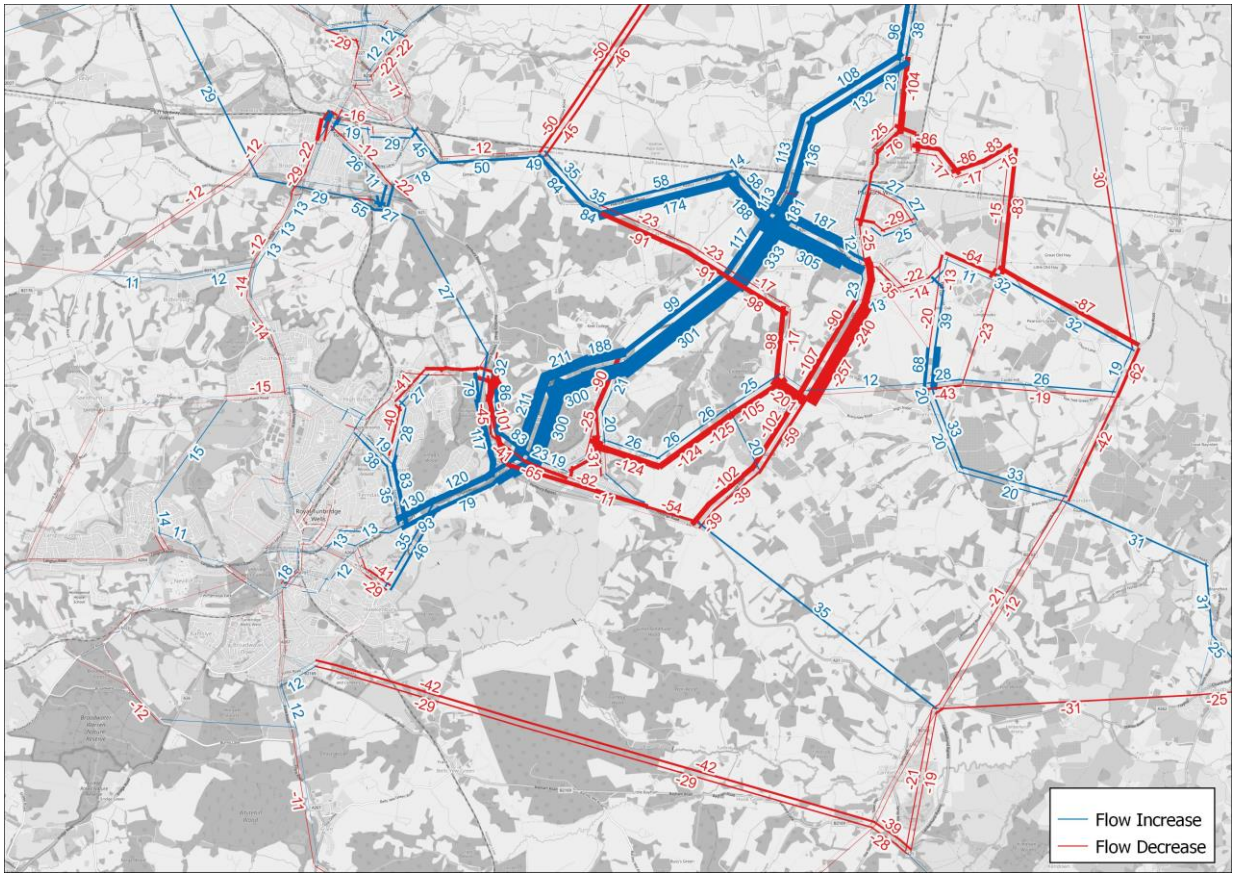
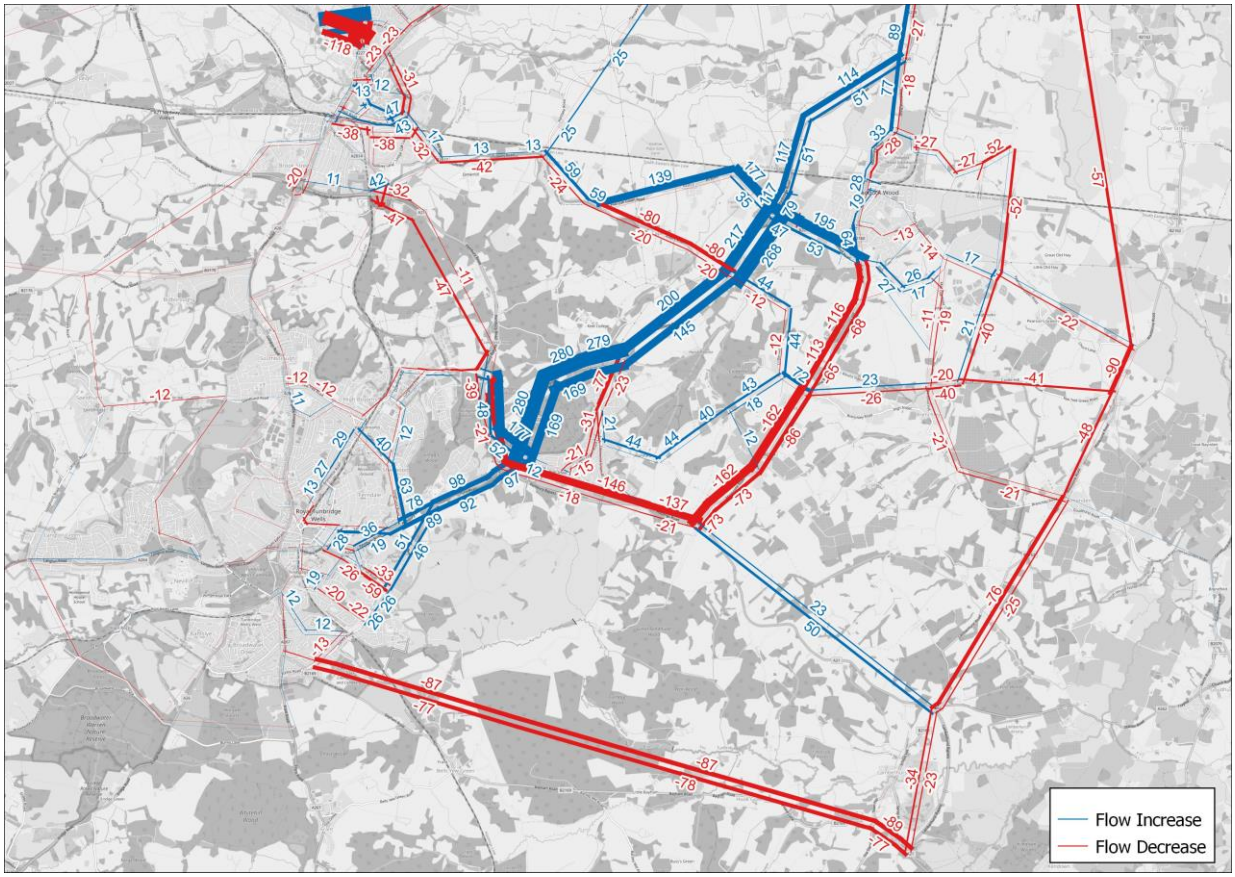


Figure 22: Local Plan Highway Mitigation Option 2 – Local Plan Modal Shift Flow Difference PM



The above demonstrates a notable increase in traffic on the A228 corridor. This can be attributed to the Badsell Roundabout and Colts Hill bypass scheme. The increase continues to the south of corridor on Pembury Road which is also associated with the increase in capacity at the junctions on this corridor. The combination of these interventions leads to a greater increase in traffic along this corridor in comparison to the LPHM1 scenario. There are corresponding decreases on the alternative routes via Kipping's Cross and Pembury.

5.11.2 Hotspots

The identification of hotspots for the LPHM2 scenario follows the same methodology as the LP Core and LPMS scenarios, as discussed in Section 3.3. The analysis has identified the following high-level summary:

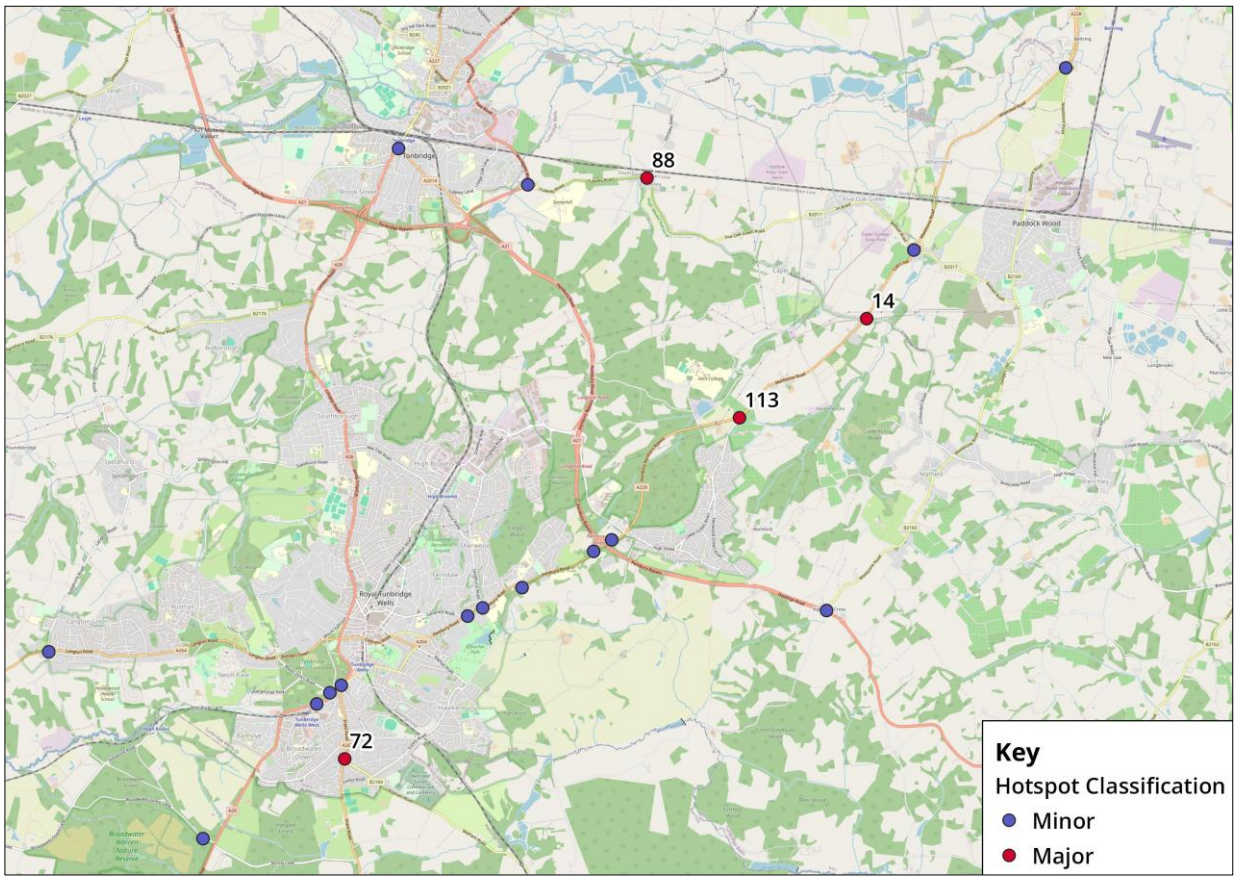
- 15 'minor' hotspot junctions - an increase from 9 in the LPMS scenario. It should be noted that 4 of these junctions were classed as 'major' hotspots in the LPMS scenario.
- 4 'major' hotspot junctions - a reduction from 8 in the LPMS scenario. These include 3 that remain from the LPMS scenario and 1 additional location.

The 'major' hotspots are summarised in Table 23 and illustrated in Figure 23.

Table 23: Major Hotspot Summary – Local Plan Highway Mitigation Option 2 Scenario

ID	Junction name	Location
14	A228 / Alders Road / Crittenden Road	Paddock Wood
72	A267 / B2169 Birling Road	Royal Tunbridge Wells
88	B2017 / Hartlake Road	Tudeley
113	A228 / Maidstone Road	Pembury

Figure 23: Hotspot Junction Locations – Local Plan Highway Mitigation Scenario



A total of 5 junctions that fall out of the 'major' hotspot list from the LPMS scenario, 3 are as a direct result of the highway mitigation measures included in the model as follows:

- Junction 8: Somerhill Roundabout
- Junction 12: Hop Farm Roundabout
- Junction 13: Badsell Roundabout

The remaining 2 junctions falling out of the 'major' hotspot list are resultant of the combined effect of the Colts Hill Bypass, Badsell Roundabout, and Pembury Road corridor improvements which divert traffic away from B2160 Maidstone Road:

- Junction 35: Kipping's Cross Roundabout
- Junction 107: Matfield Crossroads

Of the outstanding 4 'major' hotspots the following 3 junctions have not been considered for highway interventions for the reasons set out in Section 4.3.2:

- Junction 14: A228 / Alders Road / Crittenden Road
- Junction 72: A267 / B2169 Birling Road
- Junction 88: B2017 / Hartlake Road

The remaining 'hotspot' junction is additional to those presented in the LPMS scenario:

- Junction 13: A228 / Maidstone Road – this junction is located on the Pembury Road corridor to the north of the junctions where capacity has been added in the LPHM2 scenario and to the south of Colts Hill Bypass and Badsell Roundabout. The general increase in traffic on this corridor due to these capacity improvements has caused this junction to also become over capacity. This junction is also identified as a 'hotspot' in the LPHM1 scenario. It is recommended that this

junction is either considered as part of the A228 Pembury Road corridor study or taken account of in the Monitor and Manage plan with a view to investigating mitigation measures as part of relevant planning applications.

5.12 Highway Mitigation Phasing

The model results have been analysed to identify the estimated year the highway mitigation measures are likely to be required. The analysis is based on V/C statistics by year derived using the following methodology:

- V/C results for 2018 Base Case, 2030 LPMS and 2038 LPMS scenarios taken directly from relevant models.
- V/C results for remaining years calculated using interpolation based on total future residential development build out rates (Reference Case and Local Plan rates combined). These build out rates are summarised in Table 24.

Table 24: Major Hotspot Summary – Local Plan Highway Mitigation Scenario

Year	Ref Case Housing	Local Plan	Cumulative Buildout Rate
2018/19	10%	0%	5%
2019/20	8%	0%	10%
2020/21	12%	0%	17%
2021/22	21%	0%	22%
2022/23	37%	0%	31%
2023/24	53%	0%	40%
2024/25	63%	3%	47%
2025/26	70%	10%	53%
2026/27	74%	19%	58%
2027/28	80%	30%	66%
2028/29	83%	42%	72%
2029/30	86%	54%	78%
2030/31	88%	64%	83%
2031/32	89%	76%	89%
2032/33	91%	86%	93%
2033/34	93%	94%	97%
2034/35	95%	96%	98%
2035/36	96%	97%	98%
2036/37	98%	98%	99%
2037/38	100%	100%	100%

The V/C statistics by year are presented in Table 25 and Table 26 for the AM and PM peak hours respectively.

Table 25: Mitigation Junction V/C Results by Year AM

ID	Junction	Approach	Year															
			2018	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
8	A26 / B2017 Tudeley Road	A26 Woodgate Way (N)	68	83	85	88	90	92	94	97	98	99	100	100	101	101	101	101
		B2017 Tudeley Road (E)	62	80	83	86	88	92	94	97	97	98	98	98	98	98	98	98
		A26 Woodgate Way (SW)	66	79	81	84	85	88	90	92	93	95	96	98	98	98	98	98
		Tudeley Lane (W)	33	44	46	48	50	52	54	55	58	60	62	63	64	64	64	65
12	A228 / B2160 Maidstone Road (Hop Farm Roundabout)	A228 Branbridges Road (NE)	91	94	94	95	95	95	96	96	97	98	99	100	100	100	100	100
		B2160 Maidstone Road (SE)	83	93	95	97	98	100	102	104	104	105	106	107	107	107	107	107
		A228 Whetsted Road (SW)	71	82	84	85	87	89	91	92	93	94	95	96	96	96	96	96
		Unnamed Road (NW)	10	12	13	13	13	14	14	14	15	15	16	16	16	16	16	16
13	A228 / B2017 (Badsell Roundabout)	A228 Maidstone Road (N)	99	105	106	107	108	109	110	111	111	112	112	113	113	113	113	113
		B2017 Badsell Road (E)	78	94	97	100	102	105	107	110	111	113	114	115	116	116	116	116
		A228 Maidstone Road (S)	77	87	89	91	92	94	96	97	98	99	100	101	101	101	101	102
		B2017 Badsell Road (NW)	43	55	57	58	60	62	64	66	67	68	69	70	71	71	71	71
20	A228 Pembury Road / Tonbridge Road	A228 Pembury Northern Bypass (NE)	81	85	85	86	86	87	87	88	89	90	90	91	91	91	91	91
		High Street (SE)	48	59	61	62	64	66	68	69	71	73	75	76	76	76	77	77
		A228 Pembury Northern Bypass (SW)	54	59	59	60	61	62	63	63	63	63	64	64	64	64	64	64
		Tonbridge Road (NW)	44	48	48	49	50	50	51	52	52	52	52	53	53	53	53	53
21	A228 Pembury Road A21 flyover North East Dumbbell	A21 NB Slips (N)	53	61	62	63	64	65	66	68	68	68	68	68	68	68	68	68
		A228 Pembury Road (NE)	60	73	75	77	78	81	83	85	85	85	85	85	85	85	85	85
		A264 Pembury Road (SW)	81	89	90	91	92	94	95	96	96	96	96	96	96	96	96	96
22	A228 Pembury Road A21 flyover South West Dumbbell	A21 SB Slips (N)	51	76	80	84	87	91	95	99	99	99	99	99	99	99	99	99
		A228 Pembury Northern Bypass (E)	37	54	57	60	62	65	68	70	70	70	70	70	70	70	70	70
		Unnamed Road (S)	15	25	27	28	30	31	33	34	37	40	42	44	44	44	45	45
		A228 Pembury Road (W)	51	64	66	68	69	71	73	75	75	76	76	76	76	76	76	76
35	A21 / B2160 Maidstone Road (Kipping's Cross)	B2160 Maidstone Road (N)	74	89	92	94	96	99	101	103	105	106	107	108	108	108	108	108
		A21 (E)	97	106	107	109	110	111	113	114	115	116	117	117	117	117	118	118
		Dundale Road (S)	12	13	13	13	13	14	14	14	14	14	14	14	14	14	14	14
		A21 Hastings Road (W)	52	58	59	60	60	61	62	63	64	66	67	68	69	69	69	69

Table 26: Mitigation Junction V/C Results by Year PM

ID	Junction	Approach	Year															
			2018	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
8	A26 / B2017 Tudeley Road	A26 Woodgate Way (N)	79	87	89	90	91	92	94	95	95	95	95	94	94	94	94	94
		B2017 Tudeley Road (E)	31	38	39	40	41	42	43	44	45	45	46	47	47	47	47	47
		A26 Woodgate Way (SW)	73	85	87	89	90	92	94	96	96	96	96	96	96	96	96	96
		Tudeley Lane (W)	23	29	30	31	32	32	33	34	35	36	36	37	37	37	37	37
12	A228 / B2160 Maidstone Road (Hop Farm Roundabout)	A228 Branbridges Road (NE)	53	61	63	64	65	67	68	69	71	74	76	78	78	78	78	79
		B2160 Maidstone Road (SE)	69	76	77	78	79	80	81	82	85	89	92	95	95	96	96	97
		A228 Whetsted Road (SW)	102	103	103	103	104	104	104	104	104	104	104	104	104	104	105	105
		Unnamed Road (NW)	35	38	38	38	39	39	40	40	41	42	42	43	43	43	43	43
13	A228 / B2017 (Badsell Roundabout)	A228 Maidstone Road (N)	62	76	79	81	83	85	87	90	92	95	98	100	100	101	101	101
		B2017 Badsell Road (E)	45	59	61	63	65	68	70	72	75	78	81	83	84	84	84	85
		A228 Maidstone Road (S)	89	95	96	97	98	99	100	101	102	103	103	104	104	104	104	104
		B2017 Badsell Road (NW)	74	89	92	94	96	99	101	103	105	107	108	109	110	110	110	110
20	A228 Pembury Road / Tonbridge Road	A228 Pembury Northern Bypass (NE)	56	63	65	66	67	68	69	70	73	75	77	79	79	79	79	80
		High Street (SE)	66	74	75	76	78	79	80	81	82	83	84	84	84	84	84	85
		A228 Pembury Northern Bypass (SW)	77	78	78	79	79	79	79	79	79	78	78	77	77	77	77	77
		Tonbridge Road (NW)	91	90	89	89	89	88	88	88	89	91	92	94	94	94	94	95
21	A228 Pembury Road A21 flyover North East Dumbbell	A21 NB Slips (N)	33	53	57	60	62	66	69	72	74	77	79	81	81	82	82	82
		A228 Pembury Road (NE)	79	84	85	86	87	88	89	89	90	90	91	91	91	91	91	91
		A264 Pembury Road (SW)	93	88	87	86	85	84	83	83	83	84	84	85	85	85	85	85
22	A228 Pembury Road A21 flyover South West Dumbbell	A21 SB Slips (N)	60	82	86	89	92	96	99	102	102	102	102	102	102	102	102	102
		A228 Pembury Northern Bypass (E)	52	66	68	70	72	75	77	79	80	80	81	81	82	82	82	82
		Unnamed Road (S)	63	97	103	108	113	119	124	129	131	134	136	138	138	139	139	139
		A228 Pembury Road (W)	69	79	81	83	84	86	88	90	91	92	93	94	94	94	94	95
35	A21 / B2160 Maidstone Road (Kipping's Cross)	B2160 Maidstone Road (N)	51	61	62	64	65	67	69	70	73	77	80	82	83	83	83	84
		A21 (E)	53	61	63	64	65	67	68	69	70	71	72	73	73	73	73	73
		Dundale Road (S)	19	22	22	23	23	24	24	25	25	26	26	27	27	27	27	27
		A21 Hastings Road (W)	70	81	83	85	86	88	90	92	94	96	98	99	99	99	100	100

The V/C results above have been reviewed to identify the estimated year the highway mitigation measures are likely to be required. The findings are summarised in Table 27.

Table 27: Highway Mitigation Implementation Summary

ID	Junction name	Year	Reasoning
8	Somerhill Roundabout	2033	Junction is forecast to become over capacity in the AM peak in 2033.
12	Hop Farm Roundabout	2028	Junction forecast to become over capacity in the AM peak in 2028. Junction already over capacity in PM peak.
13	Badsell Roundabout and Colts Hill Bypass	2029	Junction forecast to become over capacity in the PM peak in 2029. Junction already over capacity in AM peak.
20, 21, 22, 24	Pembury Road corridor junctions	2029 / 2030	Maidstone Road approach to Kipping's Cross Roundabout forecast to become over capacity in AM peak in 2029. A21 southbound slip road at A21 / A228 dumbbell junction forecast to become over capacity in PM peak in 2030. Improvements likely to be required following introduction of Colts Hill Bypass to accommodate general increase in traffic flows along corridor.
35	Kipping's Cross Roundabout	2029	Maidstone Road approach to Kipping's Cross Roundabout forecast to become over capacity in AM peak in 2029.

5.13 Collision Hotspots

Following a request from KCC, a review of collisions has been undertaken across the study area to understand any locations where the Local Plan development traffic may have a detrimental impact on road safety. Potential safety interventions at such locations are also considered for potential further discussion with KCC.

Locations for analysis were identified where:

- Observed accidents of 3 or more in total across a 3-year period, and
- Increase of 50 or more vehicles in either the AM or PM peak with the Local Plan development

A total of 8 locations met the above criteria. The locations are illustrated in Figure 24. Locations 2 (Hop Farm Roundabout) and 7 (Kipping's Cross Roundabout) are also locations considered within the previously discussed highway capacity mitigation measures. Table 28 sets out any common issues and potential treatments for further consideration.

Figure 24: Collision Hotspot Locations

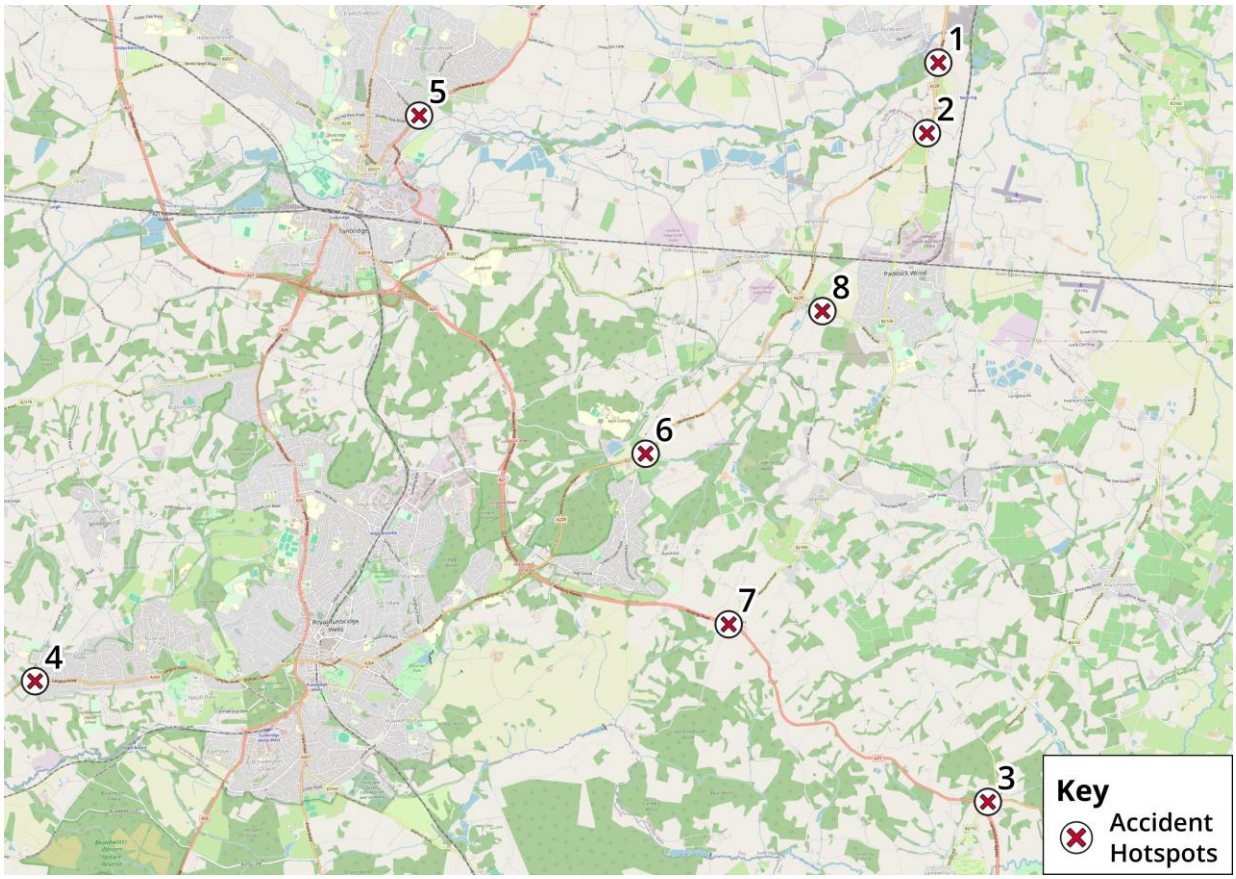


Table 28: Collision Hotspot Considerations

Ref	Location	Accidents (last 3 years)	Total hourly increase due to Local Plan		Cause of Collisions	Potential Treatments
			AM	PM		
1	A228 Boyle Way/ Branbridges Road	7	164	144	Drivers leaving Branbridges Road (side road) trying to find a gap in traffic on A228. One collision with driver failing to see roundabout. Could be a result of a steady stream of A228 traffic and potentially speed due to geometry inviting high entry/ exit speeds.	Roundabout already comprehensively signed but could consider use of transverse bar markings on A228 approaches OR reduce speed limit through junction section.
2	A228 Branbridges Road/ Whetsted Road	15	176	284	Drivers trying to find a gap in traffic on A228. Could be a result of a steady stream of A228 traffic and potentially speed due to geometry inviting high entry/ exit speeds. Drivers losing control on bend on Maidstone Road arm approach/ exit.	Roundabout already comprehensively signed but could consider use of transverse bar markings on A228 approaches OR reduce speed limit through junction section.
3	A262/ Lamberhurst Road	4	369	207	Generally, with drivers leaving roundabout and shunting vehicle at the T-junction or emerging driver causing collision. Potential for high driver speeds leaving roundabout onto A262.	Consider narrowing A262 leaving roundabout on nearside with localised realignment into Lamberhurst Road and provide new advanced directional sign to show left turn into Lamberhurst Road or relocate existing junction warning sign closer to roundabout.
4	A264 Langton Road/ Broom Lane	6	67	27	Drivers tuning right from A264 into Broom Lane trying to find a gap in oncoming traffic. Drivers failing to give way at A264 from The Green; potentially trying to find a gap to join/ cross. Poor visibility to the left.	Location challenging for space to offset side road arms. Work with adjacent residents to improve visibility obscured by vegetation. Provide flat topped road hump on The Green approach to the junction or reduce carriageway width at entrance and tighten radii. A264 has advanced crossroads warning signs already.

5	A26 Hadlow Road/ The Ridgeway	6	65	27	Very long right turn lane on A26 suggests heavy right turn. The Ridgeway is split into two approach lanes which suggests busy exit flows.	Review projected flows. Potentially signalise junction, although this might be problematic with existing residential accesses. Potentially provide mini-roundabout, but only if flows are fairly balanced.
6	A228 Pembury Northern Bypass/ C571 Maidstone Road	9	322	269	Drivers pulling out of side road being hit by westbound drivers on mainline. Issue potentially one of finding a gap in oncoming traffic.	Review traffic flows to gain better idea of likely gap issue and potentially reduce speed limit to 40mph through junction section.
7	A21 Kipping's Cross Roundabout	5	186	215	Drivers shunting vehicles ahead.	Western arm already has yellow transverse bar markings and advance direction signs. Consider adding "queues likely" warning signs.
8	B2017 Badsell Road	6	584	320	Drivers travelling too fast for the conditions and loss of control.	Review condition of local carriageway skidding resistance and potentially speed limit reduction to 40mph (roundabout to Paddock Wood entry point).

6 Summary and Conclusions

6.1 Summary

Sweco has undertaken traffic modelling for the Tunbridge Wells Borough Council (TWBC) Local Plan submission to assist in addressing Inspector's comments at the Examination in Public (EiP). The work is an update to the work undertaken for the previous Local Plan and focusses on a revision to the proposed development allocations, most notably the removal of the Tudeley Village development strategic site and reduced growth at Paddock Wood.

The modelling has been undertaken in stages as follows:

- **Stage 1** reviewed the previous model assumptions and set out the approach to the updated modelling;
- **Stage 2** created updated Reference Case and Local Plan (LP) forecast scenarios at the 2038 end of Local Plan year. The model outputs were analysed to identify hotspot locations where the Local Plan developments are forecast to have a significant impact on the local highway network;
- **Stage 3 Part 1** comprised an analysis of the potential for sustainable transport interventions to encourage mode shift away from the car. An additional Local Plan Modal Shift (LPMS) scenario was created with reduced car demand and the hotspot locations were reviewed; and
- **Stage 3 Part 2** assessed potential highway interventions to mitigate the traffic impacts at the remaining hotspots. Two alternative Local Plan Highway Mitigation (LPHM) scenarios were created to demonstrate the effectiveness of these in mitigating Local Plan impacts on the highway network. The mitigations included in each scenario are summarised in Table 29.

Table 29: Local Plan Highway Mitigation Model Scenarios

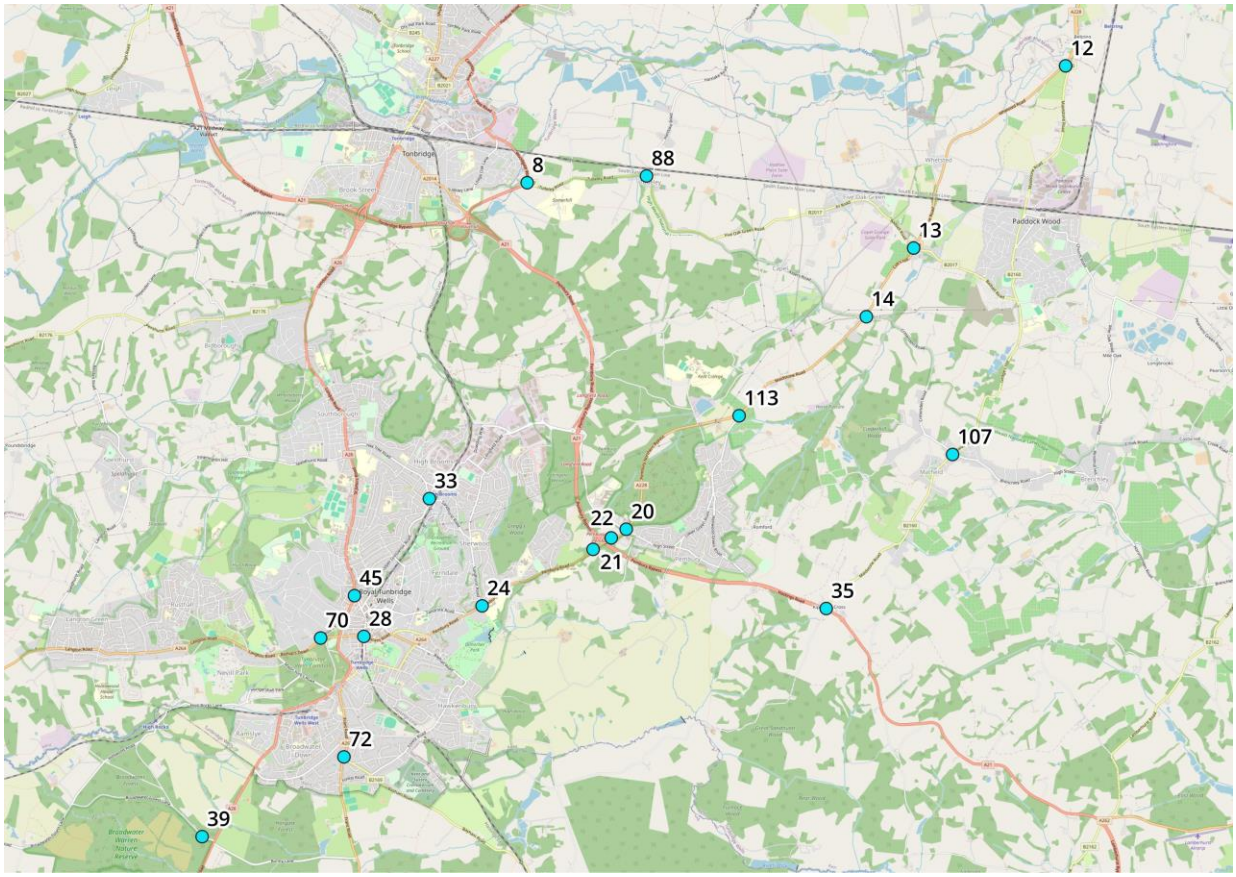
Mitigation	**LPHM1**	**LPHM2**
Sustainable Transport Interventions (see Chapter 4)	✓	✓
Colts Hill Bypass	✓	✓
Badsell Roundabout Improvements	✓	✓
Somerhill Roundabout Improvements	✓	✓
Hop Farm Roundabout Improvements	✓	✓
Kipping's Cross Roundabout Improvements	✓	
Pembury Road Capacity Improvements		✓

The identified hotspots are summarised by model scenario in Table 30. The locations of these junctions are illustrated in Figure 25.

Table 30: Major Hotspot Summary by Model Scenario

ID	Junction name	LP	LPMS	LPHM1	LPHM2
8	A26 / B2017 Tudeley Road	✓	✓		
12	A228 / B2160 Maidstone Road (Hop Farm Roundabout)	✓	✓		
13	A228 / B2017 (Badsell Roundabout)	✓	✓		
14	A228 / Alders Road / Crittenden Road	✓	✓	✓	✓
20	A228 Pembury Road / Tonbridge Road			✓	
21	A228 Pembury Road A21 flyover South West Dumbbell			✓	
22	A228 Pembury Road A21 flyover North East Dumbbell	✓		✓	
24	A264 Pembury Road / Sandhurst Road			✓	
28	A264 / Mount Pleasant Road	✓			
33	North Farm Road / Upper Grosvenor Road / Sandhurst Road	✓			
35	A21 / B2160 Maidstone Road (Kipping's Cross)	✓	✓		
39	A26 / Bunny Lane / Broadwater Forest Lane	✓			
45	A26 / Grosvenor Road	✓			
70	A264 / Mount Ephraim	✓			
72	A267 / B2169 Birling Road	✓	✓	✓	✓
88	B2017 / Hartlake Road	✓	✓	✓	✓
107	B2160 / Chestnut Lane / Brenchley Road (Matfield Crossroads)	✓	✓		
113	A228 / Maidstone Road			✓	✓
Total Hotspots		**14**	**8**	**8**	**4**

Figure 25: Hotspot Locations



6.2 Conclusions

The addition of the Local Plan development on the highway network, without mitigation, is forecast to have a significant impact at locations throughout the Borough of Tunbridge Wells. The analysis identifies the need for additional capacity beyond what is currently provided.

The results from the LPMS scenario show that delivering sustainable transport schemes with high levels of modal shift can contribute to bringing about the congestion relief required. This outcome follows the direction of travel from the Government with a need for more focus on enabling walking and cycling and using public transport.

Whilst sustainable transport will help reduce the Local Plan impact, additional local highway improvements are required and should be considered, namely:

- Colts Hill bypass and associated junction improvements at Badsell Roundabout (Junction 13)
- Somerhill Roundabout improvements (Junction 8)
- Hop Farm Roundabout improvements (Junction 12)
- Junctions on the Pembury Road corridor which are currently the subject of a study by Stantec. Improvements on this corridor would also result in a diversion of traffic away from the B2160 Maidstone Road. This has the potential to mitigate the Local Plan impact at Matfield Crossroads (Junction 107) and Kipping's Cross Roundabout (Junction 35)

The LPHM2 scenario includes the above interventions and offers significant overall improvements in congestion and mitigations for the Local Plan impacts. Improvements to Kipping's Cross Roundabout were included in the LPHM1 scenario and also demonstrate the scheme's potential to mitigate the Local Plan impact at this location, however the results from the LPHM2 scenario indicate this scheme may not be required if capacity can be increased along the Pembury Road corridor.

The following standalone locations should also be considered as part of the Monitor and Manage approach with a view to investigating minor local mitigation measures as part of relevant planning applications.

- A267 / B2169 Birling Road (Junction 72)
- B2017 / Hartlake Road (Junction 88)
- A228 / Maidstone Road (Junction 113)