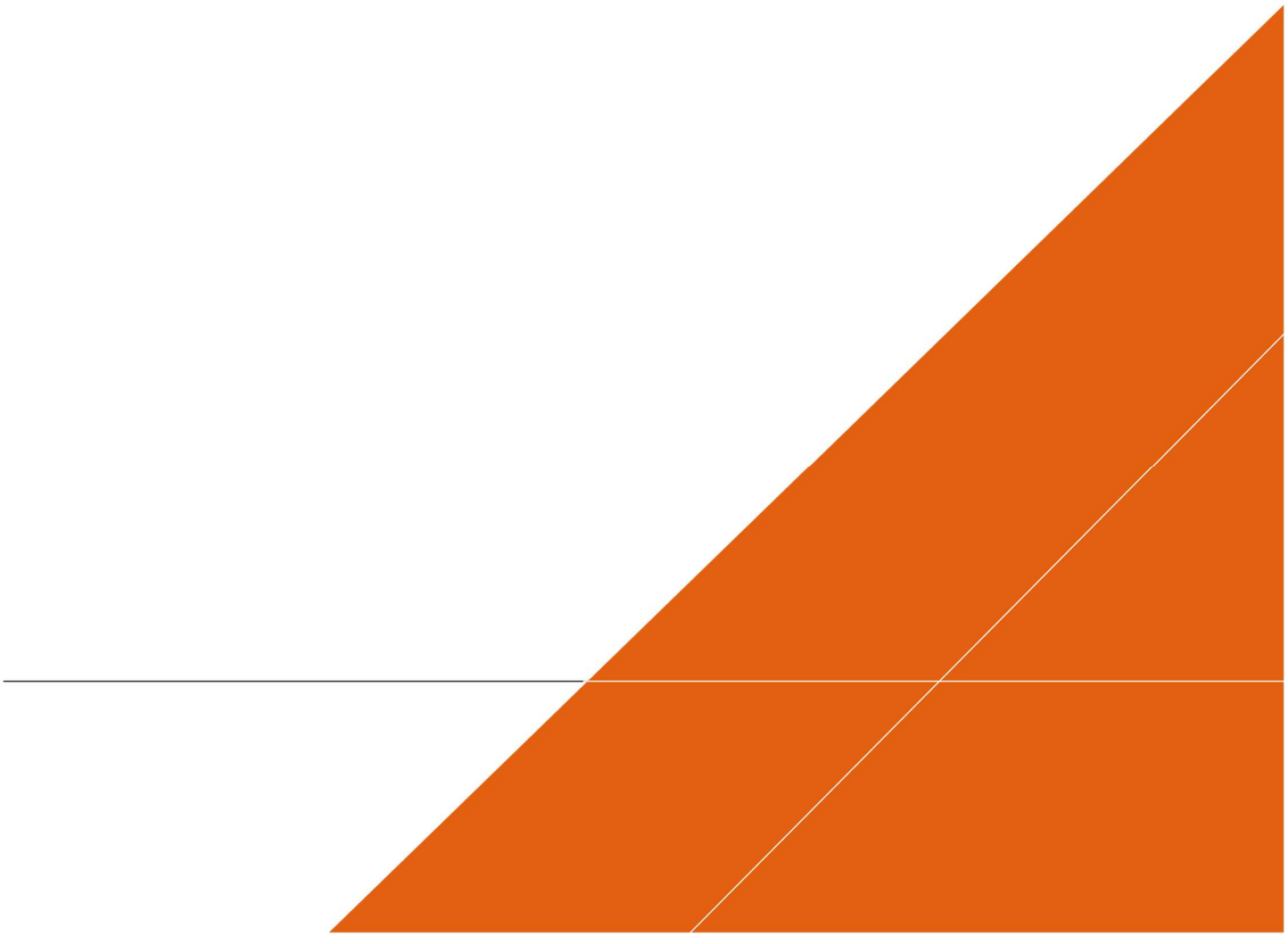
ARCADIS Design & Consultancy for natural and built assets

RUNNYMEDE LOCAL PLAN

M25 Junction 11 & 13 – Step 2 Traffic Concept Design

SEPTEMBER 2019



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VERSION CONTROL

Version	Date	Author	Changes
1.0	15/04/2019	DM	Draft Report (for comments)
1.1	18/04/2019	DM	Draft Report (including Runnymede comments)
2.0	17/06/2019	DC	Draft Report (Further Junction 13 assessment)
2.1	18/07/2019	DC	Draft Report (Tineline assessment Added)
2.2	06/09/2019	DC	Final Report

CONTENTS

FIGURES

TABLES

1 Introduction

1.1 Background

Late 2017, early 2018, Arcadis undertook a traffic study of the A320 corridor. This study was related to the preparation of the Runnymede 2030 Local Plan and included the proposal for additional land use development along the A320 corridor.

The traffic modelling undertaken was composed of:

- A Traffic Demand Forecast extracted from SINTRAM 72 model, which included the proposed developments; and
- A series of junction assessments along the corridor as well as for M25 Junction 11.

In the statement of common ground between Runnymede Borough Council and Highways England, dated 28 November 2018 (see Appendix A), Highways England highlights the following concerns:

- The strategic model version used for the assessment does not fully comply with the latest modelling requirements, in particular in relation to trip rates; and
- Traffic conditions on the M25 mainline have not been considered while the corridor is experiencing regular congestion.

Further traffic modelling was therefore required to address Highways England's concerns.

An initial assessment of the existing situation was prepared using the calculation method agreed with Highways England (Runnymede Local Plan, M25 Traffic Impact Assessment Note, Rev 2.1, March 2019).

1.2 Purpose of the Document

The purpose of this report is to present the M25 Junction 11 proposed junction mitigation measures and its supporting information. The ramp metering system on the on-slips road of Junction 11 has been taken into account. This scheme has been developed in consultation with Highways England.

The trip generation and distribution from the Runnymede Local Plan to M25 Junction 13 is also presented in this report.

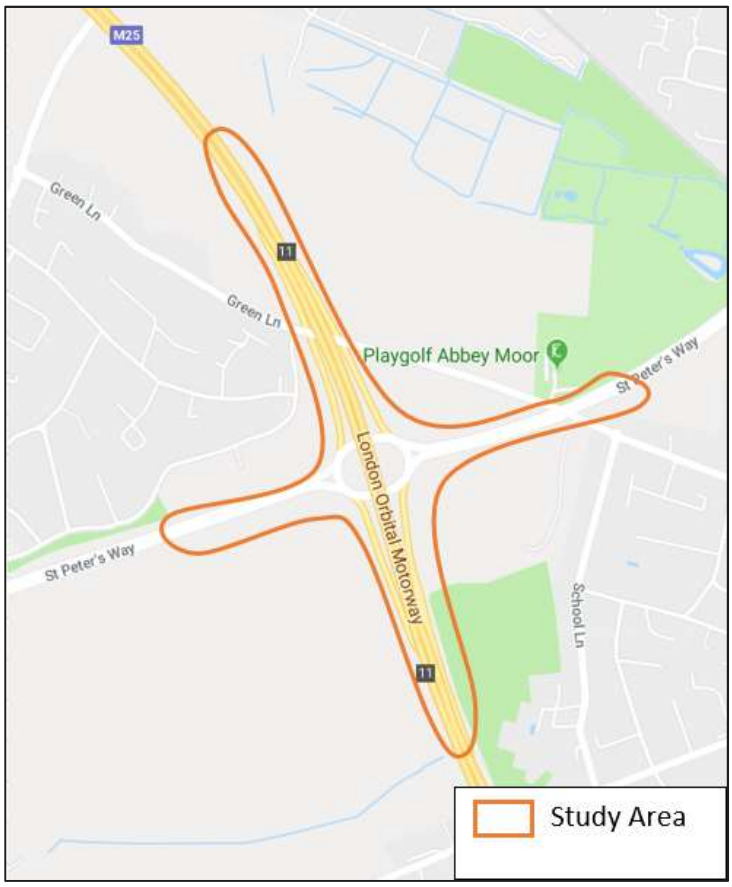
1.3 M25 Junction 11 Study Area

The extent of the M25 Junction 11 study area is shown in Figure 1. The concept design focuses on solutions for the following two requirements:

- Accommodating M25 Junction 11 2030 future traffic volumes; and
- Developing suitable traffic management measures to protect Highways England's network from the impact of queues blocking back onto the M25.

It was agreed with Highways England that the design of neither the merges nor the diverges on the M25 would be considered from a design point of view. Only the merge type is being assessed in order to estimate the potential blocking back queue.

Figure 1: Study Area



1.4 Document Structure

The remaining part of this document is structured as follows:

- Section 2 covers the assessment of M25 Junction 11 existing conditions;
- Section 3 covers the assessment of M25 Junction 11 existing layout using 2030 traffic volumes;
- Section 4 presents the M25 Junction 11 proposed layout;
- Section 5 presents the M25 Junction 13 related trip generation and distribution; and
- Section 6 presents the conclusions and recommendations.

2 M25 Junction 11 – 2017 Existing Conditions

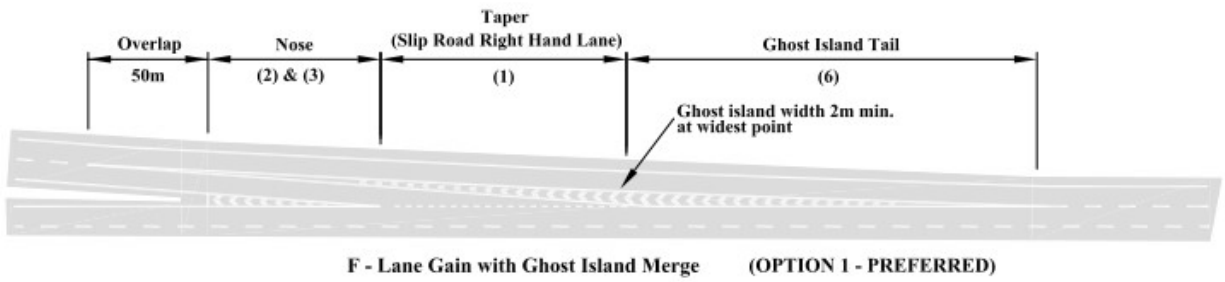
2.1 Junction Existing Layout

As visible in Figure 2, the M25 Junction 11 is a two lane, part-signalised, roundabout with traffic signals on northbound and southbound approaches (from the M25). There is an existing ramp metering system in operation on the two on-slip ramps of the M25.

Figure 2: Existing Junction layout

The existing merge type onto the M25 is Type F, as illustrated in Figure 3. This merge type includes a lane gain for the nearside lane of the ramp.

Figure 3: Existing Junction layout (TD22/06)



2.2 Roundabout Traffic Demand and Capacity Assessment

The M25 Junction 11 traffic count took place on Tuesday 31st October 2017. The total traffic throughput volume at the junction was 5,442 vehicles per hour in the AM peak and 5,249 vehicles per hour in the PM peak. The traffic volumes and detailed calculations for the LinSig assessment are provided in Appendix A.

Table 1 below shows a summary of the capacity assessment.

Table 1: 2017 M25 J11 Roundabout Capacity Assessment Results

Junction	Direction	Arm	2017 (Existing situation) Max Degree of Saturation (%)	
			AM	PM
M25 J11	Southbound	M25 North off-slip	84.7	58.5
	Westbound	St Peter's Way East	74.6	89.0
	Northbound	M25 South off-slip	83.4	96.7
	Eastbound	St Peter's Way West	69.3	50.9

The traffic analysis results show that:

- In AM peak period, the junction operates at capacity; and
- In the PM peak period, the M25 South Off Slip is operating in saturated conditions.

These capacity calculations are consistent with the observed traffic conditions on the ground.

2.3 Merge and Diverge Traffic Assessments

The merge and diverge traffic volumes are shown in Table 2 and have been prepared using the following sources:

- The 2017 WebTRIS M25 mainline flows (Northbound and Southbound sites on J11); and
- The 2017 M25 Junction 11 turning count.

Table 2: 2017 Mainline, Merge and Diverge flows (Veh/hr)

M25 J11 Section	Period	2017	
		Mainline flow (Veh/hr)	Merge / Diverge Flow (Veh/hr)
Northbound Off-slip (Diverge)	AM	5812	993
	PM	5294	885
Northbound On-slip (Merge)	AM	5812	1570
	PM	5294	1569
Southbound Off-slip (Diverge)	AM	5155	1667
	PM	5504	1131
Southbound On-slip (Merge)	AM	5155	1044
	PM	5504	1298

Table 3 shows that, if the merge type would have to be designed to DMRB standard using 2017 traffic volumes, the merge type northbound would require a widening of the M25 mainline to four lanes underneath the junction.

Table 3: DMRB Assessment Findings on the M25 J11 with the Existing 2017 Flows

Section	2017				
	Mainline flow (Veh/hr)	Merge / diverge flow (Veh/hr)	Existing Section	DMRB Calculated Section	Comments
M25 J11 NB Onslip, AM peak flows	5812	1570	Type F - 3 lane upstream, 2 lane connector road and 4 lanes downstream	Type F - 4 lane upstream, 2 lane connector road and 5 lanes downstream	The current section is smaller than required by the design standard for existing volumes
M25 J11 SB Onslip, AM peak flows	5504	1298	Type F - 3 lane upstream, 2 lane connector road and 4 lanes downstream	Type F - 3 lane upstream, 2 lane connector road and 4 lanes downstream	The merge type is at the very edge of the design envelope but remains suitable

Source: DMRB Volume 6 Section 2 Part 1 TD 22/06. Figures 2/3MW & 2/5MW

2.4 Conclusion

The following has been concluded following the analysis of the 2017 base line traffic:

- The roundabout has reached capacity in 2017;
- The existing situation is that the M25 mainline is already experiencing congestion north of Junction 11; and
- Based on 2017 traffic volumes, the design standard would require one additional lane on the M25 clockwise mainline.

3 M25 Junction 11 – 2030 Scenarios with Existing Layout

3.1 Future Traffic Demand and Capacity Assessment

The M25 Junction 11 roundabout future traffic volumes have been prepared using the following sources:

- The 2017 M25 Junction 11 turning count;
- TEMPro 2017 to 2030 Principal Road growth factors[1] (AM 1.1378 / PM 1.1386); and
- The non-consented development trip distribution/assignment outputs.

Table 4 below shows a summary of the traffic volumes.

Table 4: M25 J11 Traffic Volumes Summary at the Roundabout

Source	Volume (Veh/hr)	
	AM	PM
2017 Baseline	5442	5249
2030 Baseline	6192	5976
Non-consented developments	193	320
2030 with non-consented developments	6385	6296

Table 5 below shows a summary of the capacity assessment results at the roundabout:

Table 5: 2030 M25 J11 Roundabout Capacity Assessment Results Summary

Direction	Arm	2030 Baseline		2030 with Non-consented developments	
		Max Degree of Saturation (%)		Max Degree of Saturation (%)	
		AM	PM	AM	PM
SB	M25 North off-slip	96.4	78.4	105.4	88.1
WB	St Peter's Way EB Circulatory	84.9	89.0	82.1	89.6
NB	M25 South off-slip	95.0	110.1	95.8	121.8
EB	St Peter's Way WB Circulatory	78.9	58.0	76.0	58.0

3.2 Conclusion

The traffic analysis results show that:

- Three out of four approaches are at or over practical capacity in both AM and PM peaks;
- In the PM peak period, the M25 South Off Slip is operating over capacity; and
- The non-consented developments from the Runnymede Local Plan would add an additional 3.1% - 5.3% in excess of the baseline. The congestion at the roundabout is increased compared to the 2030 baseline.

[1] **TEMPro Criteria**. Trip end type: Origin/Destination, Transport Mode: Car driver/passenger, Area: Runnymede 007(E02006399), NTM AF15: Urban, Principal Road.

4 M25 Junction 11 – 2030 Proposed Layout

4.1 Roundabout Capacity Increase

Based on the 2030 roundabout traffic assessment, a junction upgrade will be required at the M25 Junction 11. The proposed mitigations measures include:

- The full signalisation of the roundabout (partially signalised now) with suitable phasing, staging and optimisation of cycle times;
- The widening of the northbound and southbound off slips from the existing two lanes to three lanes in order to accommodate the increased traffic and avoid any queues blocking back onto the M25;
- The widening to three lanes at St Peters Way eastbound approach with a signalised left turning movement onto the M25; and
- The increase in the capacity of the circulatory carriageway on the east and west arms from the existing two lanes to three lanes.

Figure 4 below shows the concept of the upgraded roundabout, the drawings are available in Appendix A.

Figure 4: Roundabout Upgrade Concept

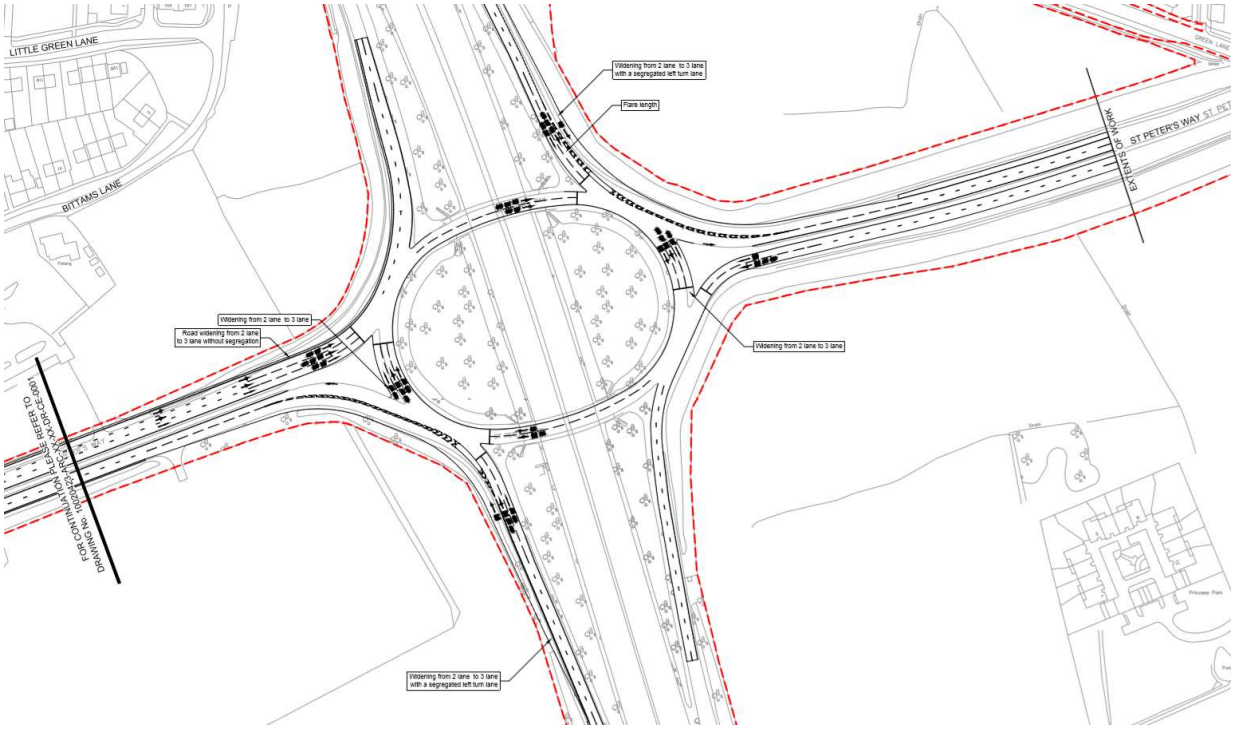


Table 6 below shows the capacity assessment results of the proposed upgrade.

Table 6: 2030 M25 J11 Roundabout Proposed Scheme Capacity Assessment Results

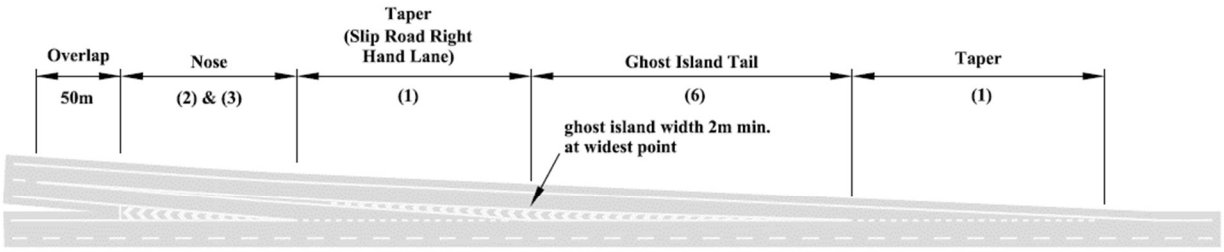
Junction	Direction	Arm	2030 with Non-consented developments	
			Max Degree of Saturation (%)	
			AM	PM
M25 J11 Proposed Layout	SB	M25 North off-slip	72.9	78.6
	NB	M25 South off-slip	67.1	80.6
	WB	St Peter's Way WB	88.0	88.2
	EB	St Peter's Way EB	86.1	87.2

The detailed LinSig assessment for the roundabout scheme is provided in Appendix C.

4.2 Merge and Diverge Sections Traffic Assessment

It is our understanding that the smart motorway project is not providing a motorway upgrade following typical DMRB standards for the 2030 scenario. In contrast, the northbound and southbound merge sections are understood to be downgraded to a ghost island section without lane gain (Type C on Figure 5).

Figure 5: DMRB Type C Merge



C - Ghost Island Merge
(Only used where design flows on mainline are light, there are 3 lanes or more on mainline and merging flow is over one lane capacity, see paragraph 2.30).

The following points were taken into account in the assessment:

- Based on the DMRB guidelines, a maximum merge flow of 1700 Veh/hr (850 veh/hr/lane) is recommended for a motorway merge type C, regardless of the mainline traffic volume;
- The 2017 PM the northbound merge is already close this absolute maximum traffic volume, with 1570 Veh/hr; and
- The 2030 baseline flows are already above the recommended threshold.

Table 7 below presents the minimum traffic gating required at the junction in the event the onslip merge can accommodate 1700 Veh/hr.

Table 7 Excess of Traffic between 2030 with Non-consented Developments in Veh/h.

Time Period	2030 Non-consented Developments	DMRB Type C Merge Volume Threshold (Veh/hr)	Excess of traffic		
			Total	Coming from the west	Coming from the east
AM peak	1921 NB on slip	1700	221	133	88
	1294 SB on slip	1700	-	-	-
PM peak	1916 NB on slip	1700	216	130	86
	1580 SB on slip	1700	-	-	-

In practice, such a level of traffic volume would act as a lane gain, leaving the motorway mainline saturated.

Storing the excess traffic

For the purpose of this assessment, it has been assumed the excess queue is accommodated on the local network. The excess of traffic on the local network was assessed for the proposed layout in LinSig by controlling the flow discharge (green times) onto the on-slip ramps. Queues are expected to reach approximately 450m and 380m on the West and East approaches respectively.

The following was concluded:

- The proposed third lane on the St Peter's Way west approach is required to be approximately 500m; and
- The two-lane approach on the St Peter's Way east approach does not need to be widened.

A detailed summary of DMRB volumes on the mainline and merges and all the information related to the assessment including the LinSig models are provided in Appendix D.

4.3 Intervention Timeline

Overall Junction Performance Consideration

From an overall junction traffic performance point of view, M25 Junction 11 is already congested, as indicated in Table 1. The 2017 surveyed traffic conditions were already saturated, in particular on St Peter's Way.

Road Safety Consideration

From a road safety consideration, the major risk would be a blocking back of vehicles from the roundabout on the off-slip , onto the motorway in the future. A high level assessment has been performed using the LinSig model assuming:

- The existing road layout and traffic signal timings;
- A uniform traffic growth at the junction from 2017 traffic volumes; and
- The non activation of the traffic signal hurry call that would enable clearing a significant blocking back queue.

This calculation has assessed the scale of the traffic growth required to generate blocking back queues onto the motorway under typical traffic conditions.

The result of the assessment, detailed in Appendix F, shows that blocking back conditions would require a growth of:

- 29% in the AM peak (southbound off-slip);
- 26% in the PM peak (northbound off-slip – Already saturated in 2017).

The traffic growth for 2030, including the non-consented development, corresponds to 17% in the AM peak and 20% in the PM peak. Even by 2030, with non-consented development, M25 Junction 11 is not at risk of blocking back onto the M25 as the motorway mainline merge/diverge as well as St Peter's Way would reach capacity before a blocking back queue situation.

Conclusion

As a conclusion, the M25 Junction 11 is already saturated, and therefore is due for a capacity upgrade in the existing situation. With a scenario without the implementation of a proposed scheme, the merge/diverge motorway segments as well as the approaches on St Peter's Way would reach capacity before a blocking back scenario onto the M25.

From a timeline point of view, the junction upgrade is therefore desirable in the existing situation.

5 M25 Junction 13 – Trip Generation Assessment

5.1 Early Assessment

The purpose of this section is to present an updated calculation to the trip generation and distribution from the proposed developments going to M25 Junction 13 as established by the Local Plan.

5.2 Junction Configuration

Junction 13 is a large thee/four lane spiral roundabout. It is controlled using traffic signals on all approaches and includes link roads towards the south, parallel to the M25 connecting to the A308 interchange.

5.3 Traffic Trip Generation

The detailed trips generation for the proposed developments using TRICS is provided in Appendix E.

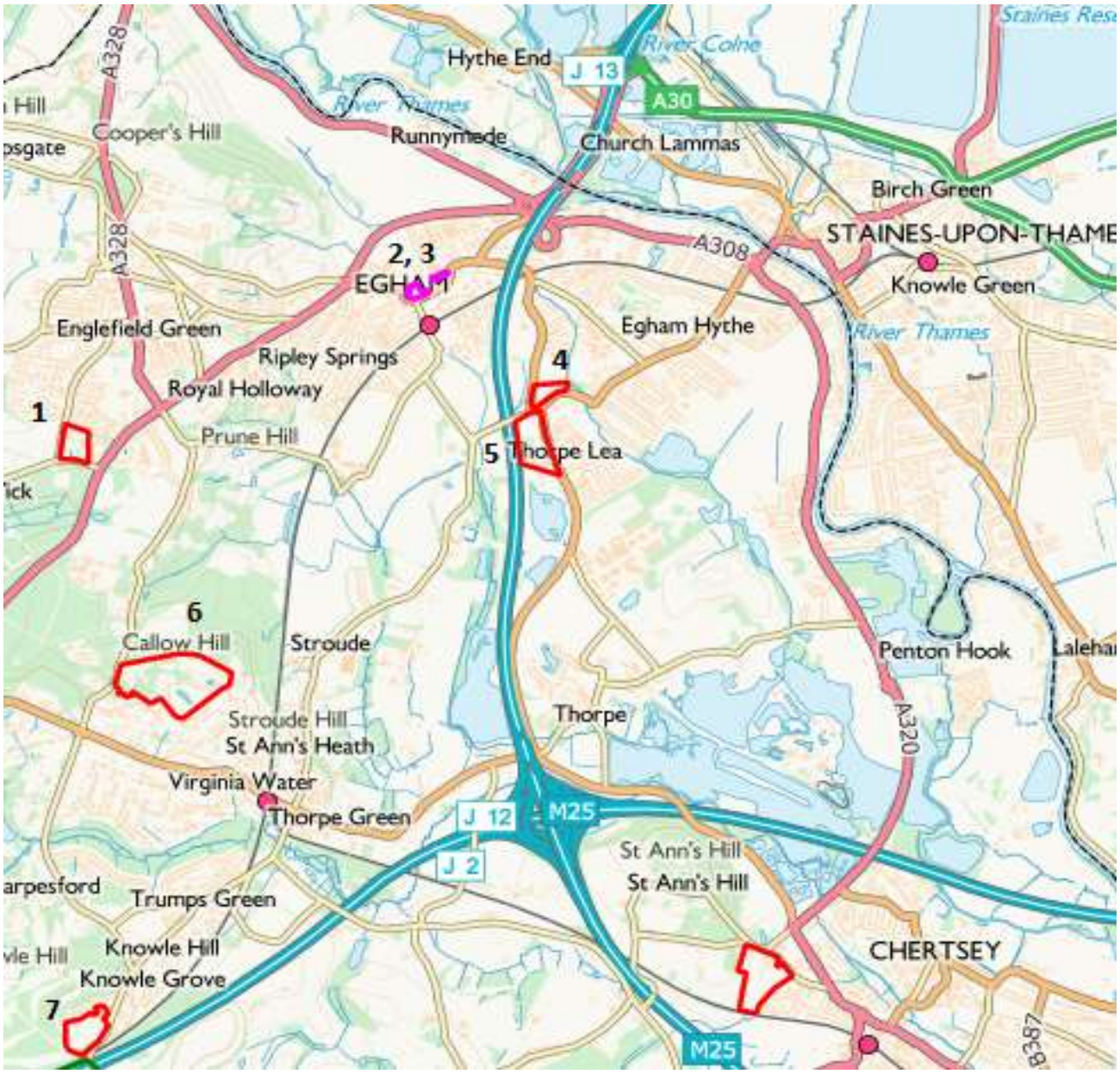
Table 8 shows a summary of total trips for each development.

Table 8: Proposed development trips

Proposed Development	Net Change (Veh.)					
	AM			PM		
	Arr.	Dep.	Total	Arr.	Dep.	Total
Blays House	-18	19	1	-1	-80	-82
Egham Gateway West	-7	6	-2	52	27	79
Egham Gateway East	-4	6	2	-1	-17	-18
Thorpe Lea Road North (Kerry Foods)	-4	11	7	7	-19	-12
Thorpe Lea Road North (Glenville Farm)	0	8	8	10	2	13
Thorpe Lea Road West	-11	39	27	55	-18	37
Virginia Water North	9	29	38	38	24	61
Virginia Water South	10	34	44	47	27	74
Total Trips	**-26**	**152**	**126**	**206**	**-54**	**152**

The location of each site is presented in Figure 6. All sites are located south of the interchange, typically along or south of the A308. The net trip generation is overall quite low because a lot of the residential developments are replacing office land use.

Figure 6: Location of proposed developments related to M25 Junction 13



5.4 M25 Junction 13 Traffic Volumes

The proportion of non-consented development traffic going through the M25 Junction 13 roundabout has been calculated using the proportion of traffic going to and from that junction in the Omnitrans model, as a proportion of the figures in Table 8.

Table 9 below presents the additional volume of traffic forecast at M25 Junction 13 as a result of the Runnymede Local Plan. The total volume is very low and would not be expected to significantly impact traffic conditions on Highways England's road network.

Table 9: Proposed development trips to M25 Junction 13

Proposed development	Net Change (Veh.)					
	AM			PM		
	Arr.	Dep.	Total	Arr.	Dep.	Total
Blays House	-2	3	1	0	-18	-18
Egham Gateway West	-2	1	-1	7	2	9
Egham Gateway East	0	1	0	0	-2	-2
Thorpe Lea Road North (Kerry Foods)	0	2	2	1	-2	-2
Thorpe Lea Road North (Glenville Farm)	0	2	2	1	0	1
Thorpe Lea Road West	-1	9	8	5	-2	3
Virginia Water North	1	2	3	2	3	4
Virginia Water South	0	20	20	28	14	42
Total Trips	**-5**	**40**	**35**	**43**	**-6**	**37**

5.5 M25 Junction 13 Conclusion

In conclusion, the net increase of traffic arriving at M25 Junction 13 from the non-consented developments is anticipated to be very low and should not impact Highways England's road network significantly.

6 Conclusions and Recommendations

6.1 Conclusions

The key conclusions from this study are:

- The M25 Junction 11 roundabout is required to be upgraded in the existing situation;
- The geometric improvements proposed are sufficient to cater for the increased traffic volumes in 2030;
- The merge type onto the M25 receives more traffic in 2017 than would be acceptable for the design of a new merge type to DMRB standard. In the future, the traffic demand forecast estimates an increase in traffic while the merge type is planned to be downgraded as part of the smart motorway scheme; and
- Using the maximum capacity of a type C merge, proposed as part of the smart motorway scheme, the excess traffic could be gated onto the local road network, but the west side of St Peter's Way will require widening to three lanes.

The mitigation of the blocking back queue from the smart motorway programme has not been communicated to this project.

Runnymede Local Plan is not anticipated to significantly impact M25 Junction 13 or Highways England's road network in its vicinity.

6.2 Recommendations

Arcadis recommendation is:

- To undertake the upgrade of M25 Junction 11 roundabout only. The upgrade of St Peter's Way would require further study from the smart motorway programme. The proposed traffic management gating strategy can be considered in case of an incident, but it is not appropriate for typical traffic conditions; and
- Not to undertake further traffic assessment regarding M25 Junction 13.

Appendix A – 2017 Junction Analysis

Electronic Format Only

Appendix B – 2030 Traffic Assessment

Further information available in electronic format.

The merge and diverge future traffic volumes have been prepared using the following sources:

- The 2017 WebTRIS M25 mainline flows (NB and SB sites on J11 & J13)
- The 2017 M25 Junction 11 turning count;
- The TEMPro 2017 to 2030 Motorway growth factors[2] (AM 1.1732 / PM 1.1740); and
- The non-consented development trip distribution/assignment outputs.

M25 J11 Section	Period	2030 baseline		2030 with non-consented developments	
		Mainline flow (Veh/hr)	Merge/diverge flow (Veh/hr)	Mainline flow (Veh/hr)	Merge/ diverge flow (Veh/hr)
NB Off-slip	AM	6819	1165	6819	1176
	PM	6215	1039	6215	1148
NB On-slip	AM	6819	1842	6819	1921
	PM	6215	1842	6215	1916
SB Off-slip	AM	6048	1956	6048	1973
	PM	6462	1328	6462	1402
SB On-slip	AM	6048	1225	6048	1294
	PM	6462	1524	6462	1580

Appendix C – Roundabout Scheme Analysis

Electronic Format Only

Appendix D – 2030 Merge and Diverge Sections Assessment

Electronic Format Only

Appendix E – Junction 13 Trip Generation and Distribution

Electronic Format Only

Appendix F – Timeline Analysis

Electronic Format Only

[2] **TEMPro Criteria**. Trip end type: Origin/Destination, Transport Mode: Car driver/passenger, Area: Runnymede 007(E02006399), NTM AF15: Rural, Motorway.