SURREY
COUNTY COUNCIL

RUNNYMEDE BOROUGH COUNCIL LOCAL PLAN

Strategic Highway Assessment Report

Minnerva
Networked Wisdom

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CONTENTS

1 INTRODUCTION

1.1 Regulation 19 Appraisal

1.1.1 Runnymede Borough Council is in the process of finalising their 2035 Local Plan to ensure future growth can be accommodated within the Borough. Minnerva in partnership with Surrey County Council have been commissioned to assess the impact of the preferred development option using the County's strategic transport model SINTRAM.

1.1.2 The overall aim is to help inform the decision making surrounding the suitability of potential development sites which have been identified, and to highlight junctions and sections of roads to focus mitigation solutions. This will aid the Borough by providing the transport evidence base to inform the Regulation 19 consultation.

1.2 Organisation of this Report

1.2.1 Chapter 2 describes the development and validation of the Base year (2014) model from which forecasts are subsequently projected. The chapter introduces the two-level modelling system that is applied.

1.2.2 Chapter 3 describes the forecasting process. This is based on forecasting travel demand using modelling components for trip productions and attractions (trip ends), and the patterns of travel (trip distribution). The impact of travel demand on the transport network is modelled using network assignment procedures. Chapter 3 explains how the demand for travel, using the higher-level, multi-modal 'SINTRAM72' modelling, is converted to forecasts of traffic demand used to provide forecasts of peak-hour traffic conditions on the Runnymede highway network in 2036.

1.2.3 Chapter 4 presents the results of the forecasts and analysis of them. The results are presented in tabular form and using network graphics for the borough of Runnymede. The analysis distinguishes between the effects on local and motorway roads. Network hotspots are presented to summarise the key links and junctions potentially impacted by the implementation of the Local Plan.

1.2.4 Chapter 5 provides an overview of the key findings from the modelling.

1.2.5 The Appendix contains a significant number of figures and tables that are referenced in the main text.

1.2.6 NOTE: The figures and tables in this report are designed for viewing in print and at standard scales, but they have a resolution that enables them to be viewed on-screen with a reasonable level of zoom to facilitate reading and discerning details.

2 BASE MODEL DEVELOPMENT AND VALIDATION

2.1 Model and Scope

2.1.1 The modelling for the Runnymede Strategic Highway Assessment Report (SHAR) associated with preparation of the Runnymede 2035 Local Plan is largely focused on a local highway model that covers Runnymede Borough and a hinterland. The hinterland incorporates parts of Woking and Surrey Heath Boroughs, in particular, the adjacent proposed developments at Martyrs Lane, Woking, and Fairoaks Airport in Surrey Heath.

2.1.2 Significantly, this local model is derived from Surrey County Council's new regional, multi-modal transport model, version SINTRAM72[1]. It is used in this application to forecast changes in the demand for travel in 2036, as well as to provide initial ('prior') Base year highway travel information for the local model in the form of origin-destination (OD) trip matrices. These prior OD matrices from SINTRAM72 are refined as part of the validation process reported below in Section 2.11.

2.1.3 The modelling system, all of which is implemented in OmniTRANS modelling software, may thus be understood as having two levels, with SINTRAM72 forecasting demand, and the local Runnymede model providing assessments of the highway conditions for different planning scenarios relevant to the Local Plan. Although the SINTRAM72 demand forecast is regional in nature, covering all of Surrey and beyond, it includes a fine zone system and uses details of Local Plan developments as supplied by Runnymede BC to Surrey CC.

2.2 Further Model Documentation

2.2.1 The validation of the SINTRAM72 model provides an important background and further basis of assurance for the Runnymede SHAR modelling, and its validation reports are relevant and available from Surrey CC on request.

2.2.2 SINTRAM72 reports include:

- The calculation of trip ends and car availability is described in *Technical Note TN1 Processing Trip Ends*.
- The development of Base trip matrices is described in *Technical Note TN3 Base Trip Matrix Production*.
- The validation of SINTRAM72 is described in *Technical Note S72 TN4 Model Assessment and Validation Report.*
- The nature of the modelling is described in *Technical Note TN5 Model Technical Report*.
- Besides this document, aspects of the model are also described in the *User Guide, Running the SINTRAM Model*.

2.2.3 Runnymede Local Model reports are:

- *Local Model Validation Report (LMVR)* document which provides a full account of the validation of the Runnymede Local Model summarised in Section 2.11.

[1] Developed in 2017

- The *Local Model User Guide* which provides further information on the operation of the Local Model.

2.3 Base and Forecast Years

2.3.1 The model base year is 2014.

2.3.2 The forecast year is 2036. This year both represents the year in which all Local Plan developments may be assumed to be complete, and is a year for which general Department for Transport (DfT) growth forecasts are available[2], so avoiding the need for interpolation of values.

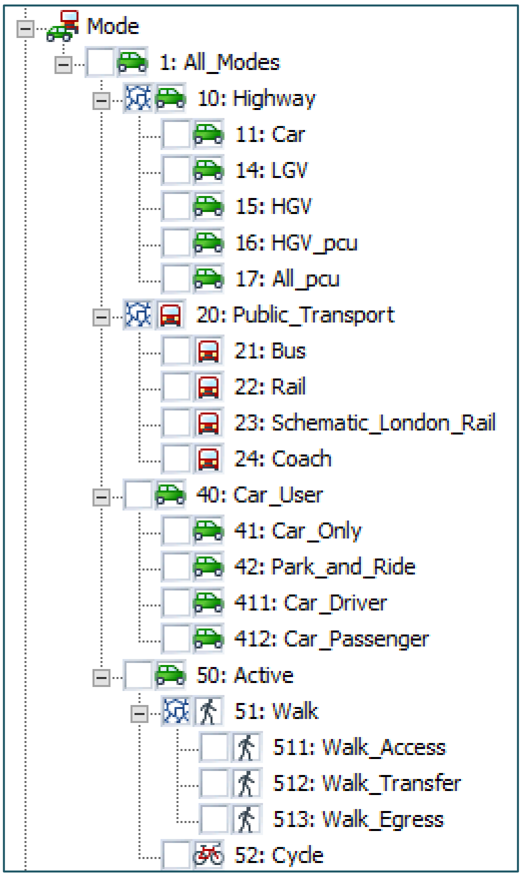
2.4 Modes of Transport

2.4.1 The modelling of demand in SINTRAM72 is multi-modal, with the main modes of:

- Highway
- Public Transport
- Active

2.4.2 As shown in Figure 2-1, these categories include an extensive number of sub-modes.

Figure 2-1 Travel Modes for Demand Modelling



2.4.3 For both the SINTRAM72 and Local Model cases, primary highway vehicle types are: car; light goods vehicles (LGV); and heavy goods vehicles (HGV). Additionally, bus vehicles are included in the highway traffic, as are the car components of Park

[2] As provided by the DfT National Trip End Model (NTEM)

& Ride trips[3], though both these categories have limited effect in the Runnymede area.

2.4.4 For highway assignment modelling, all the vehicle types are considered in terms of passenger car units (PCUs). Most vehicles on the road have a PCU value of 1.0, i.e. 'vehicles' and 'PCUs' are the same, but HGVs have a PCU value of 2.0 and buses of 2.5, reflecting their relatively greater impact on network capacity.

2.4.5 Some of the analyses reported in Chapter 4, regarding Levels of Service (LoS) for example, uses PCU units, but other analyses more related to person trips simply uses car as the vehicle type.

2.5 Time Periods

2.5.1 The starting point for the calculation of travel demand is an average 24-hours for a working day in a 'neutral' month (avoiding significant holiday periods and more extreme winter weather). This enables total daily trip rates by trip purpose to be assumed constant over the forecasting period.

2.5.2 For most demand modelling though, trips are allocated to the four time-periods of AM (0700 – 1000), Inter-Peak (1000 – 1600), PM (1600 – 1900), and Off-Peak/night-time (1900 – 0700).

2.5.3 The demand modelling focuses on the 12 daytime hours covered by AM, Inter-peak (IP), and PM, but return-trips include consideration of Off-Peak (OP) travel.

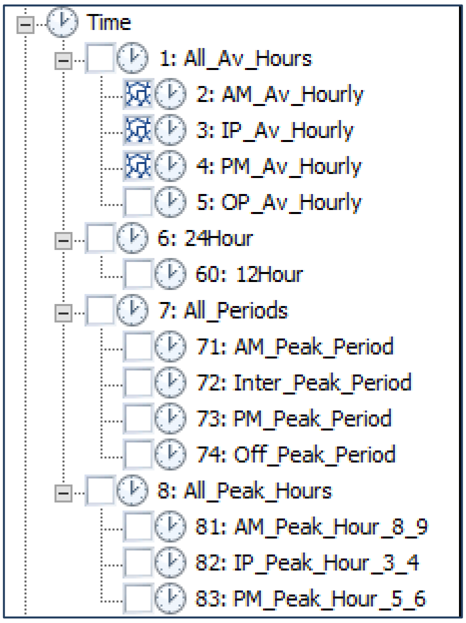
2.5.4 The SINTRAM72 highway modelling uses 'peak hour' factors to represent heightened levels of congestion within the AM and PM peak periods, respectively taken as occurring for the peak hours 8am – 9am and 5pm – 6pm. For the Local Model AM and PM peak hours, trips are further adjusted with reference to values of local peak-hour traffic counts.

2.5.5 An average hourly Inter-Peak highway network assignment is generated in the Local Modelling, but is not subject to specific validation or reporting.

2.5.6 The set of time periods used at various points in the modelling are shown in Figure 2-2.

[3] Park and ride trips include connectivity between car and rail as well as traditional car and bus

Figure 2-2 Time Periods used in Modelling

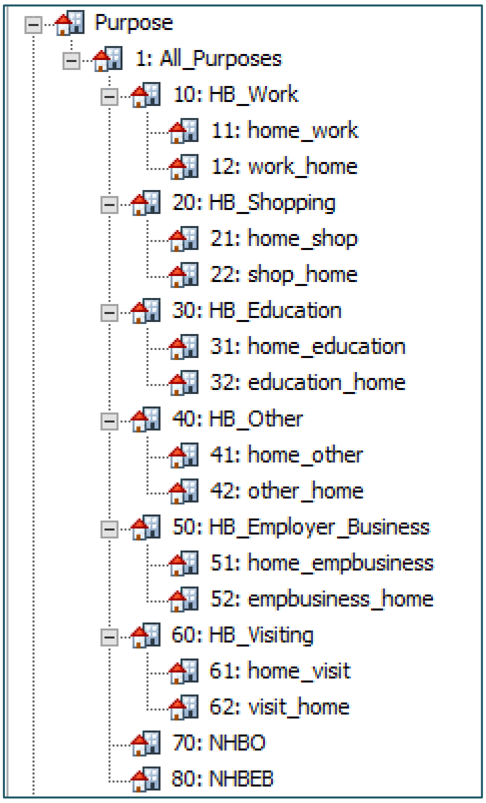


2.6 Demand Types

2.6.1 For demand modelling, trips are initially considered as 'tours' and identified as 'Production-Attraction' ('PA') trips. Tours apply to home-based (HB) trips, with an outbound trip from the home implying (in nearly all cases) a return trip later in the day. Non-home based (NHB) trips do not imply return trips. For network assignment modelling, and, importantly, for local modelling, trips are considered as 'Origin-Destination' ('OD') movements for a particular time period, that is, OD trip tables (matrices) include both outbound and (returning) inbound home-based trips, as well as any NHB trips arising in the particular time period.

2.6.2 The set of trip purposes used in demand modelling is shown in Figure 2-3.

Figure 2-3 Trip Purposes used in Demand Modelling



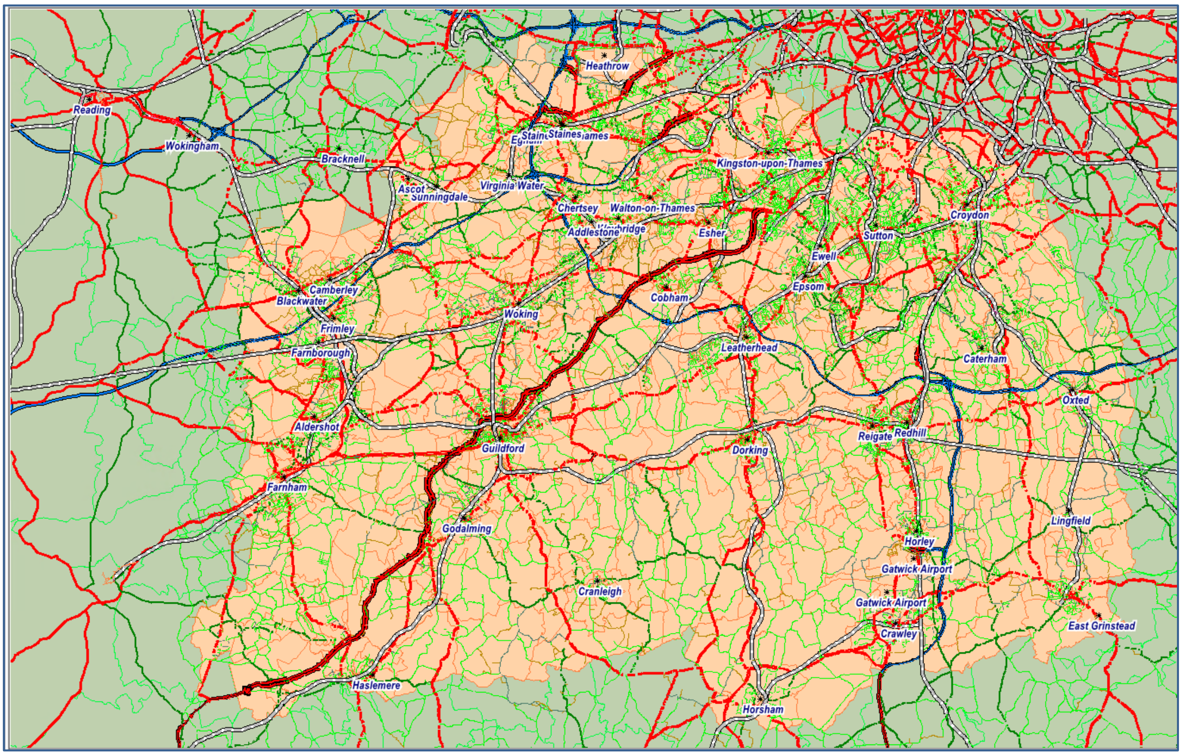
2.6.3 Travel demand is further categorised in the demand modelling according to the availability of a car for travel.

2.6.4 For the Local Model, all person car trips are considered as all purposes combined but, obviously, the pattern of trips reflects the underlying trip purposes used in the demand modelling.

2.7 Study Area

2.7.1 Figure 2-4 shows a part of the SINTRAM72 transport network. An 'Inner Study Area' (ISA), where the modelling is most detailed, is shown with a light orange background. The ISA includes Surrey and some adjacent areas. While the area of the Runnymede Local Model lies within the ISA, it should be noted that its northern boundary abuts the SINTRAM72 'Hinterland' area (grey background) where there is less detail and the zone sizes are larger.

Figure 2-4 SINTRAM72 Inner Study Area



2.7.2 The Local Model is defined by a cordon around Runnymede BC and some adjacent areas in the SINTRAM72 model, as shown in Figure 2-5, to produce the Local Model shown in Figure 2-6 below.

Figure 2-5 Extraction of Runnymede SHAR Network

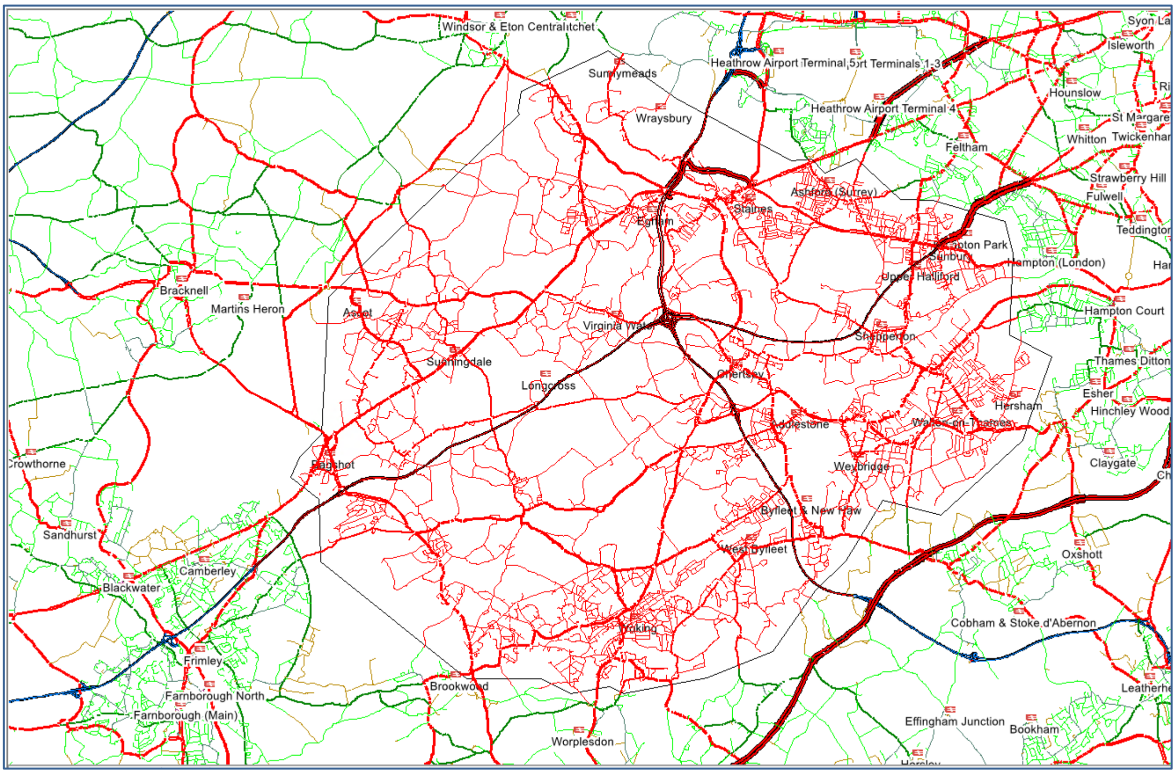
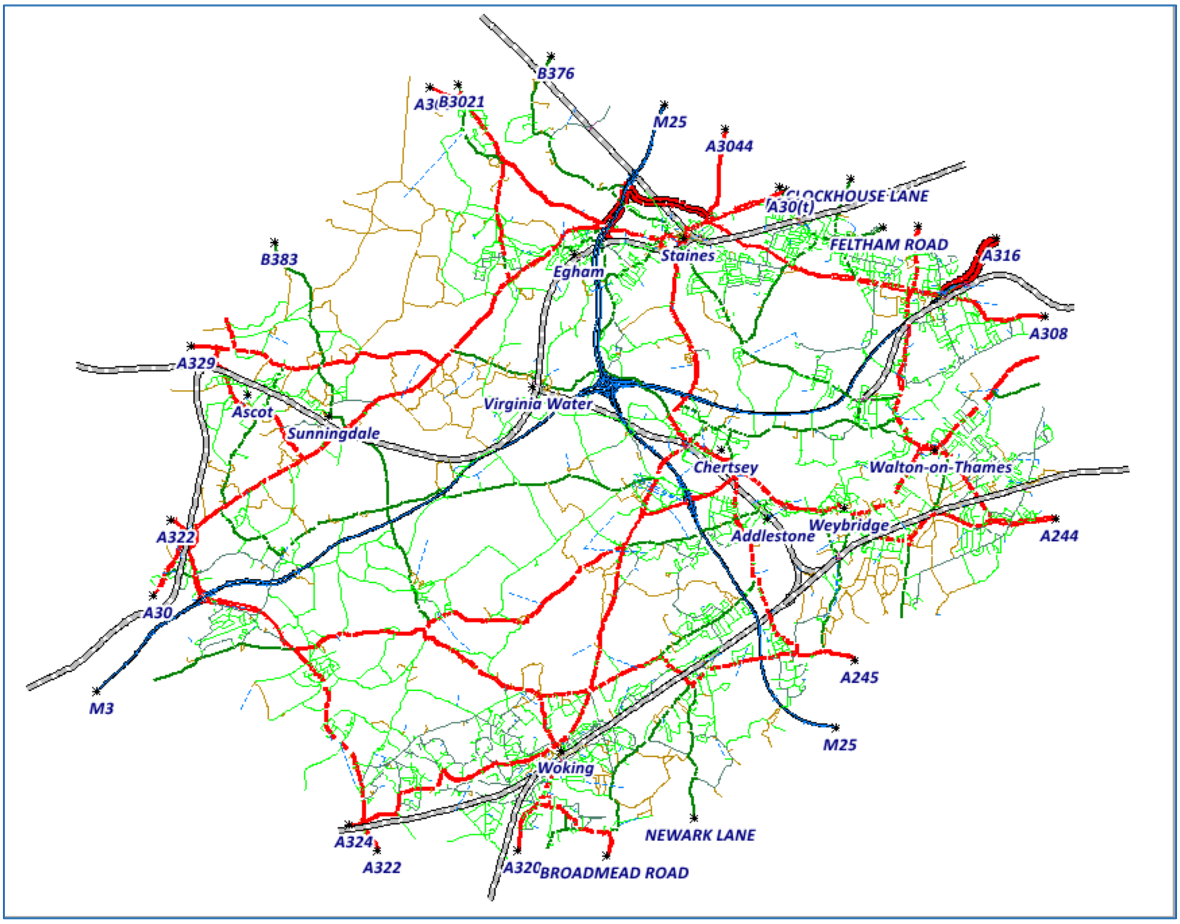


Figure 2-6 Local Model: Runnymede SHAR Network



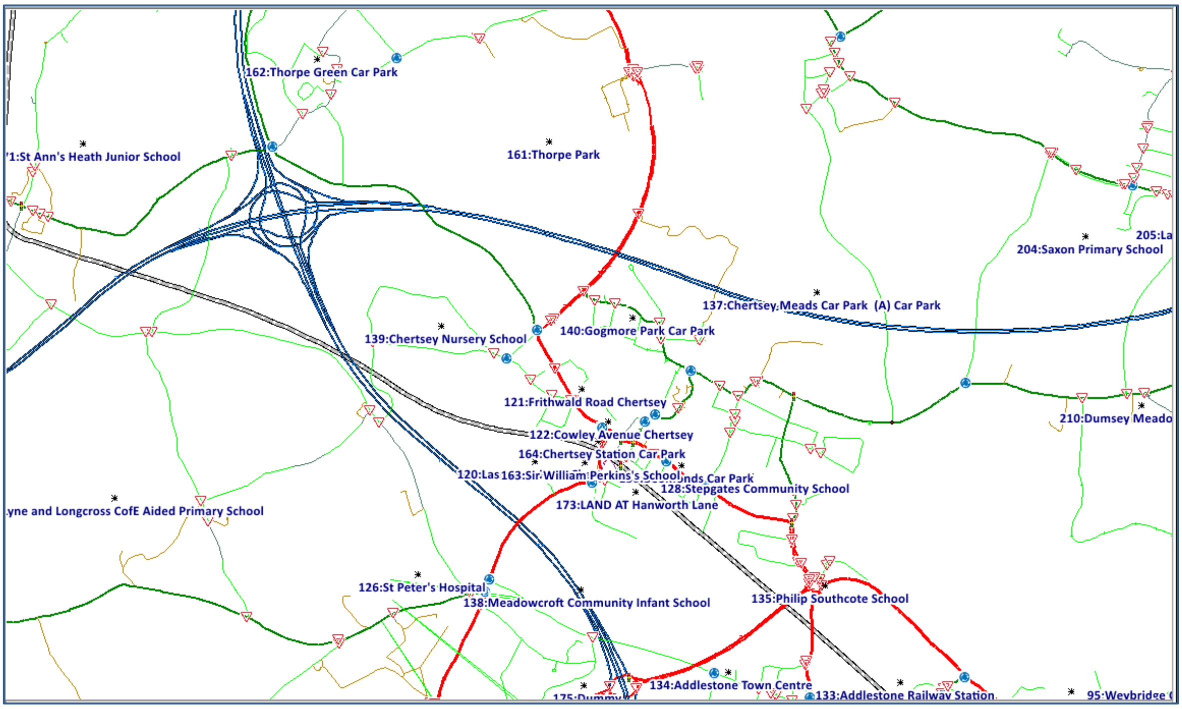
2.7.1 Runnymede Borough contains sections of the M25 and M3. These roads are the responsibility of Highways England; they are included in the analysis but as distinguishable elements.

2.7.2 The primary cross-boundary impacts are addressed by inclusion of parts of Woking and Surrey Heath Boroughs in the Local Model. Further analysis of cross-boundary impacts is available from the SINTRAM72 modelling, but is not generally reported here. However, impacts of forecast changes outside of the Local Model on motorway flows is discussed later in Section 3.8.

2.8 Zoning

2.8.1 The Local Model has 314 zones defined. Of these, 68 correspond to the cordon crossing points, the main ones of which are labelled in Figure 2-6 above. Figure 2-7 below shows example details of the zoning in the Chertsey area via the labelled asterisk symbols. (The labelling is merely indicative of zone locations.)

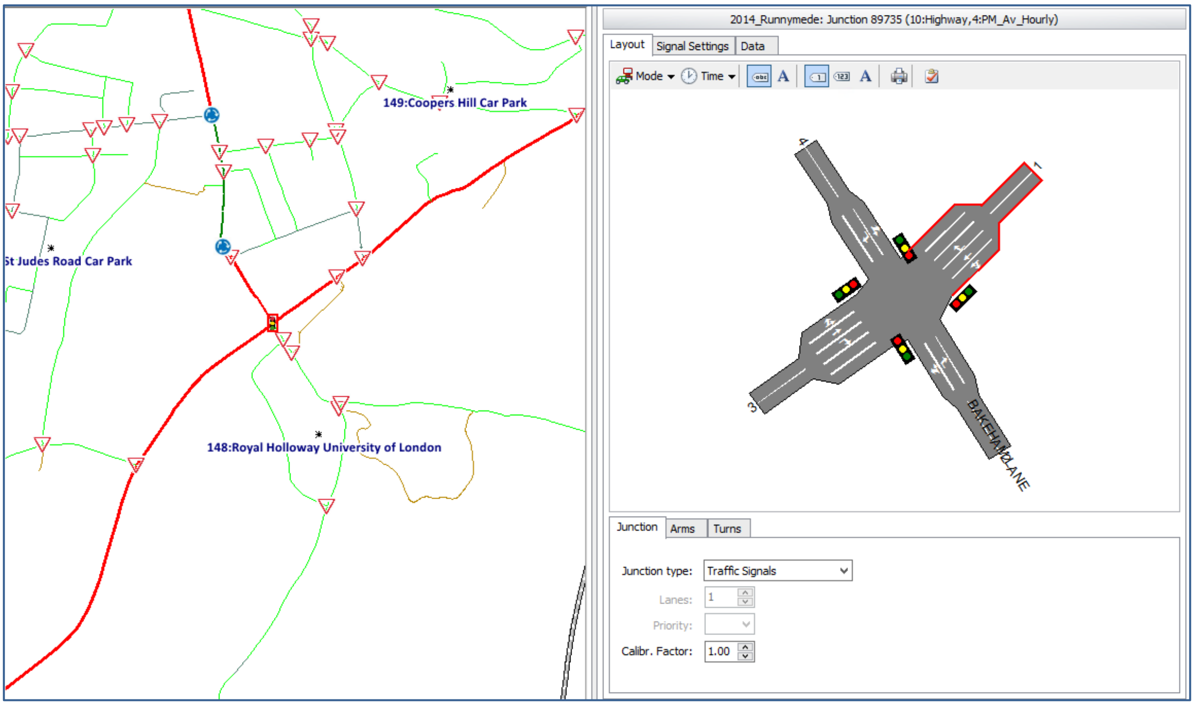
Figure 2-7 Details of Zoning and Junction Modelling



2.9 Junction Modelling

2.9.1 In Figure 2-7 symbols at road intersections indicate the type of junction controls that are modelled, and Figure 2-8 shows more details for a sample signalised junction.

Figure 2-8 Junction Controls and Lane Markings



2.10 Assignment

2.10.1 The local highway assignment modelling is provided by the OtTraffic component of OmniTRANS, which provides multi-user class (MUC) equilibrium assignment.

2.10.2 The MUC assignment models the combined effects of Cars, LGVs, and HGVs on congestion, while supporting different routeing characteristics for each class.

2.10.3 Congestion effects on links are modelled via speed-flow curves derived from 'COBA', as specified in Appendix D of WebTAG Unit M3, and which take account road types, widths, and localities (urban, rural, etc.).

2.10.4 Delays at junctions are modelled via relationships based on 'time-dependent queueing theory'. These are described further in the OmniTRANS support document *Junction Modelling*.

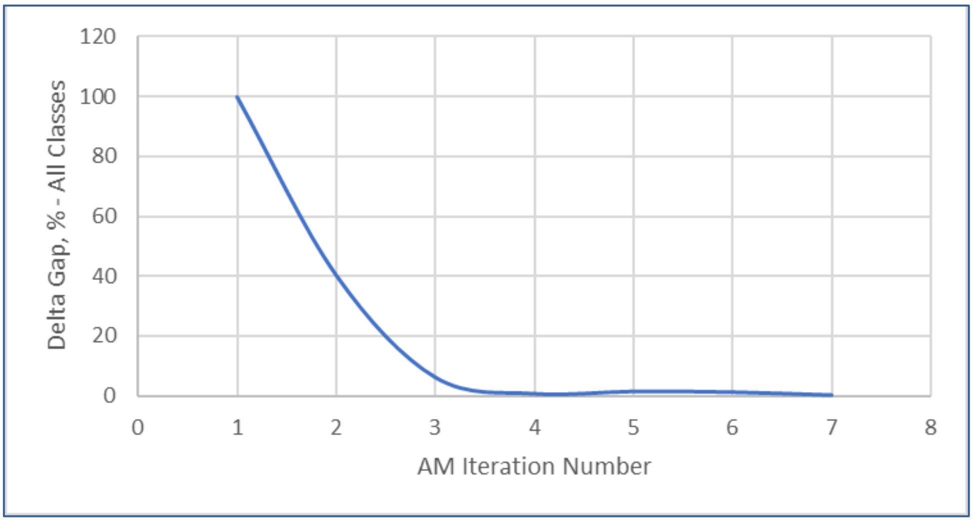
2.10.5 Additionally, Minnerva has implemented a custom 'cost function' for modelling merging delays at motorway junctions. This is based on TRL research evidence.

2.10.6 Routes through the network are calculated in terms of 'generalised time' (units of minutes). The coefficients for the expressions used to calculate generalised time are the same as reported for SINTRAM72, and are taken from the November 2016 WebTAG Databook for values of time (VoT) and vehicle operating costs (VOC) applicable to each of Cars, LGVs, and HGVs.

2.10.7 The assignments are run through an iterative process which is halted when the variation in results, as defined by the WebTAG (Unit M3, Section C.2.4) 'Delta' Gap statistic, is less than the WebTAG target value of 0.1%.

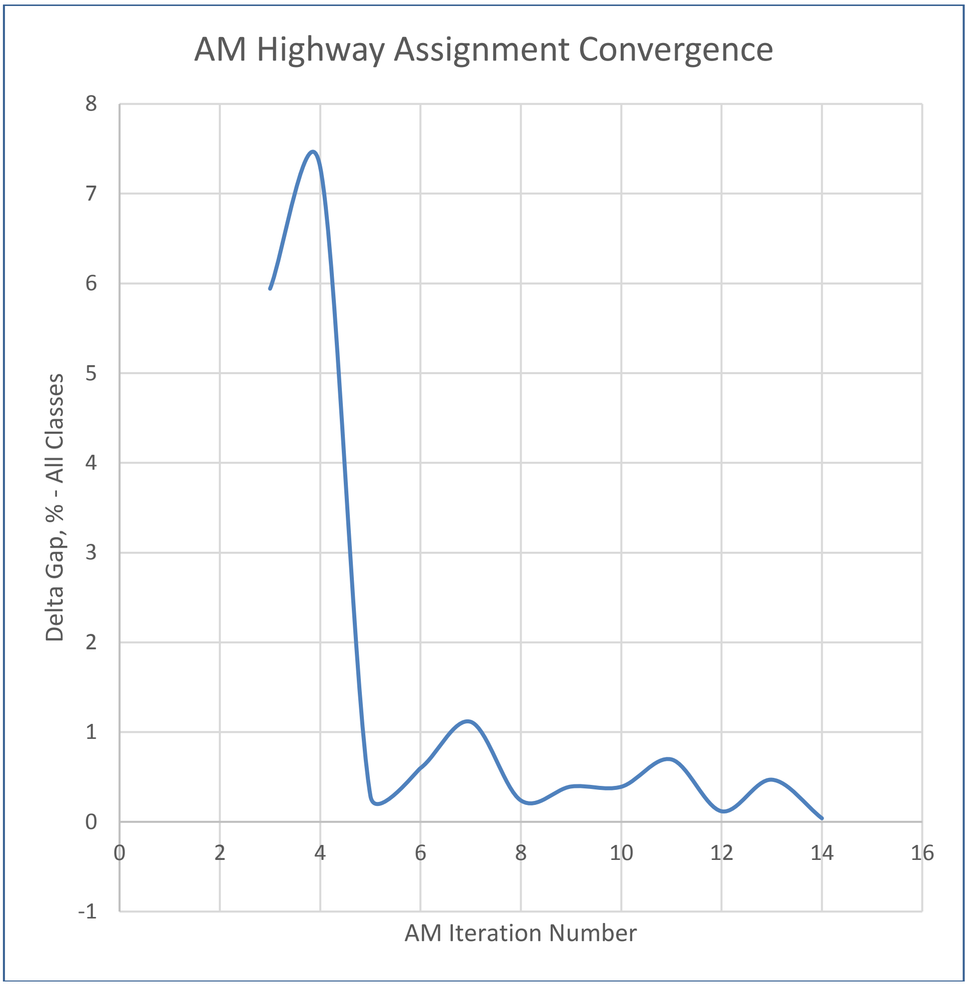
2.10.8 The convergences for the Runnymede network is shown in Figure 2-9 for the AM Base year case, and in Figure 2-10 for the AM 2036 Scenario 2 forecast. Figure 2-10 omits the first two iterations to provide clarity for variations in the later iterations.

Figure 2-9 AM Highway Assignment Convergence - Epsilon Values



2.10.9 It may be seen that convergence is quite fast in the Base year, but smaller instabilities affect the forecast year case. The convergence patterns for the PM cases are similar but quicker.

Figure 2-10 AM Forecast Scenario 1 Highway Assignment Convergence - Epsilon Values



2.10.10 As may be observed, convergence is achieved rapidly, and with only minor evidence of instability evident in the AM case. These results will be influenced by the dominant motorway flows which, in this small network, achieve stable values quickly. Instabilities on minor roads will have less impact on the gap metric.

2.11 Model Validation

2.11.1 As described in Section 2.2 above, a full description of the Local Model validation is provided in the Local Model Validation Report (LMVR). The key points and features of the validation process and results are therefore summarised in this section.

2.11.2 The **standard criteria** for assessing highway network models is provided by the DfT's WebTAG guidance, notably, *Unit M3 Highway Assignment Modelling*. This identifies three main forms of assessments formed by comparisons with observed data of 'screenline' flows for assessing OD matrices, network link flows, and travel times for a set of Journey Time routes defined for the purpose.

2.11.3 Applying these assessments to the Runnymede case raised a number of issues. Primary among these was the available set of observed, AM and PM peak-hour traffic count data.

2.11.4 The large majority of the local model observed traffic counts are taken from the set used in SINTRAM72 modelling, of which there were nearly 3,000 one-way counts. These counts were taken in the period 2011 to 2014 and have been normalised, using measures of traffic growth, to all correspond to the Base year of 2014.

2.11.5 Of these 3,000 counts, nearly 900 related to the Local Model highway network. As the Runnymede Borough is small, measuring only eight miles north to south, this implies a high density of counts, with many roads having several sets of adjacent observations within relatively short distances.

2.11.6 The data set includes counts produced by the DfT, Highways England, and Surrey CC, as well as counts produced by promoters of development schemes forming part of the Runnymede 2035 Local Plan. The count data has been observed by different means, both instrumented and manual, and across widely varying numbers of days.

2.11.7 These different forms and sources of collection also vary in how and the extent to which traffic is classified by the vehicle types used in the modelling of Car, LGV, and HGV. Where counts have not been classified, or only in a limited way, then estimates have had to be made of the numbers of cars, light, and heavy good vehicles associated with each count site and for each time period.

2.11.8 Simple inspection of the count data on the network reveals a considerable extent of inconsistencies that cannot be resolved by any feasible set of modelled flows. This inconsistency is not a poor reflection of the observations but, rather, a comment on the different measurement, systematic, and random errors that arise, especially in the context of the heavily congested roads in Runnymede.

2.11.9 An exacerbating factor is the dominating effect of the M3 and M25 motorways that intersect within the Borough and for which there are important access points in the modelled network. These roads carry flows ten times greater than those of many roads in the rest of the Local Model network, so variations of 10% in motorway counts can correspond to 100% of many local counts.

2.11.10 It is therefore difficult to discern which counts are more accurate than others. The methodology has therefore been to identify counts that are most self-consistent. This has been aided by the fact that the provenance of the OD matrices from the SINTRAM72 model means that their resulting modelled flows can be adopted as fair guidance on likely flow levels and, in any event, these flows are certain to be self-consistent.

2.11.11 On this basis, nearly 300 counts were adopted as being adequately self-consistent and so were used to refine the initial OD matrices via matrix estimation techniques.

2.11.12 TAG Unit M3 specifies the use of another set of counts for validation purposes that are not used in matrix estimation. This is problematic for several reasons: if the 'validation' counts differ from the 'estimation' counts then they should be included in the estimation set if the differences imply additional information that should not unreasonably be withheld from the estimation. If the differences arise because of observation errors, then they are not fair validation tests.

2.11.13 For these reasons, the assessment of modelled link flows is confined to the 300 counts that have passed the quality threshold of 'reasonably self-consistent', although this is far from being 'fully self-consistent'. The full set of c.900 counts is retained in the model so that variances with modelled values can be inspected, but the major source of differences lies with the variability of the count data itself. This uncertainty in the count data also affects screenline flow comparisons, which include some additional sites to those used in link comparisons to help form count screenlines.

2.11.14 The number of nearly 300 counts is still very large for the size of the local model network, so any broad level of agreement, coupled with the established provenance of the prior OD matrices, provides strong assurance that the model reflects base year travel patterns.

2.11.15 The WebTAG criteria place a strong emphasis on comparisons of observed traffic counts and modelled traffic flows using a comparison metric termed the 'GEH' statistic. However, there are features of the count data for the Runnymede Local Model, notably the high density of counts, that expose the limitations of the GEH-based criterion with its implicit assumption about the 'correctness' of count data, which considerably undermines its merits for model assessment.

2.11.16 In contrast, the GPS-based journey time data, sourced from TrafficMaster and available via DfT-sponsored arrangements, provides statistically high quality, consistent data.

2.11.17 The following now considers the various elements of the validation process that serve to build confidence in the Local Model's ability to reflect present day/Base year conditions.

2.11.18 Much of the assurance in the quality of the Local Model is based on the significant attention and extent of data sources used to generate the Base year SINTRAM72 trip matrices. These, in turn, provide the sound foundation in the form of the 'prior' OD matrices used in the development of the Local Model car OD matrices. The matrices and their development therefore reflect the following primary elements.

2.11.19 **Travel Patterns**: these are formed from data fusion, applied to PA and OD matrices, of synthetic matrices, Census Travel to Work data, GPS-sourced travel pattern data, as well as vehicle and passenger count data.

2.11.20 **Trip Ends** (zonal trip productions and attractions): these are derived from SINTRAM72 modelling which uses local population and employment data at a detailed level for the Base year of 2014. Trip productions are calculated from trip rates for different trip purposes from CTripEnd v6.2. CTripEnd is part of the DfT's National Trip End Model (NTEM); it represents a more flexible implementation for integration into advanced models, such as SINTRAM, compared to the other, better-known NTEM 'TEMPRO' system[4].

2.11.21 **Modelling Parameters:** parameters, such as car occupancy levels by trip purpose, are taken from the WebTAG Data book using November 2016 values.

2.11.22 **Local Model OD Matrices**: are therefore based on 'prior' SINTRAM72 matrices involving extensive processing to create consistent PA and OD matrices (i.e. to control to National Travel Survey (NTS) observed daily trip rates) and to absorb diverse data. The fusion methodology makes best use of available data, given varied precision of data. The final Local Model Car, LGV, and HGV OD matrices for AM and PM peak hours are adjusted via matrix estimation and a very large set of traffic count data. There is no evidence to indicate any significant resulting changes to matrix structure or trip rates.

2.11.23 **Local Model Network Definition:** The SINTRAM72 and Local Model highway networks are defined using Ordnance Survey Integrated Transport Network (ITN) digital mapping. The network capacities are set according to road type and speed limits. As part of Local Model validation some network capacities have been reduced to avoid flows in inappropriate locations (e.g. residential areas) or where journey time data indicated unexpectedly low speeds due to 'friction factors' such

[4] It is noted that CTripEnd v7.0 was released in the latter part of 2016, but the DfT has not released full v7.0 tables, as provided for v6.2. Trip rates have been altered in V7.0.

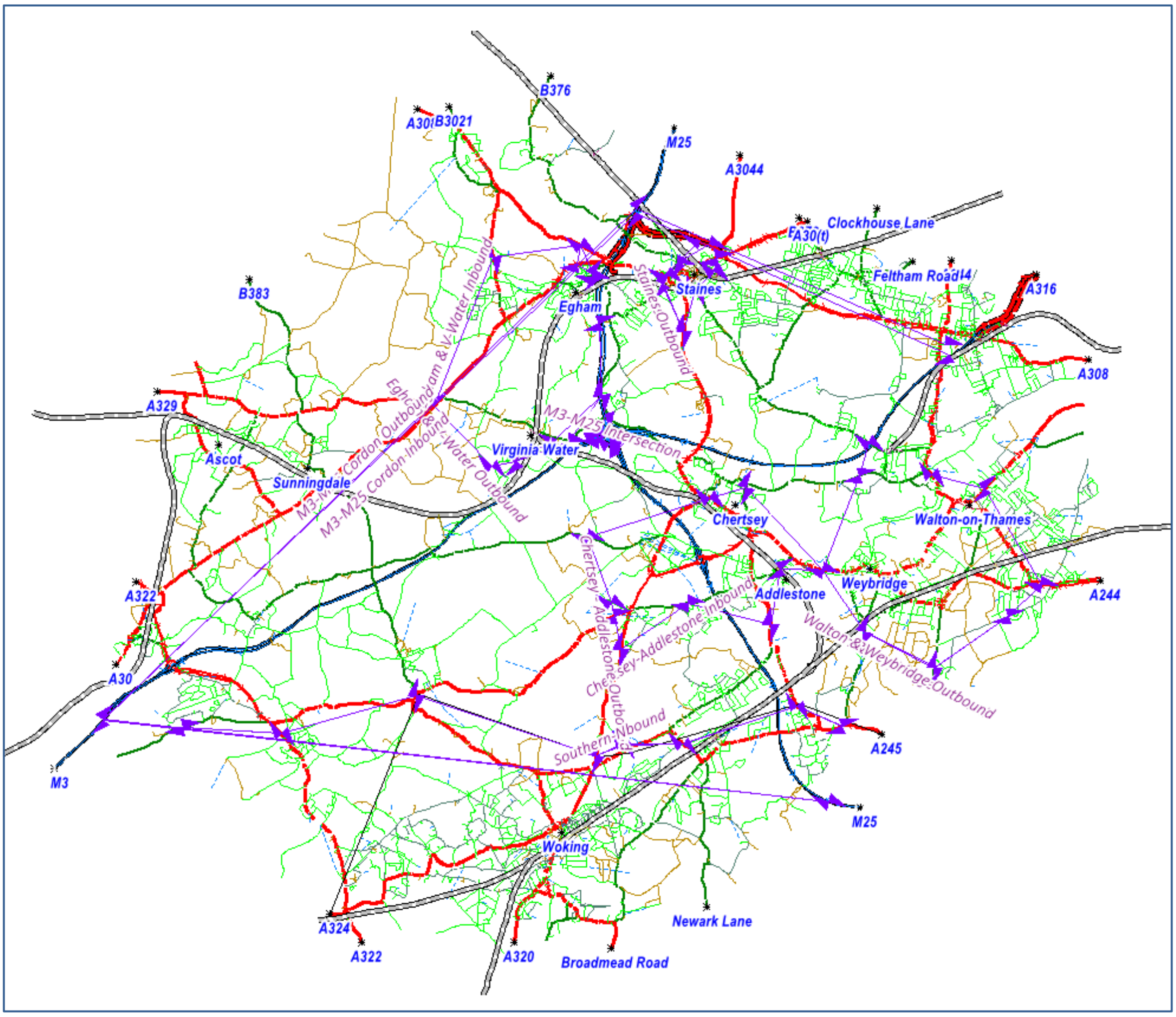
as pedestrian activity, and similar. Figure 6-6 in the Appendix provides a view of network capacities.

2.11.24 The following summarises the results of the Local Model validation process and shows illustrative results, for which fuller details are available in the LMVR report and its appendices.

2.11.25 **Screenline flows:** WebTAG (Unit M3 Section 3.2) states “The validation of a highway assignment model should include assigned flows and counts totalled for each screenline or cordon, as a check on the quality of the trip matrices”. This comparison is motivated from the era when the use of roadside interviews (RSIs) was commonplace for developing OD matrices, with the RSI sites organised into sets of screenlines. RSI data made only a minor contribution to the development of the SINTRAM72 matrices and the assessment of trip matrices correspondingly owes less to screenlines.

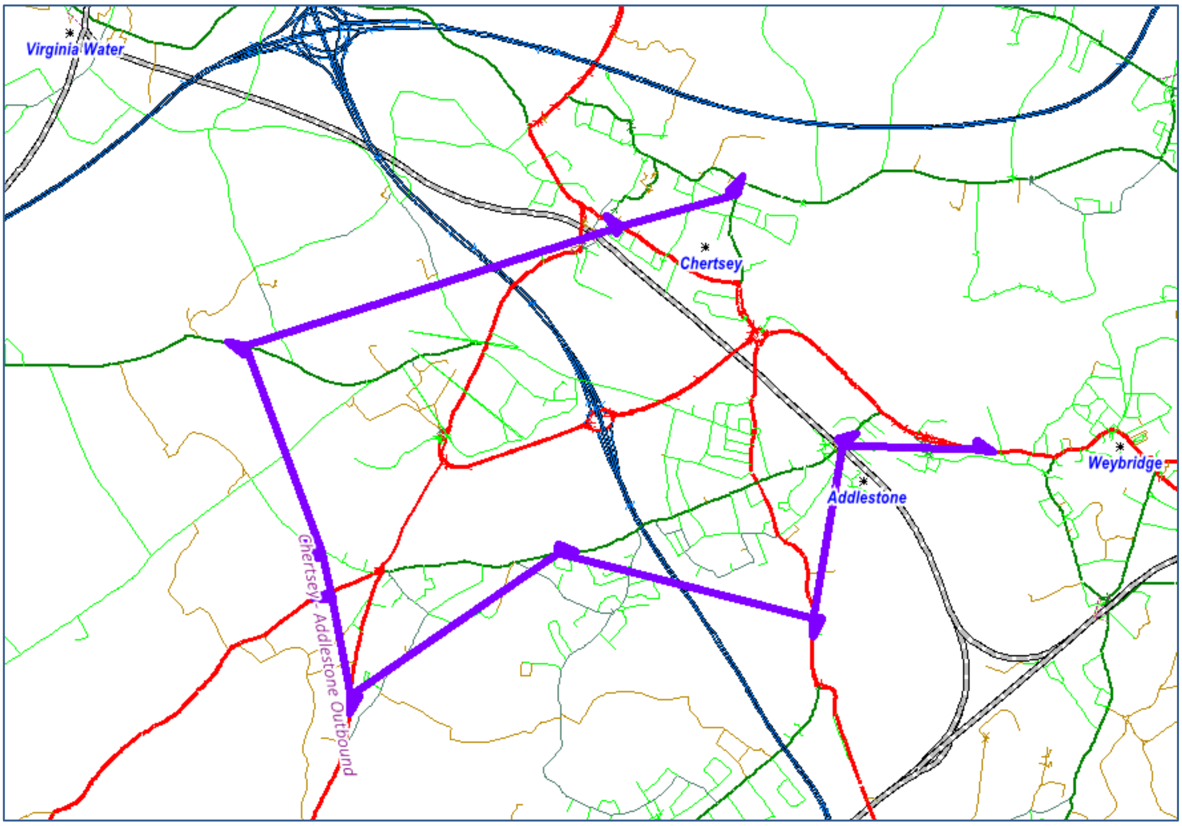
2.11.26 The compact nature of Runnymede coupled with the dense mixture of motorways, A-roads, and minor roads does not provide the basis for natural screenline locations, but for the purposes of reporting, a set of five screenlines were defined for Runnymede comprising: three screenlines forming cordons around localities labelled as: ‘Egham & Virginia Water’, ‘Chertsey & Addlestone’, ‘Walton & Weybridge’, plus an east-west screenline intercepting (broadly) north-south movements at the southern region of Runnymede (north of Woking), together with two motorway screenlines formed respectively by entries and exits of the M3 and M25, and a summary of all movements where count data exists at the intersection of the M3 and M25 near Egham. These screenlines each provide comparisons for two directions (‘inbound’, ‘outbound’, etc.), except for the M3-M25 intersection where the movements are considered as a group. The locations of the screenlines are indicated in Figure 2-11.

Figure 2-11 Runnymede Reporting Screenlines



2.11.27 Figure 2-12 illustrates details of the outbound screenline around the Chertsey and Addlestone areas as an example.

Figure 2-12 Example Locality Screenline for Chertsy & Addlestone



2.11.28 The comparisons for Car, LGV, and HGV vehicle types are shown for the AM and the PM peak hours in Table 2-1and Table 2-2, respectively. The WebTAG target is for screenline flows to be within 5% of counts.

Table 2-1AM Screenline Count-Flow Comparisons

ID	Screenline Name	AM Pk Count Car	AM Pk Flow Car	Car Count - Flow %	AM Pk Count LGV	AM Pk Flow LGV	LGV Count - Flow %	AM Pk Count HGV	AM Pk Flow HGV	HGV Count - Flow %
56	Staines Inbound	5,972	5,830	-2.4	508	501	-1.4	168	132	-21.4
57	Staines Outbound	4,548	4,175	-8.2	459	399	-13.1	160	157	-1.9
58	Egham & V-Water Inbound	6,153	6,107	-0.7	511	567	11.0	173	154	-11.0
60	Chertsey-Addlestone Inbound	4,828	5,241	8.6	451	356	-21.1	113	131	15.9
61	Chertsey - Addlestone Outbound	4,435	3,946	-11.0	418	352	-15.8	105	89	-15.2
64	Southern-Sbound	5,366	5,542	3.3	471	526	11.7	155	143	-7.7
65	Southern-Nbound	4,921	5,166	5.0	538	591	9.9	160	131	-18.1
66	M3-M25 Cordon Inbound	11,828	11,801	-0.2	1824	1929	5.8	1325	1372	3.5
67	M3-M25 Cordon Outbound	8,957	9,176	2.4	1381	1438	4.1	985	986	0.1
68	M3-M25 Intersection	17,677	18,873	6.8	2783	2931	5.3	1924	1722	-10.5
69	Egham & V-Water Outbound	5,381	5,065	-5.9	506	537	6.1	199	136	-31.7
70	Walton & Weybridge Inbound	5,846	6,336	8.4	578	717	24.0	136	148	8.8
71	Walton & Weybridge Outbound	5,891	6,272	6.5	516	569	10.3	139	157	12.9

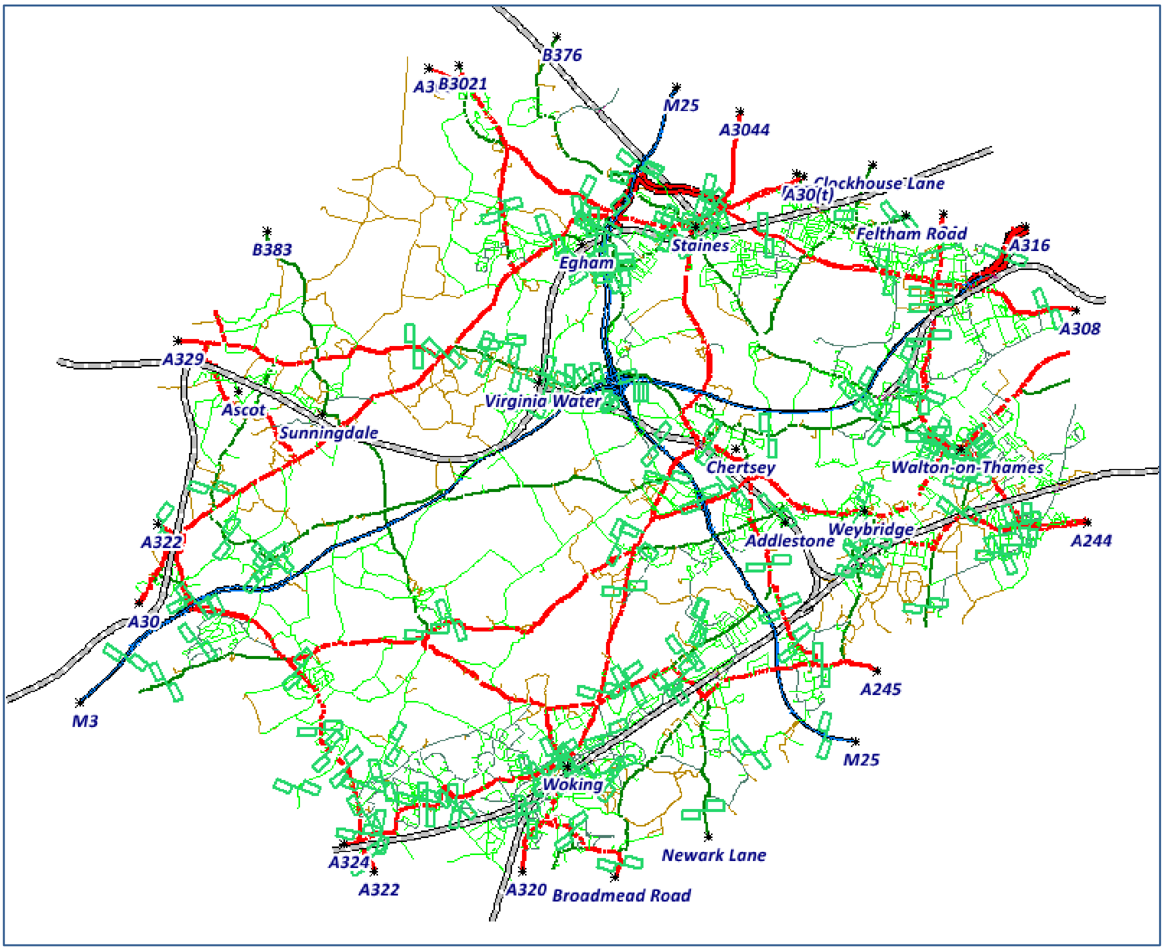
Table 2-2 PM Screenline Count-Flow Comparisons

ID	Screenline Name	PM Pk Count Car	PM Pk Flow Car	Car Count - Flow %	PM Pk Count LGV	PM Pk Flow LGV	LGV Count - Flow %	PM Pk Count HGV	PM Pk Flow HGV	HGV Count - Flow %
56	Staines Inbound	3,768	3,981	5.7	311	332	6.8	74	88	18.9
57	Staines Outbound	5,108	5,285	3.5	427	429	0.5	71	61	-14.1
58	Egham & V-Water Inbound	2,792	3,080	10.3	260	286	10.0	45	40	-11.1
59	Egham & V-Water Outbound	2,517	2,566	1.9	232	217	-6.5	31	33	6.5
60	Chertsey-Addlestone Inbound	5,051	5,095	0.9	600	410	-31.7	55	62	12.7
61	Chertsey - Addlestone Outbound	4,422	5,198	17.5	431	442	2.6	57	87	52.6
62	Walton & Weybridge Inbound	4,329	4,414	2.0	374	381	1.9	32	39	21.9
63	Walton & Weybridge Outbound	3,925	4,211	7.3	370	393	6.2	23	36	56.5
64	Southern-Sbound	5,242	5,339	1.9	616	441	-28.4	103	142	37.9
65	Southern-Nbound	5,048	5,601	11.0	487	387	-20.5	74	104	40.5
66	M3-M25 Cordon Inbound	12,563	12,308	-2.0	2332	1677	-28.1	875	997	13.9
67	M3-M25 Cordon Outbound	10,660	10,961	2.8	2134	1584	-25.8	703	771	9.7
68	M3-M25 Intersection	17,932	18,619	3.8	3394	2431	-28.4	1331	1181	-11.3

2.11.29 The definition of the screenlines seeks to make sense from a geographical perspective, but has to be opportunistic regarding the choice of count sites used. Accordingly, these results are affected by the vagaries of count site data quality as discussed above. In particular, the locality screenlines make use of ‘Partial’ counts, which have very limited statistical quality and, in the PM case, are not available, so limit the numbers of count sites forming the screenline comparison.

2.11.30 **Comparison of Link Counts v Flows:** the locations of the 284 count sites forming the primary basis of comparisons with equivalent modelled traffic flows are shown in Figure 2-13 as green boxes.

Figure 2-13 Count Sites used in Validation



2.11.31 The comparisons between modelled and counted link flows is presented below via tables and pictorially using ‘bandwidth’ presentations (limited here to the AM case; the PM case is similar and is reported in the LMVR).

2.11.32 The bandwidths reflect the amount of traffic on links; where links have count sites then comparisons are made so that, as shown in the legends, blue represents modelled flows, green indicates matching observed and modelled flows. Where orange is visible next to green, this implies more vehicles counted than modelled, and where blue is visible next to green, this implies more modelled than counted vehicles on that link.

2.11.33 The different magnitude of traffic on motorways compared to other roads means that scaling the diagrams can be visually confusing, so the bandwidth presentations are split between ‘motorway’ and ‘non-motorway’ links on this account.

2.11.34 While these bandwidth plots provide a good overview across the network, aspects of them need to be treated with caution: links that are not wholly green are indicative of mismatches between modelled and observed, but the mismatch often arises from data inconsistencies and not necessarily from modelling inadequacies. Nevertheless, they indicate a good level of matching across the network as a whole.

Figure 2-14 All Vehicles v Counts AM Peak – non-Motorways

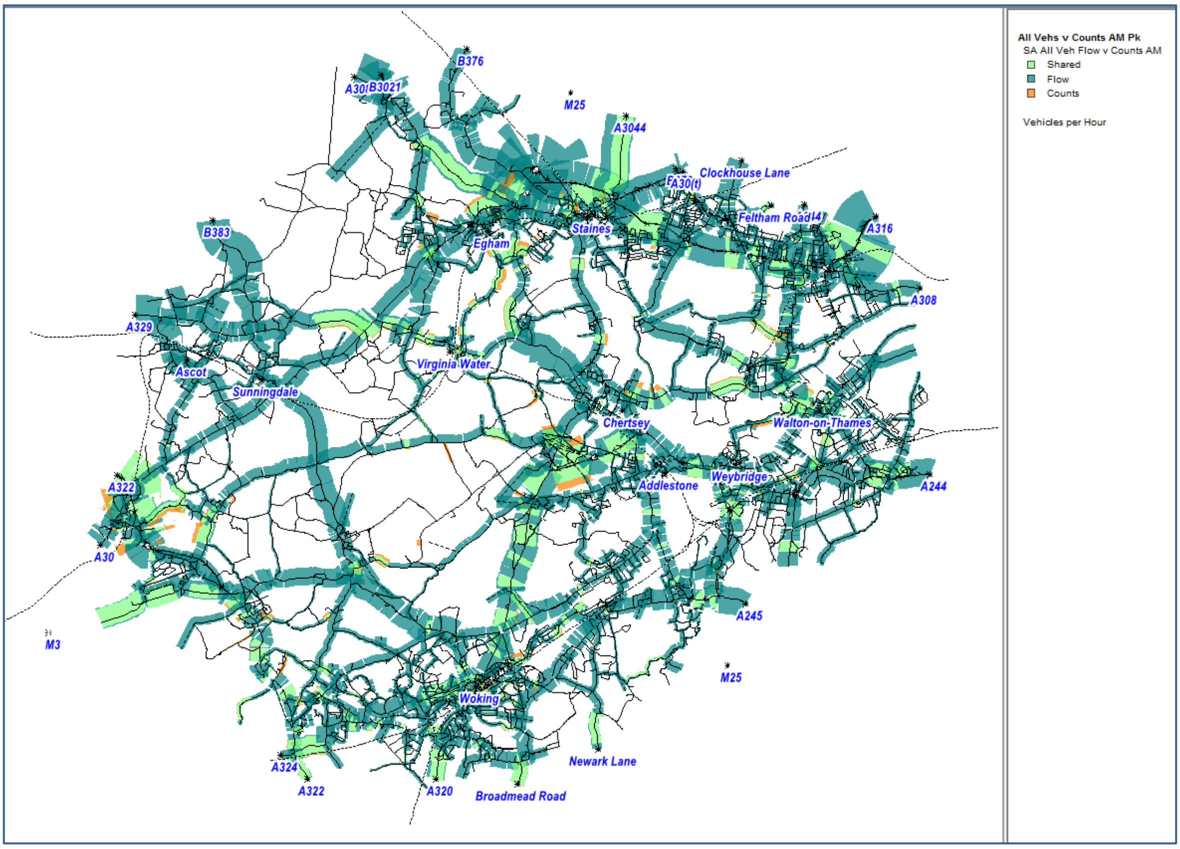


Figure 2-15 All Vehicles v Counts AM Peak - Motorways

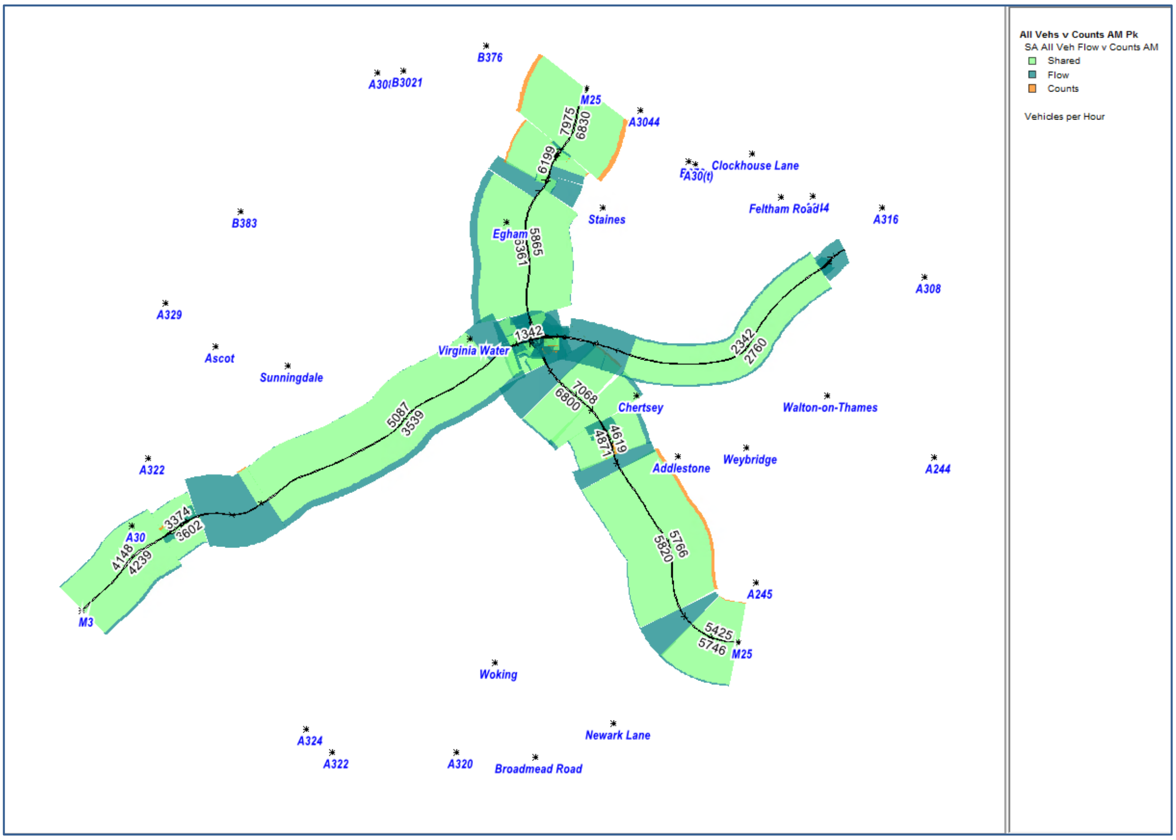
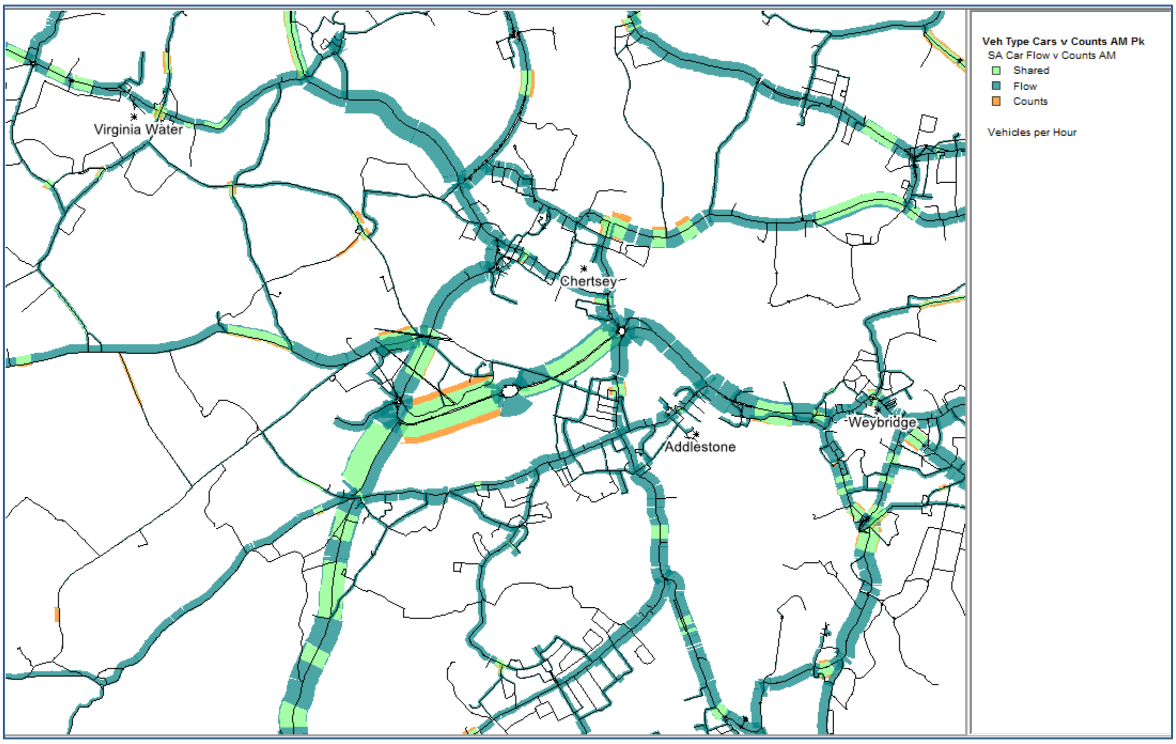


Figure 2-16 Detail of AM Counts v Flows for Chertsey Area



2.11.35 As explained above, the WebTAG criteria represent a standard basis of modelled traffic flow assessments, notably through the GEH statistic, for which the target is that 85% of count sites should have GEH values of 5.5 or less.

2.11.36 Comparisons are also specified for three flow groups separating sets of small and large flows. Targets for two of the comparisons within a range are also set at 85%; the third comparison is to identify the number of outliers.

2.11.37 These sets of comparisons are shown in Table 2-3 and Table 2-4 for the AM and peak hour period, and in Table 2-5 and Table 2-6 for the PM case.

Table 2-3 Summary of AM Peak Modelled Flow v Count Comparisons by Vehicle Type

Time Period	Vehicle Type	No. of Observed Counts	Sum of Observed Counts	Sum of Modelled Flows	Average GEH	Sum of Differences	Total Percentage Difference	GEH < 5.5	GEH < 5.5 Adjusted for Partials
8 - 9am	Car	283	207,567	206,897	3.60	-670	-0.3%	79%	82%
8 - 9am	LGV	282	24,034	25,029	1.91	995	4.1%	94%	-
8 - 9am	HGV	278	11,541	11,347	1.39	-194	-1.7%	97%	-

Table 2-4 AM Car Modelled Flow v Count Comparison by Flow Groups

	Observed below 700vph & Modelled within 100vph	Observed between 700 & 2,700vph & Modelled within 15%	Observed greater than 700vph & Modelled less than 400vph
Number of counts met criteria	151	52	0
% met criteria	*76%*	*74%*	*0%*
Number of counts	*199*	70	0

Table 2-5 Summary of PM Peak Modelled Flow v Count Comparisons by Vehicle Type

Time Period	Vehicle Type	No. of Observed Counts	Sum of Observed Counts	Sum of Modelled Flows	Average GEH	Sum of Differences	Total Percentage Difference	GEH < 5.5	GEH < 5.5 Adjusted for Partials
5 - 6pm	Car	263	200,097	204,227	3.60	4130	2.1%	77%	78%
5 - 6pm	LGV	263	21,142	20,551	1.26	-591	-2.8%	98%	-
5 - 6pm	HGV	236	7,019	7,464	1.12	445	6.3%	98%	-

Table 2-6 PM Car Flow v Count Comparison by Flow Groups

	Observed below 700vph & Modelled within 100vph	Observed between 700 & 2,700vph & Modelled within 15%	Observed greater than 700vph & Modelled less than 400vph
Number of counts met criteria	130	51	0
% met criteria	*71%*	*78%*	*0%*
Number of counts	*184*	65	0

2.11.38 From Table 2-1 and Table 2-3 it may be seen that the correspondence for Cars appears slightly better for the AM than the PM. Both have an average GEH value of 3.6; 79% of counts are associated with a GEH of less than 5.5 in the AM, and 77% in the PM.

2.11.39 The LGV comparisons are better in the AM than the PM, while for HGVs the reverse applies. In both cases, the GEH < 5.5 percentages are well into the 90s.

2.11.40 Attention therefore turns to the Car GEH values. As shown, these may readily be improved to 82% and 78% respectively by discounting comparisons with 'Partial' counts. These counts have no real statistical value, but are retained because they provide some, though not necessarily accurate, information in parts of the network otherwise lacking counts. (The location of counts being often due to happenstance of local developments and issues.)

2.11.41 This still leaves a gap from the target, but the following points are relevant, which largely arise from the very high density of counts.

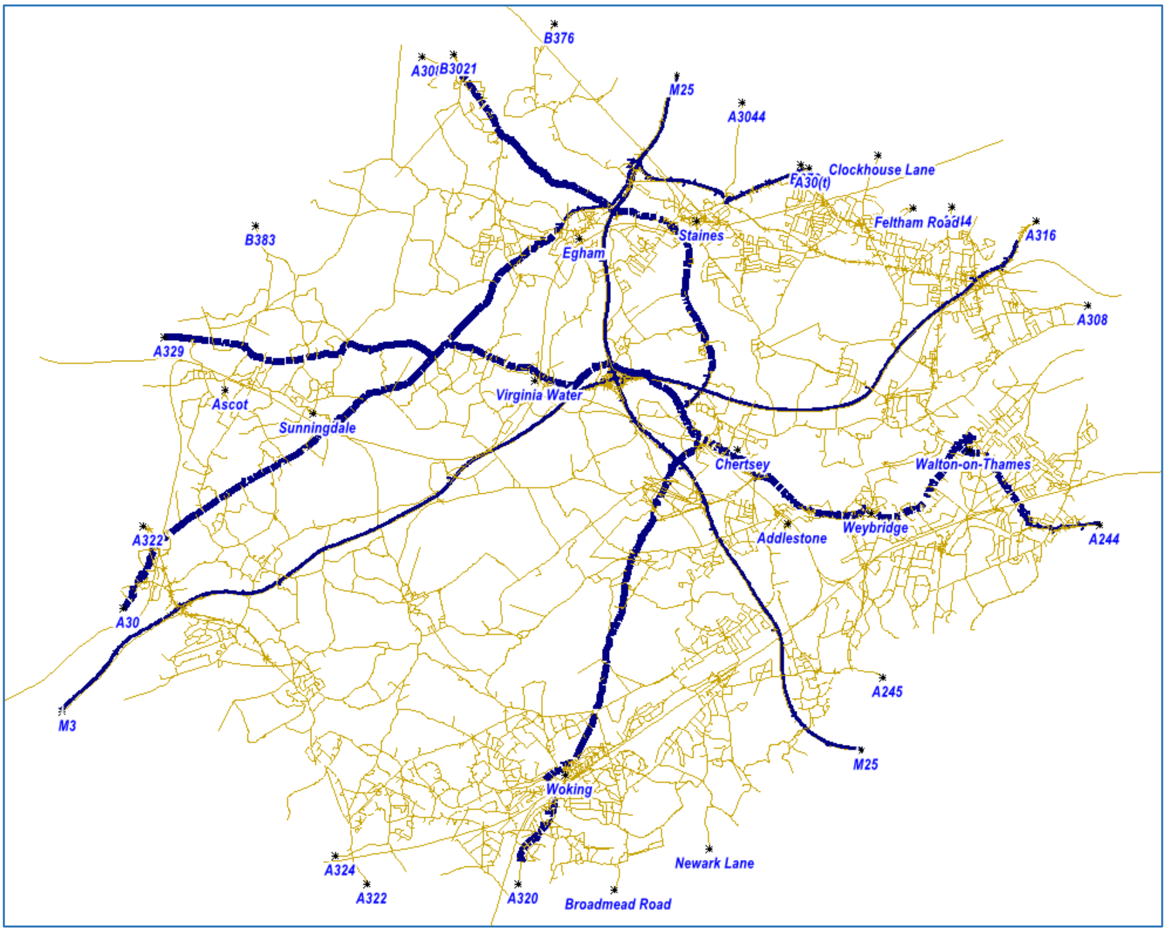
2.11.42 For the AM, for example, there are 100 counts with a GEH value of less than 1.83, which is a very low value, and 224 counts which have a GEH value less than 5.5. This is a very high number of close matches for a small geographical are, but there remains the question of the less good matches. The explanations for these are explained further in the LMVR, but are almost entirely attributable to inconsistent count data values.

2.11.43 **Journey Time Comparisons:** Five Journey Time (JT) Routes have been defined for the purposes of assessing the modelled journey times. This implies 10 one-way JT routes x 2 time-periods, which equals 20 result-sets.

2.11.44 The JT Routes are named as 'A30', 'A320', 'A329', 'M3', and 'M25'. The names for the M3 and M25 motorway routes match those roads, but the 'A' road names should be understood to include other roads along their length. The JT Routes have been defined to include a representative set of roads and traffic conditions across Runnymede.

2.11.45 There are two directional versions of each route, which are labelled 'Eastbound (EB)', 'Westbound (WB)', and similar. These are merely convenient labels, as the curving of the routes and roads can mean that actual route link directions change from their nominal labelling. The full set of JT Routes is shown in Figure 2-17. The JT Routes are of the order of 20km in length, but observed journey times vary between approximately 15 minutes and one hour.

Figure 2-17 Locations of Journey Time Routes



2.11.46 A summary of the Journey Time comparisons is shown Table 2-7 and Table 2-8 for the AM and PM peak hours respectively. While these tables focus on the overall journey times per route, more meaningful insights are provided by the graphical comparisons for the individual routes, as shown in Figure 2-18.

2.11.47 The WebTAG target (as defined in Unit M3, Table 3) is for journey times to be within 15% of observations for 85% of routes.

Table 2-7 AM Peak Hour Journey Time Comparisons

Journey Time Route	Distance (km)	Observed JT (mins)	Modelled JT (mins)	Modelled Difference (mins)	Modelled Difference %
A30 Northbound	20.3	37.7	33.7	-4.1	-11%
A30 Southbound	20.3	32.4	31.1	-1.3	-4%
A320 Northbound	23.5	46.6	43.9	-2.7	-6%
A320 Southbound	24.0	47.8	44.5	-3.2	-7%
A329 Eastbound	26.4	64.3	63.3	-1.0	-2%
A329 Westbound	25.2	60.4	54.9	-5.6	-9%
M3Eastbound	25.8	19.7	20.5	0.8	4%
M3 Westbound	23.4	16.0	16.6	0.6	4%

Journey Time Route	Distance (km)	Observed JT (mins)	Modelled JT (mins)	Modelled Difference (mins)	Modelled Difference %
M25 Eastbound	17.9	20.1	20.1	0.1	0%
M25 Westbound	18.0	15.5	17.3	1.8	12%

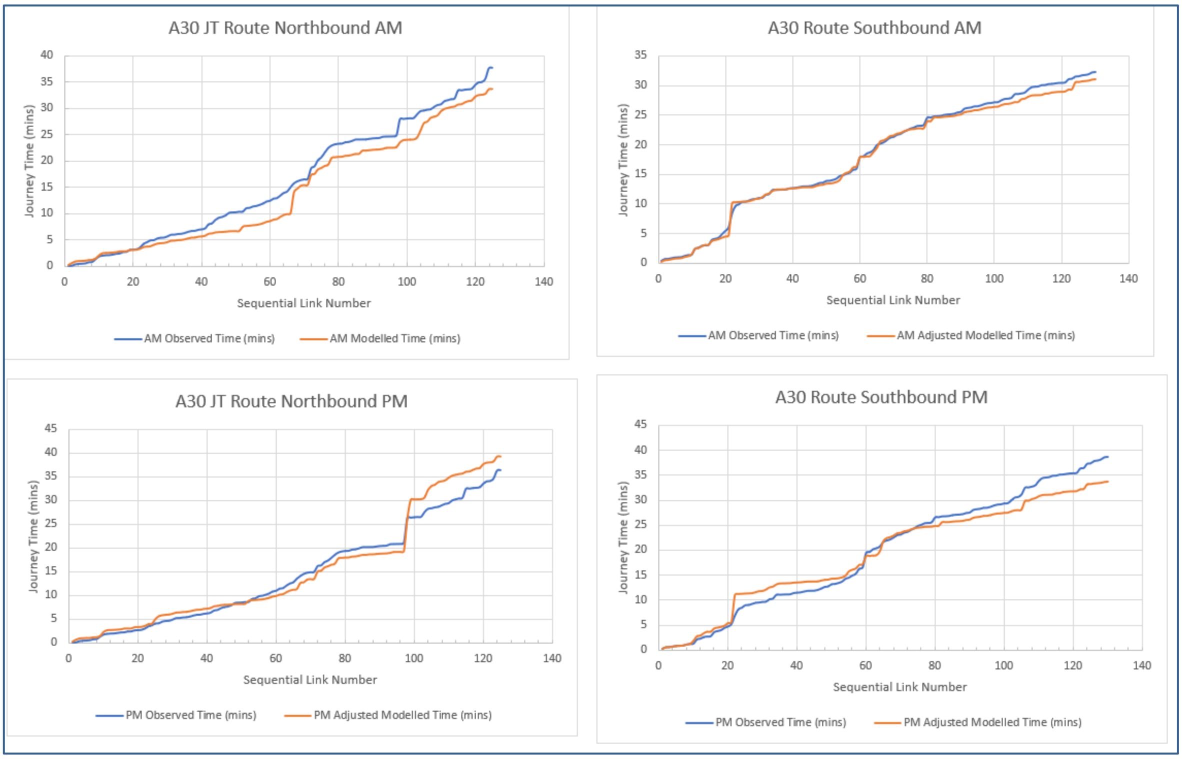
Table 2-8 PM Peak Hour Journey Time Comparisons

Journey Time Route	Distance (km)	Observed JT (mins)	Modelled JT (mins)	Modelled Difference (mins)	Modelled Difference %
A30 Northbound	20.3	36.4	39.3	2.9	8%
A30 Southbound	20.3	38.7	33.6	-5.0	-13%
A320 Northbound	23.5	51.5	38.1	-13.4	-26%
A320 Southbound	24.0	48.5	45.8	-2.7	-6%
A329 Eastbound	26.4	53.4	56.0	2.6	5%
A329 Westbound	25.2	56.1	51.7	-4.5	-8%
M3Eastbound	25.8	17.5	17.7	0.1	1%
M3 Westbound	23.4	22.2	23.5	1.4	6%
M25 Eastbound	17.9	24.1	24.9	0.9	4%
M25 Westbound	18.0	28.0	29.3	1.3	5%

2.11.48 Full information is provided in the LMVR, but Figure 2-18 shows cumulative journey times for an example JT Route. The plot is organised according to: AM (top row) and PM (bottom row) for different JT route directions (left and right columns, respectively).

2.11.49 As shown in the legends, blue is observed and orange is modelled times. Journey times are shown on the vertical axis, in minutes. The x-axis represents JT link numbering, not distance, so the gradients of the plots do not correspond to speeds, though they are indicative of where speed changes (delays) occur.

Figure 2-18 A30 Route Journey Times Comparison Plots



2.12 Validation Summary

2.12.1 A summary of the validation is as follows:

- Link Flow Comparisons
  - There are a large number of links with close matches between modelled and observed data for both AM and PM.
  - Discrepancies are usually clearly attributable to count data inconsistency issues.
  - There is no geographical bias in car counts versus flows.
  - LGV and HGV flows generally match well to counts.
- Journey Time comparisons
  - Model and observed journey time are good overall for both the AM and PM.
  - Limited adjustments have been made, primarily to reflect impacts of traffic queues at selected locations.
- WebTAG Metrics
  - The model generally, falls short of WebTAG flow-related targets. The high density of count sites and variability of count data provide both extenuating explanations for the shortfall, and expose the methodological limitations of the metrics in handling data variability.
  - The flow targets include screenline flow comparisons. These metrics are aimed at assessing trip matrices, but their relevance for this is limited where matrices are not reliant on data from roadside interview (RSI) screenline sites, and the comparison is also affected by data variability issues.
  - The results meet the WebTAG Journey Time targets. The A320 Northbound PM case represents an exception, but this is due to issues

that occur at the end of the route but which are not present in the AM case.

2.12.2 To conclude, the model validates well across geography, road types, vehicle types, and time periods.

2.12.3 The assessment, with respect to observed flows, is less assured due to the variability of the large count dataset, as well as limitations in the standard count comparison metrics. A broad view across the study area, though, does not indicate any systematic problems.

2.12.4 The Journey Time comparisons provide more assurance on account of the statistical strength of the observed data, and to which the model's results match well.

3 MODEL FORECASTING

3.1 Forecast Year

3.1.1 The model forecast year is 2036.

3.2 Forecast Scenarios

3.2.1 The Runnymede Borough Council brief for the modelling identified the following scenarios for testing as part of the SHAR:

3.2.2 **Scenario 1: Do Minimum**. This scenario includes committed developments identified from the base year (since 2014) to the forecast year 2036, where committed developments comprise sites already built, or are in the process of construction, or have planning permission.

3.2.3 The brief notes that whilst the study area is the extent of Runnymede Borough, the SHAR must factor in proposed growth in neighbouring authority areas, specifically the proposed developments at Martyrs Lane, Woking and Fairoaks Airport in Surrey Heath.

3.2.4 **Scenario 2: Local Plan Growth**. This scenario is a continuation of Scenario 1 plus the preferred options for development as contained in the emerging Runnymede 2035 Local Plan.

3.2.5 Scenario 2 includes particular consideration to the DERA Longcross South site and how the southern and northern parts of the development are linked.

3.2.6 NOTE: In this section of the report the 'Do Minimum' scenario corresponds to a 'Do Nothing' scenario as far as the Local Plan is concerned. However, there are changes arising in the highway network, as specified in Section 3.9.1. The Do Minimum also reflects background changes in travel demand as discussed in Section 1.1. The Do Minimum serves as a baseline to compare changes attributable to the Local Plan in Scenarios 1 and 2 respectively.

3.3 Development Sites and Pro-Forma

3.3.1 Information regarding the composition of both commercial and residential development sites to be considered in this appraisal was provided by Runnymede Borough Council in the form of the county council's pro-forma. The pro-forma was finalised by Runnymede BC on 21/06/2017.

3.3.2 Each development site listed in the pro-forma was matched to the model zone system using the grid references provided and Geographic Information System (GIS).

3.3.3 Figure 3-1 geographically presents the commercial development sites that have been set out in the pro-forma. Figure 3-2 shows the same but for residential sites.

Figure 3-1 Commercial development sites in Runnymede

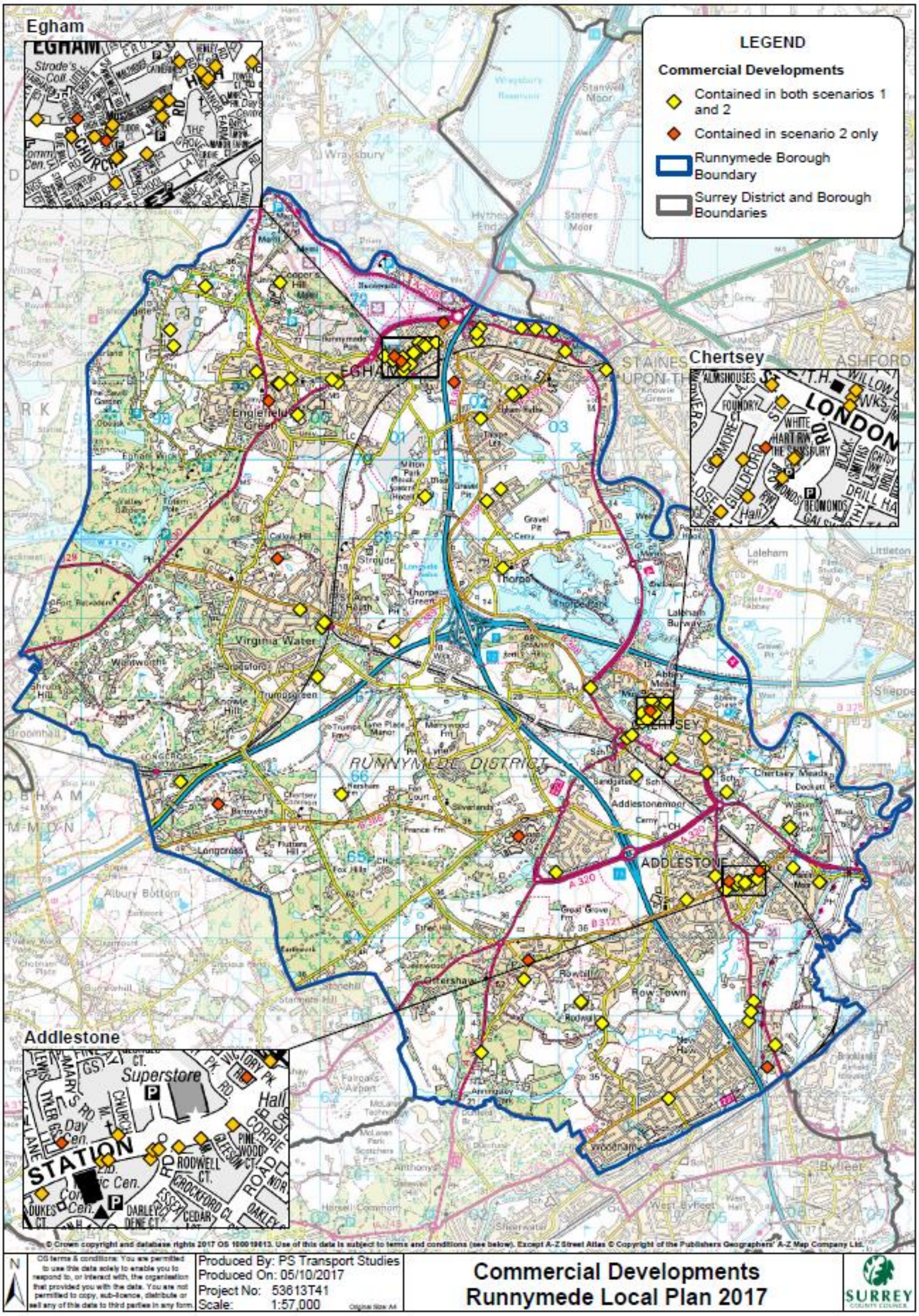
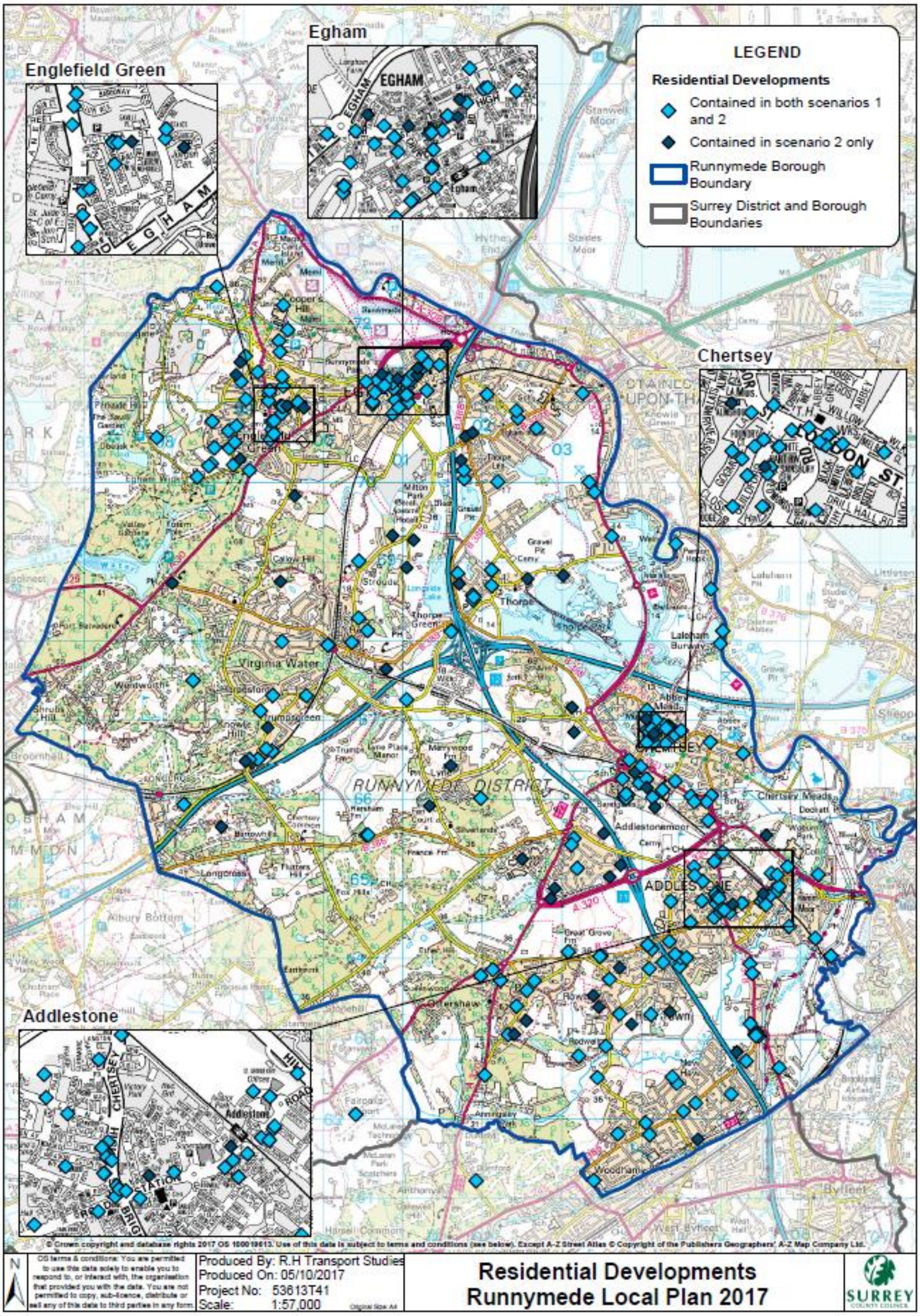


Figure 3-2 Residential development sites in Runnymede



3.4 Changes in Land Use Forecasts

3.4.1 There are three factors influencing the demand for car travel during the peak hours being modelled which are:

1) General demographic and economic trends, as per NTEM
2) Local Plan developments in housing and employment
3) Balancing to avoid double-counting between the first two factors.

3.4.2 The effect of these factors is shown in Table 3-1 for resident and job numbers for each of the three scenarios, and for the two areas of within the Runnymede SHAR cordon (i.e. the Local Model internal zones) and for the SINTRAM72 Inner Study Area (ISA).

Table 3-1 Resident and Job Numbers by Scenario and Area

	DM: residents	S1: residents	S2: residents
RM SHAR	417,442	421,442	421,435
ISA	3,240,615	3,240,602	3,240,595

	DM: jobs	S1: jobs	S2: jobs
RM SHAR	209,913	209,450	209,381
ISA	1,403,917	1,403,454	1,403,385

3.4.3 It may be seen that balancing means that the values for residents and jobs do not change materially between scenarios at the level of the ISA, but there are some differences within Runnymede. These effects are illustrated in Figure 3-3, Figure 3-4, and Figure 3-5.

3.5 Vehicle Trip Generation

3.5.1 As described above in Section 2.11.20, Local Model trip ends (zonal trip productions and attractions) are initially derived from SINTRAM72 modelling which uses local population and employment data at a detailed level for, in the case of forecasting, for the future year of 2036.

3.5.2 An extract of the Planning Spreadsheet which contains the local land use data used in the (Scenario 1) forecasting, and which is derived from the Pro-Forma information supplied by Runnymede BC, is shown in Figure 3-3. The zones highlighted in red correspond to 'Greenfield[5]' sites, typically containing major developments.

[5] This includes brownfield sites.

Figure 3-3 Extract of Scenario Land Use Data for Scenario 1

		PROPOSED							DIFFERENCE			
SINTRAM Zone	Zone Name	Population	Dwellings	Jobs - A land use	Jobs - B land use	Jobs - C land use	Jobs - D land use	Jobs - Other land use	Population	Dwellings	Jobs - A land use	Jobs - B land use
645	Gogmore Park Car Park	152	85	73	216	24	8	6	144	81	27	-352
646	Ongar Place Primary School	679	279	0	23	68	0	0	667	275	0	23
647	Holy Family Catholic Primary School A	67	25	0	0	0	0	0	56	21	0	0
648	The Magna Carta School	9	6	0	0	0	0	0	6	5	0	0
649	Pooley Green Road Egham	54	32	0	468	0	0	0	40	27	0	468
650	Pooley Green Car Park	6	3	12	3501	0	0	3	2	2	1	3144
651	Egham Library Car Park	119	76	4	237	0	0	0	112	73	0	-261
653	Royal Holloway University of London	55	28	9	0	1750	1	0	38	20	-6	-40
654	Coopers Hill Car Park	70	33	0	0	10	0	0	40	22	0	-44
655	Bishopsgate School	50	20	0	0	144	16	0	26	11	-8	-89
656	St Judes Road Car Park	272	121	0	0	40	0	0	264	118	0	0
657	Murray Road Car Park	34	15	0	0	55	5	0	29	13	-3	-245
658	Fullbrook School	37	13	0	0	5	0	0	32	11	0	-6
659	New Haw Community Junior School	24	11	0	0	0	0	3	21	10	-3	0
660	New Haw Lock Car Park	38	23	29	7	0	0	0	32	19	18	-36
661	Chertsey Lane Staines-Upon-Thames	6	3	0	0	0	0	0	6	3	0	-14
662	Egham Leisure Centre	4	2	0	248	8	0	0	1	1	0	87
663	Memorial Gardens Car Park	46	24	22	27	0	0	0	43	23	3	-57
664	Harpesford Avenue Virginia Water	37	13	0	0	8	0	0	27	10	-18	0
665	Woodham Park Way Woodham	11	4	0	0	0	0	0	6	2	0	0
667	Thorpe Green Car Park	60	25	0	837	10	0	0	54	23	0	106
669	Chertsey Station Car Park	0	0	3	0	0	0	0	0	0	3	-8
672	Hummer Road Car Park	43	24	174	42	27	58	3	31	19	145	-135
673	Longcross Railway Station	480	200	1315	1315	0	1315	1315	480	200	1315	915
674	Bourne Car Park	0	0	0	0	23	0	0	0	0	0	0
675	ACS Egham International School	17	6	0	0	0	0	0	-6	-2	0	0
676	St Anns Heath Junior School	31	12	0	18	0	0	0	22	9	0	1
677	Land at Dashwood Lang Road, Bourne Business Park	0	0	11	912	0	0	0	0	0	11	912
678	LAND AT Hanworth Lane	262	130	0	0	0	0	0	262	130	0	0
679	Former Brunel University	229	104	0	0	100	0	0	213	98	0	0
1068	Martyr's Lane	6600	3000	0	0	0	0	0	6600	3000	0	0
811	Fairoaks	4800	2000	0	0	0	0	0	4800	2000	0	0

3.5.3 Trip productions are calculated from daily trip rates for different trip purposes from the DfT's National Trip End Model (NTEM) CTripEnd v6.2 system. Trip attractions for different purposes are allocated to zones on the basis of different types of employment levels per zone. These are grouped in Figure 3-3 as the five types identified as 'Jobs A, B … Other'.

3.5.4 Further details are provided in the SINTRAM72 documentation *Technical Note TN1 Processing Trip Ends*, which also describes the allocation of trips into 'car available' and 'non-car available' categories.

3.5.5 CTripEnd is based on a coarser zoning system than represented by the 1615 zones used in SINTRAM72. However, it allows the introduction of finer zones, as is done for SINTRAM72 in general but, importantly here, also for Runnymede. So, as described earlier for validation modelling, the Local Model has 315 zones that allow land use developments to be associated with quite detailed spatial areas in the modelling.

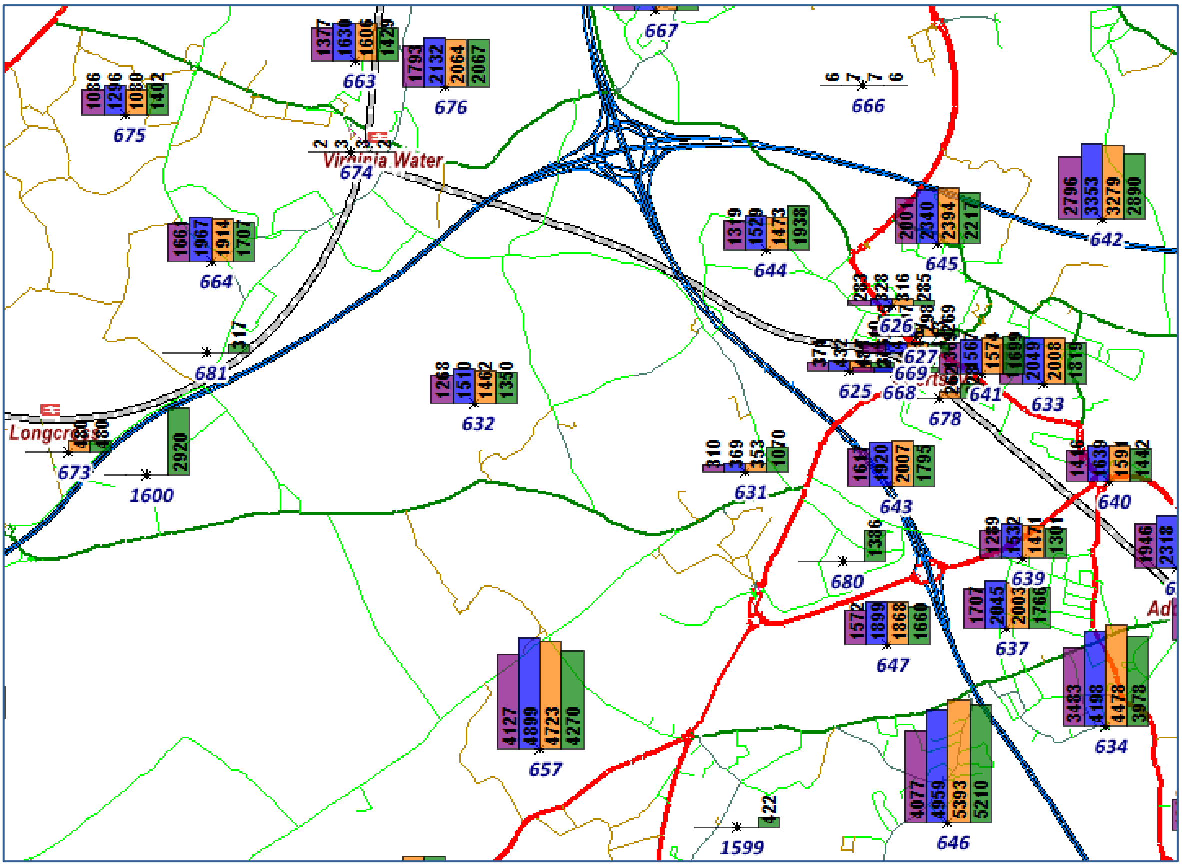
3.5.6 CTripEnd provides general, background trip-end forecasts, which form the basis of the Do Minimum scenario forecasts. For the scenarios relating to specific Local Plan developments, the general CTripEnd forecast are substituted or modified by specific development site forecasts for the zones to which they apply.

3.5.7 However, there is a standard DfT requirement that local authority land-use forecasts should not, in aggregate, exceed levels implied by national expectations of demographic and economic growth. This means that the Runnymede Local Plan developments should not cause Surrey forecasts to be excessive, and so compensating reductions (to remove 'double-counting') are required. Noting that each Borough or District in Surrey is involved with Local Plans, the balancing of numbers is implemented on a district-by-district basis. The practical impact of this is that non-Greenfield zones in Runnymede are subject to 'balancing reductions'.

3.5.8 The compensation is achieved by (rather complex) mathematical proportioning, but may be understood as providing limits on migration of residents and workers to match planned large increases in home and jobs.

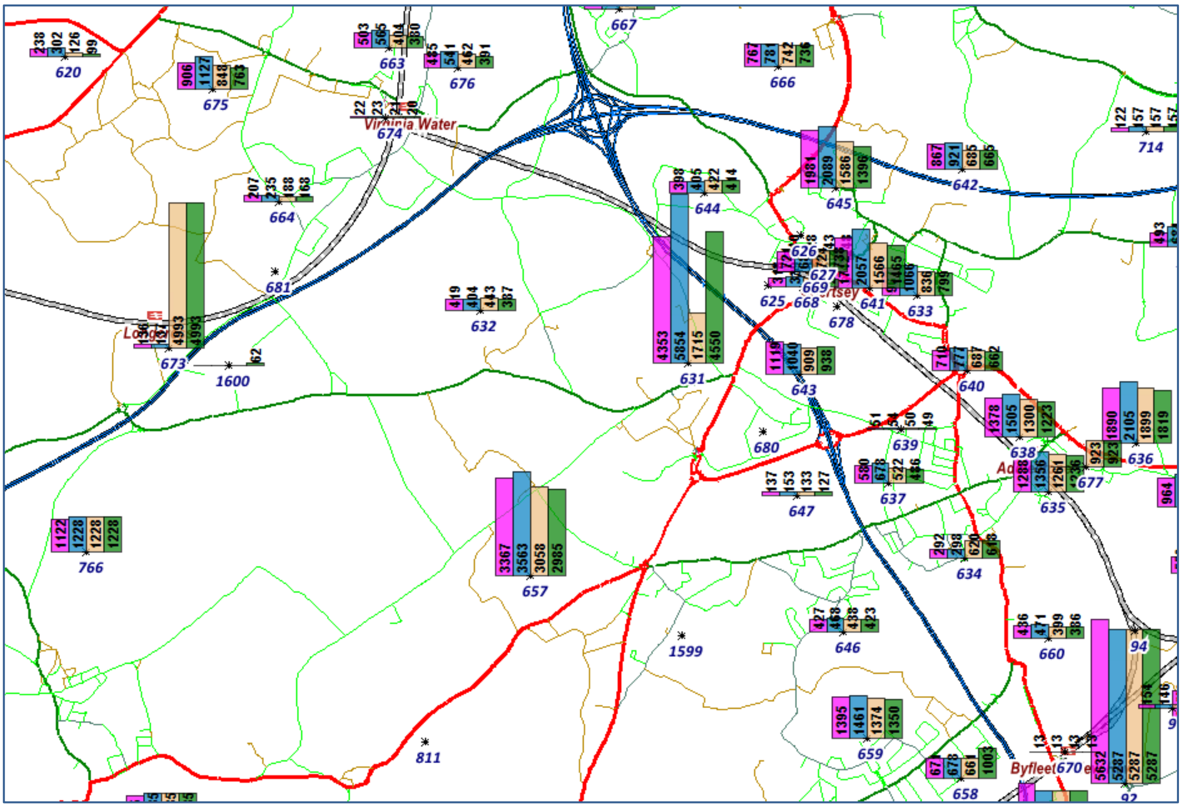
3.5.9 The effect of this is illustrated in Figure 3-4 which shows a small area of Runnymede with corresponding numbers of residents for (SINTRAM72) zones. The histograms for each numbered zone report, reading from the left, resident numbers respectively for cases of 2014 Base, Do Minimum (DM), Scenario 1, and Scenario 2. It may be seen that some zones have higher numbers of residents in the DM case than for Scenarios 1 and 2.

Figure 3-4 Sample of Changes in Resident Numbers: 2014 v DM v S1 v S2



3.5.10 A similar pattern applies to numbers of jobs per zone, which are illustrated on the same basis in Figure 3-5.

Figure 3-5 Sample of Changes in Job Numbers: 2014 v DM v S1 v S2



3.6 Vehicle Trip Distribution

3.6.1 The trip ends are used in the SINTRAM72 modelling to construct 'latent' (or 'unconstrained') demand PA trip matrices and their zonal trip ends. This corresponds to the demand for travel implied by economic and land use data applying to the forecast scenario, but not taking into account congestion on the transport networks that can inhibit demand. Calculating the effects of congestion on demand relative to the latent demand represents the 'variable demand' element. This involves a number of 'demand-supply' iterations in the modelling process.

3.6.2 The PA (production-attraction) matrices in the demand modelling reflect all-day home-based (HB) 'tours', that is, implying outbound from the home and inbound returning to the home, plus non-home based (NHB) trips. These PA matrices are converted to OD (origin-destination) trip matrices for three time-periods representing the AM peak, inter-peak, and PM peak (q.v. Section 2.5). These are used for highway assignment modelling in SINTRAM72, but also provide the forecast 'prior' car matrices for the Local Model.

3.6.3 Once the latent demand matrices have been established, as outlined above, the SINTRAM72 takes account congestion through 'variable demand modelling' (VDM). This follows the form of modelling recommended in WebTAG (Unit M2 Variable Demand Modelling), and details of the SINTRAM72 implementation are provided in the SINTRAM72 Technical Note *TN5 Model Technical Report*.

3.6.4 A central component of this is provided by '(hierarchical incremental) choice modelling', which models traveller choices for travel.

3.6.5 The choice modelling is driven by the costs of different options. In the modelling, these are expressed as generalised time (minutes) where financial costs (e.g. fares, fuel, and parking costs) are converted to time units using values of time applicable to the relevant demand segmentation, as provided in the WebTAG Data Book.

3.6.6 The sensitivity of choices to cost differences is modelled using initial values taken from WebTAG Data Book parameters. These are adjusted as part of the SINTRAM72 forecasting validation process, in particular, through the WebTAG 'Realism' sensitivity tests.

3.6.7 The choice modelling is confined to destination and mode choices. Mode choice includes Park & Ride as a choice for car users. Home-based work (commuting) and education trips are 'doubly-constrained' to match employment and education zonal trip attractions.

3.6.8 The sensitivity of travel choices to changes in costs is limited to trips with one or both ends in the SINTRAM72 Inner Study Area. Mode, time period, and destination characteristics of other ('external-to-external') trips are based on growth factoring ('Furnessing') Base year/reference trips to trip ends derived from CTripEnd.

3.6.9 Once the trip matrices have been forecast via VDM modelling, they are converted to car matrices for the Local Model. These are then subject to further processing within the Local Model to reflect the changes between the prior and estimated matrices arising in the Base year validation modelling.

3.6.10 The means of achieving this is by calculating a set of production and attraction adjustment factors for each zone that reflects the changes between the Base matrices and the equivalent estimated matrices. These adjustment factors are then applied to the future year matrices using a Furness factoring process.

3.7 <u>Goods Vehicles</u>

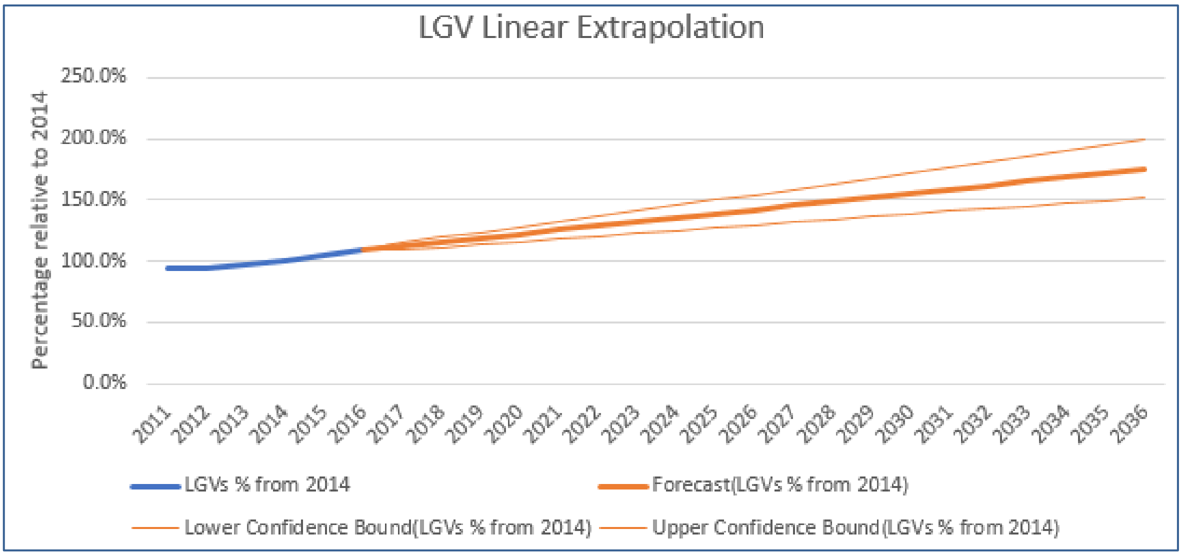
3.7.1 Goods vehicle trip matrices are forecast using growth factors by time period for LGVs and HGVs.

3.7.2 Historically such growth factors have been associated with forecasts of GDP growth, but in more recent years the link with goods vehicle numbers and GDP has been seen not to apply. The growth factors are therefore determined from recent trends, as now discussed.

3.7.3 Information on changes in LGV numbers is available from DfT[6], which is illustrated in Figure 3-6. This shows percentage changes in LGV numbers from the SINTRAM72 Base year of 2014. Observed data (2011 to 2016) is shown in blue.

[6] Table VEH0407 (Vehicle Licensing Statistics (https://www.gov.uk/government/collections/vehicles-statistics))

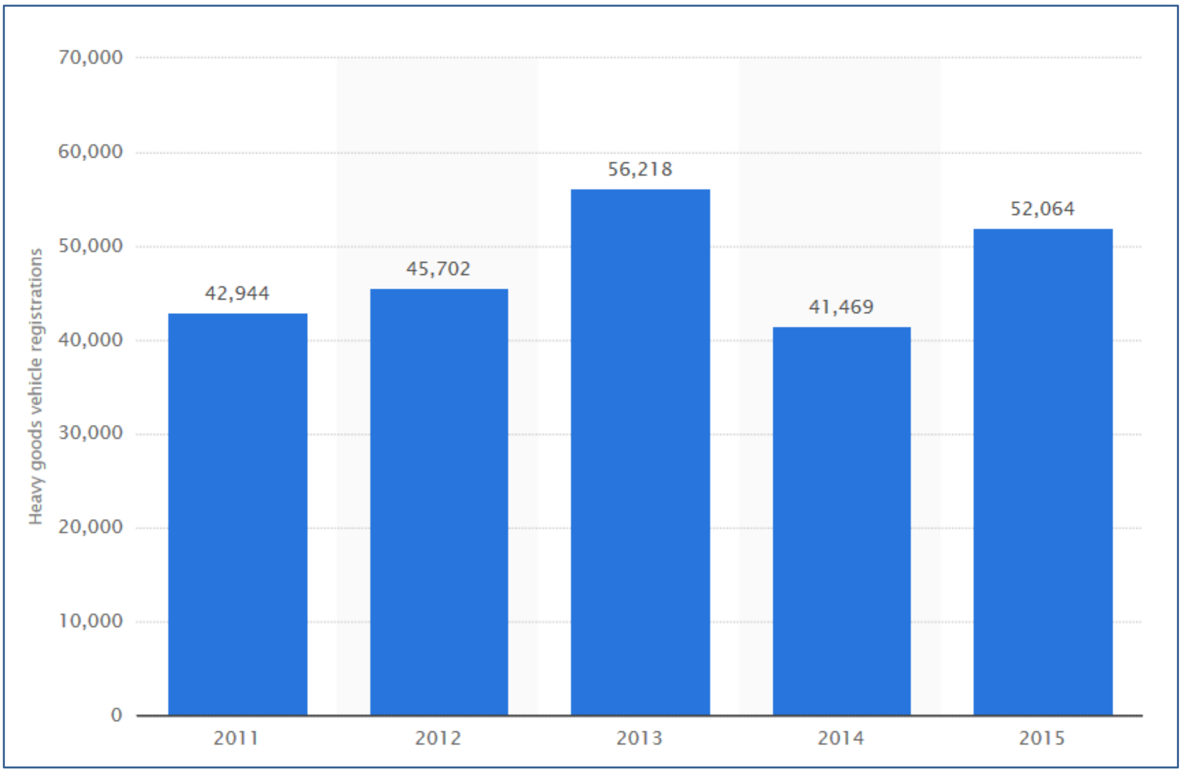
Figure 3-6 Forecast Changes in LGV Numbers



3.7.4 The orange line represents a linear extrapolation forecasting to 2036. While LGV growth may reasonably be expected to be strong, given recent changes, including the effects of deliveries associated with internet-based shopping, the linear trend is considered likely to be too strong, so just half the increase associated with the Lower Confidence Bound line is assumed in the modelling. Most goods vehicle trips occur in the inter-peak period, with congestion limiting incentives and scope for growth in the peak hours.

3.7.5 Information on HGV changes is not similarly available from DfT sources, but Figure 3-7 shows a less definite pattern of changes in in HGV registrations for the period 2011 to 2015. This information has been interpreted to imply only a small increase in HGV numbers in 2036, especially in the peak hours that HGV vehicles seek to avoid.

Figure 3-7 Changes in HGV Registrations 2011 to 2015



3.8 Changes in Forecast Demand

3.8.1 The modelling process, as described in Sections 1.1 and 3.6, converts the land use forecasts into travel demand forecast. There are four main steps in this process:

1) Calculate latent demand in SINTRAM72 – just taking account of land use changes
2) Take account of highway congestion on demand for car travel in SINTRAM72 – VDM modelling
3) Convert forecast vehicle OD matrices to Local Model OD vehicle matrices
4) Apply Base-year Local Model re-validation adjustments to Local Model OD forecasts.

3.8.2 The changes mean that there is more than one set of forecasts. Clearly, it is the results of the last step that are most pertinent, but it can be informative to understand the results of the earlier steps when seeking to interpret the results. On this account, the Appendix includes results from SINTRAM72 modelling.

3.8.3 NOTE: Care is required with regard to the units applying in the tables relating to demand, especially when comparing between tables. The tables are labelled, but values can vary according to PA (outbound elements of tours) or OD trips, average hourly and peak hours, summed over 24-hours or over AM, IP, and PM average hourly flows.

3.8.4 Table 3-2 shows average growth rates by trip purpose from 2014 for the 2036 Do Minimum scenario, but balancing means that these are very similar for Scenarios 1 and 2. It may be noted that work and education trips, which predominate in the peak hours, especially the AM peak, have lower growth rates than other purposes.

Table 3-2 Average Growth Rates 2014 to 2036

Average of Mean Production Growth	Column Labels
	DM Study Area Growth
Row Labels	Overview
home_education	1.07
home_empbusiness	1.08
home_other	1.17
home_shop	1.17
home_visit	1.14
home_work	1.06
NHBEB	1.11
NHBO	1.14
Grand Total	**1.1175**

3.8.5 Table 3-3 shows the Latent Demand increases associated with major development sites for Scenarios 1 and 2. The applicable SINTRAM72 zone numbers are shown in the first column. The Car User trips provide the basis for the Car (vehicle) trips in the Local Modelling, but with changes for congestion and local re-validation effects.

Table 3-3 Major S1 S2 Greenfield Increases - AM + IP + PM Trips

PA		Production					
Sum of Future Trips		Column Labels					
		S1 Greenfield Change			S2 Greenfield Change		
Row Labels	Zone Name	Active	Car_User	Public Transport	Active	Car_User	Public Transport
673	Longcross Railway Station	524	1847	103	521	1856	104
677	Land at Dashwood Lang Road, Bourne Business Park	24	152		24	153	
680	Chertsey Bittams A, B, C, D, E				75	243	27
811	Fairoaks	294	1148	49	294	1148	49
1068	Martyr's Lane	423	1583	70	423	1582	70
1600	Longcross South				197	699	
634	Crockford Open Space Car Park	503	551		501	551	
679	Former Brunel University	71	84		70	83	
631	St Peters Hospital					153	
678	LAND AT Hanworth Lane					57	
681	Virginia Water South					21	
1599	Ottershaw East					25	
Grand Total		1839	5365	222	2105	6571	250

3.8.6 Further details of non-incremental Latent Demand increases are provided in Table 6-3 and Table 6-4 in the Appendix.

3.8.7 The matrices totals applying in the Local Model forecasts are, as explained in Chapter 3, modified from Latent Demand values on account of highway congestion and Local Model validation changes. The resulting Local Model totals are shown in Table 6-6 of the Appendix, but a summary of the growth is shown here in Table 3-4. The comparison is made relative to the 2036 Do Minimum for the 2014 Base (reference), and 2036 Scenarios 1 and 2.

3.8.8 It may be noted that Scenarios 1 and 2 only vary from the Do Minimum by about 2% in the peak hours for Cars, and with little change for goods vehicles.

Table 3-4 Matrix Growth Relative to 2036 Do Minimum

Average of Relative to DM	Column Labels			
Row Labels	2014_Ref	2036_DM	2036_S1	2036_S2
All_Purposes, Car, AM_Peak_Hour_8_9, All_Users	0.89	1.00	1.02	1.02
All_Purposes, Car, IP_Av_Hourly, All_Users	0.91	1.00	1.03	1.04
All_Purposes, Car, PM_Peak_Hour_5_6, All_Users	0.85	1.00	1.02	1.03
All_Purposes, HGV, AM_Peak_Hour_8_9, All_Users	1.00	1.00	0.99	0.99
All_Purposes, HGV, IP_Av_Hourly, All_Users	0.97	1.00	1.00	1.00
All_Purposes, HGV, PM_Peak_Hour_5_6, All_Users	0.96	1.00	1.00	1.00
All_Purposes, LGV, AM_Peak_Hour_8_9, All_Users	0.87	1.00	1.00	0.99
All_Purposes, LGV, IP_Av_Hourly, All_Users	0.62	1.00	0.99	0.99
All_Purposes, LGV, PM_Peak_Hour_5_6, All_Users	0.85	1.00	1.00	1.00
Grand Total	**0.88**	**1.00**	**1.01**	**1.01**

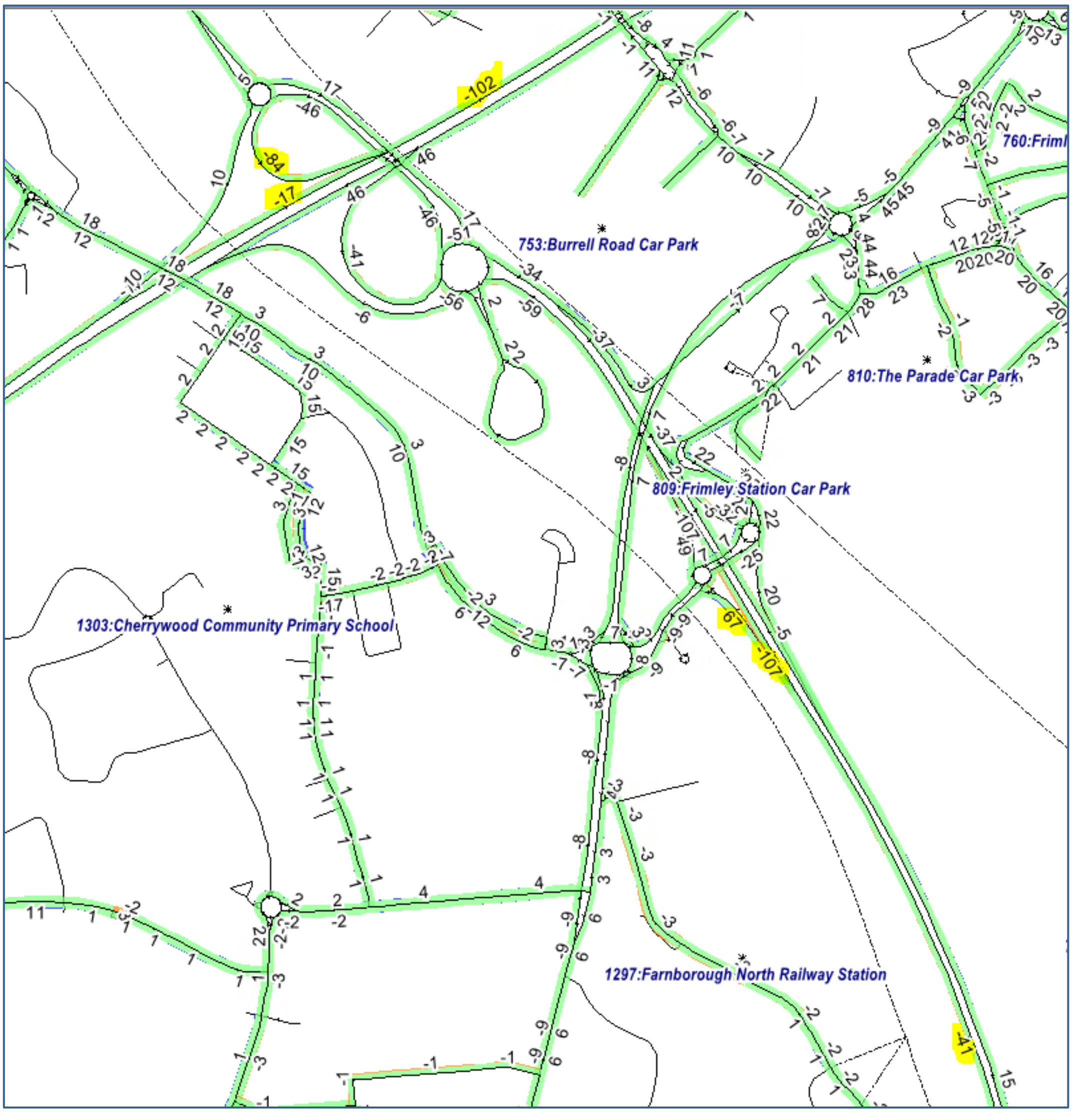
3.8.9 Changes in forecast Car (vehicle) trip productions and attractions in the Local Model are illustrated in Section 6.2 of the Appendix.

3.8.10 Figure 6-1 to Figure 6-4 compare Scenario 1 with the Do Minimum. This starts with a view of the area with the major development sites, and for AM and PM cases. The information is also shown for the full set of zones, but motorway zones (cordon points) are separated out due to the very different numbers of trips involved that give rise to scaling problems when all zones are viewed together.

3.8.11 One result that is evident in Figure 6-4 is that AM Car trip productions on the southern M3 cordon (i.e. northbound trips) are appreciably higher (4875 vph) for the DM compared with the S1 scenario (4504 vph), which is not expected. This matter is not evident in the PM case (not illustrated here), but is visible on the M25 too.

3.8.12 The reasons for these changes have been investigated for the case of the M3 northbound trips. Figure 3-8 is a detail from Figure 6-5 in the Appendix.

Figure 3-8 M3 AM Vehicle Flow Changes Near Frimley



3.8.13 Figure 3-8 shows changes in AM flows between DM and S1 scenarios in the region of the M3/A339 interchange near Frimley. The M3 is the straighter road running diagonally near the top left of the figure. Near its interchange with the A339 (running diagonally top-left to bottom-right), some flow-difference values have been highlighted. The value of -102 shows, for example, that there are 102 fewer northbound vehicles on this section of the M3 in the S1 scenario compared with the DM scenario.

3.8.14 The network and flows shown in Figure 3-8 (and Figure 6-5) are from the SINTRAM72 modelling. It may be seen from Figure 2-5 that Frimley lies to the south of the Local Model cordon boundary, so these flow figures indicate the source of flows feeding into the M3 cordon point.

3.8.15 It may be observed that there is little change, just 17 vph, prior to the M3/A339 interchange, but a complex series of changes (as highlighted) on the A339 northbound contribute to the final change on the M3 flows.

3.8.16 In themselves, these changes are not sufficient to be considered significant, but it is clear that the effect of a lower M3 flow is amplified in the Local Model through applying the validation adjustment factors. This occurs because, as discussed in the LMVR document, the count data for motorways exhibits considerable variability for peak hours and the total flow levels are high, so the absolute level of flow differences can easily be magnified by adjustment factors.

3.8.17 These discrepancies arising from the effects of variable count data are essentially confined to motorway flows (for example, they are not evident in Figure 6-3 AM Peak Hour Car Trip Ends: S1 v DM – Non-Motorway Roads).

3.8.18 The equivalent SINTRAM72 highway assignment comparative results are more self-consistent, including on motorways (as they are not subject to the extra validation adjustment factors) but, then, they do not offer quite the same precision for local, non-motorway roads as provided by the Local Model.

3.8.19 These motorway flow effects have consequences for the network statistics shown in the following Section 4.2 and mean, where relevant, that more significance should be placed on statistics for non-motorway flows. For motorway flows, reference can suitably be made to SINTRAM72 modelling regarding comparative results between scenarios.

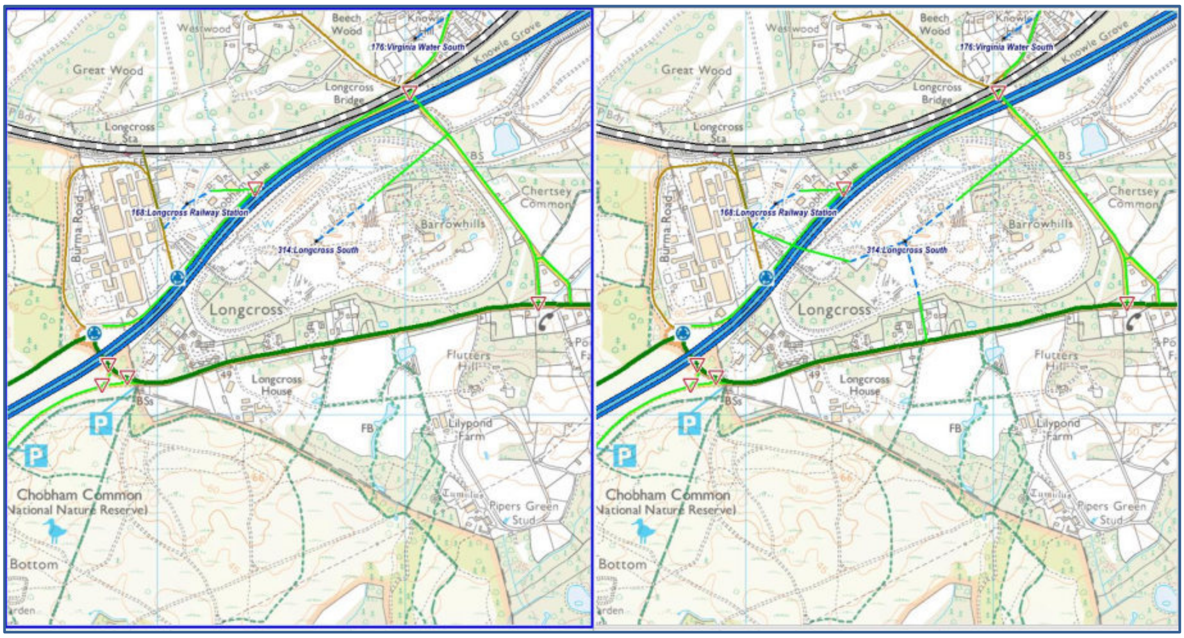
3.9 Forecast Network

3.9.1 The Do Minimum forecast network is a copy of the Base but with the following changes listed below. These are committed or completed highway schemes of strategic importance.

- Runnymede Roundabout major scheme;
- M3 hard shoulder running between junctions 2 and 4a;
- Malden Rushett signal junction of A243 Leatherhead Road with B280 Fair Oak Lane;
- Increase to two lanes of travel between Toshiba and Hospital roundabouts in an eastbound direction, Frimley;
- Guildford Waitrose development new signalled junction;
- East Street development, Farnham;
- Redhill balanced network; and
- Epsom Plan E.

3.9.2 The network is not altered for Scenarios 1 and 2, except to connect zones representing Greenfield sites. This is achieved by adding in ‘centroid connector’ links; these do not aim to match specific access and egress road arrangements, except in the case of the Longcross development, where the altered network is shown in Figure 3-9. The network and junction configuration for this sites has been coded according the developer’s proposed plan.

Figure 3-9 Network Configuration for Scenario 1 (left) and 2 (right) near DERA Longcross Site



3.10 Assignment

3.10.1 The assignment methodology is the same as reported for the Base year in Section 2.10.

4 MODEL RESULTS AND ANALYSES

4.1 Overview

4.1.1 All results presented within this section represent modelled forecast traffic impacts on highways in the borough of Runnymede, comparing scenario 1 with scenario 2 for the forecast year 2036 taken from the Local Model.

4.1.2 Scenario 1 is the Do Minimum scenario which presents a future in which there is only the currently committed development in Runnymede borough, but accounts for full development in the rest of the Great Britain to 2036, based on the Department for Transport's forecasts. It also considers the nearby proposed developments at Martyrs Lane, Woking and Fairoaks Airport in Surrey Heath.

4.1.3 Scenario 2 is the Local Plan scenario. It contains all the development in Scenario 1 together with the addition of the preferred options for development as contained in the emerging Runnymede Local Plan.

4.1.4 The potential highway impacts of the draft Regulation 19 Local Plan can therefore be identified by comparing Scenario 1 Do Minimum with Scenario 2 Local Plan.

4.2 Network Statistics

4.2.1 Table 4-1 and Table 4-2 provide a set of summary network statistics by vehicle and road type for the AM and PM peak hours respectively. The statistics reported are total vehicle-distance and total vehicle-time for the borough of Runnymede.

4.2.2 It can be seen that during the AM peak hour, the total for all vehicles and all road types shows a small reduction in vehicle distance and vehicle time. At first glance this may appear favourable but also implausible with the introduction of the Local Plan in Scenario 2. However, closer examination of the results show that whilst there are expected increases in total vehicle distance for car trips, there is a decrease for light and heavy goods vehicles on local roads. These vehicles have transferred to the motorway network, to avoid local congestion issues. The network is congested in Runnymede, and thus sensitive to any change, particularly for long distance trips with nearby origins and destinations. This becomes apparent in subsequent network appraisal in the following sections.

4.2.3 As reflected in the lower values of total vehicle distance and time, the PM peak hour is less congested than the AM peak hour, and thus less sensitive to routeing changes arising from the increase in households and employment set out in the Local Plan. The results shown for the PM peak hour are therefore more typical of Local Plan growth, with marginal increases of 1% for total vehicle distance and 3% for total vehicle time, which are also shown more evenly across all vehicle types. Nevertheless there still appears to be a shift away from the local roads to the motorway, particularly for light and heavy goods vehicles. For example there is a 9% reduction in total vehicle distance HGVs on B roads.

4.2.4 During both time periods, the largest increases in total vehicle distance and time are for car trips travelling on minor and B roads. For example there is a 3% increase in total vehicle distance and vehicle time for cars travelling on B roads in the PM peak hour. These increases correlate well to the location of the proposed development. For example the B386 Longcross Road which is adjacent to the proposed Longcross South development.

Table 4-1 AM Peak Hour (0800 – 0900) Network Statistics for Runnymede Borough

Vehicle Type	Road Type	Total Vehicle Distance (veh km)				Total Vehicle Time (veh hr)			
		Scenario 1	**Scenario 2**	**Difference**	**% Change**	**Scenario 1**	**Scenario 2**	**Difference**	**% Change**
Car	Motorway	300,305	300,433	128	0%	3,920	3,932	11	0%
	Trunk	2,718	2,691	-27	-1%	35	35	-1	-2%
	A Principal	57,435	57,593	158	0%	2,569	2,493	-75	-3%
	B Roads	32,163	32,833	670	2%	1,083	1,080	-2	0%
	Minor Roads	41,037	40,494	-543	-1%	2,201	2,230	29	1%
	Total	**433,658**	**434,044**	**386**	**0%**	**9,808**	**9,770**	**-38**	**0%**
LGV	Motorway	46,985	47,488	503	1%	594	602	9	1%
	Trunk	378	390	12	3%	5	5	0	2%
	A Principal	13,954	13,552	-402	-3%	626	580	-46	-7%
	B Roads	9,008	8,237	-771	-9%	292	261	-31	-11%
	Minor Roads	11,410	10,913	-497	-4%	606	572	-33	-5%
	Total	**81,735**	**80,580**	**-1,155**	**-1%**	**2,122**	**2,021**	**-102**	**-5%**
HGV	Motorway	21,279	21,413	134	1%	217	219	2	1%
	Trunk	106	107	1	1%	1	1	0	0%
	A Principal	2,377	2,200	-177	-7%	104	93	-12	-11%
	B Roads	1,085	957	-128	-12%	34	29	-4	-13%
	Minor Roads	1,079	1,007	-72	-7%	56	52	-4	-8%
	Total	**25,926**	**25,684**	**-242**	**-1%**	**412**	**394**	**-18**	**-4%**
All	Motorway	368,569	369,334	765	0%	4,731	4,753	22	0%
	Trunk	3,202	3,188	-14	0%	42	41	0	-1%
	A Principal	73,766	73,345	-421	-1%	3,300	3,167	-133	-4%
	B Roads	42,256	42,027	-229	-1%	1,408	1,371	-37	-3%
	Minor Roads	53,526	52,414	-1,112	-2%	2,863	2,854	-9	0%
	Total	**541,319**	**540,308**	**-1,011**	**0%**	**12,343**	**12,185**	**-158**	**-1%**

Table 4-2 PM Peak Hour (1700 – 1800) Network Statistics for Runnymede Borough

Vehicle Type	Road Type	Total Vehicle Distance (veh km)				Total Vehicle Time (veh hr)			
		Scenario 1	**Scenario 2**	**Difference**	**% Change**	**Scenario 1**	**Scenario 2**	**Difference**	**% Change**
Car	Motorway	303,936	306,530	2,594	1%	3,774	3,936	163	4%
	Trunk	2,674	2,600	-74	-3%	34	33	-1	-2%
	A Principal	57,251	57,206	-45	0%	1,910	1,912	2	0%
	B Roads	31,044	31,859	815	3%	853	874	21	3%
	Minor Roads	32,218	32,427	209	1%	1,427	1,504	77	5%
	Total	**427,123**	**430,622**	**3,499**	**1%**	**7,997**	**8,259**	**262**	**3%**
LGV	Motorway	41,069	41,452	383	1%	509	528	19	4%
	Trunk	228	230	2	1%	3	3	0	1%
	A Principal	9,097	8,987	-110	-1%	311	308	-3	-1%
	B Roads	6,250	6,255	5	0%	166	170	3	2%
	Minor Roads	6,485	6,422	-63	-1%	307	302	-6	-2%
	Total	**63,129**	**63,346**	**217**	**0%**	**1,296**	**1,310**	**14**	**1%**
HGV	Motorway	15,443	15,612	169	1%	157	163	6	4%
	Trunk	80	80	0	0%	1	1	0	0%
	A Principal	1,509	1,475	-34	-2%	51	49	-2	-3%
	B Roads	854	778	-76	-9%	19	18	-1	-4%
	Minor Roads	522	488	-34	-7%	24	23	-1	-6%
	Total	**18,408**	**18,433**	**25**	**0%**	**252**	**254**	**2**	**1%**
All	Motorway	360,448	363,594	3,146	1%	4,440	4,628	188	4%
	Trunk	2,982	2,910	-72	-2%	38	37	-1	-2%
	A Principal	67,857	67,668	-189	0%	2,272	2,269	-3	0%
	B Roads	38,148	38,892	744	2%	1,038	1,062	24	2%
	Minor Roads	39,225	39,337	112	0%	1,758	1,828	70	4%
	Total	**508,660**	**512,401**	**3,741**	**1%**	**9,545**	**9,823**	**278**	**3%**

4.3 Level of Service (LoS) Metric

4.3.1 The Level of Service (LoS) metric, which is an adaptation of the US Highway Capacity Manual LoS metric, is determined by the level of traffic flows relative to network link and junction capacities, expressed in terms of the ratio of flow to capacity (RFC). The interpretation of RFC values in terms of experienced levels of congestion are described in Table 4-3 .

4.3.2 A level of service categorised as A represents the best operating conditions with an RFC value of less than 0.5. On the other hand category D is the worst level of service with an RFC value greater than 1. An RFC value greater than 1 means that the stretch of road or turning movement has a higher level of traffic flow than its theoretical capacity, suggesting flow breakdown and extensive queues.

Table 4-3 Interpretation of Level of Service Categories

Category		Description	RFC
A	Free flow	Traffic flows at or above the posted speed limit and motorists have complete mobility between lanes. Motorists have a high level of physical and psychological comfort.	0 to 0.5
B	Stable flow	Ability to manoeuvre through lanes is noticeably restricted and lane changes require more driver awareness. Speeds slightly decrease as traffic volume slightly increase. Freedom to manoeuvre within the traffic stream is much more limited and driver comfort levels decrease. Roads remain safely below but efficiently close to capacity.	0.5 to 0.85/0.90*
C	Unstable flow, operating at capacity	Flow becomes irregular and speed varies rapidly because there are virtually no usable gaps to manoeuvre in the traffic stream and speeds rarely reach the posted limit. Any disruption to traffic flow, such as merging ramp traffic or lane changes, will create a shock wave affecting traffic upstream. Drivers' level of comfort become poor.	0.85/0.90* to 1
D	Forced or breakdown of flow	Every vehicle moves in lockstep with the vehicle in front of it, with frequent slowing required. Travel time cannot be predicted, with generally more demand than capacity.	>1

** 0.85 threshold has been used for links and 0.90 for junctions*

4.3.3 The methodology for calculating the LoS has been applied to the analysis of both link flow and junction delay to aid the interpretation of the model results. The calculated LoS has been colour coded using the traffic light colours: green; amber; and red.

4.4 Link Analysis

4.4.1 Flow difference plots for the entire study area of Runnymede borough have been presented for Scenario 2 in comparison to Scenario 1 for the weekday AM and PM peak hours in Figure 4-1. Scenario 2 contains the preferred locations for development and hence shows the impact of the Local Plan. Bandwidths coloured red show an increase in flow, whereas those coloured blue represent a decrease in flow, with their size being proportional to the increase or decrease. Note that labels are only shown for changes of greater than 50 PCU.

4.4.2 As expected, the worse increases in link flows are found around the new development sites.

4.4.3 In the AM peak hour it can be seen that the largest increases in flow are found in the Chertsey South area, in the vicinity of St Peter's Hospital. The largest increase originates from the St Peter's Hospital development site of 1,389 PCU. Resulting from this, there are large increases in flow on both the A320 Guildford Road (219 PCU) and the B386 Holloway Hill (265 PCU). There is also an increase in flow along the whole B386 corridor in the eastbound direction (231 PCU), which can be attributed to the Longcross South development.

4.4.4 In the north of the borough there is a large increase of 103 PCU on the A30 from Runnymede Roundabout to M25 junction 13. There is also an increase of 114 PCU on Bakeham Lane, and 99 PCU on A308 Windsor Road. These are due to vehicle trips changing routes to avoid local delay.

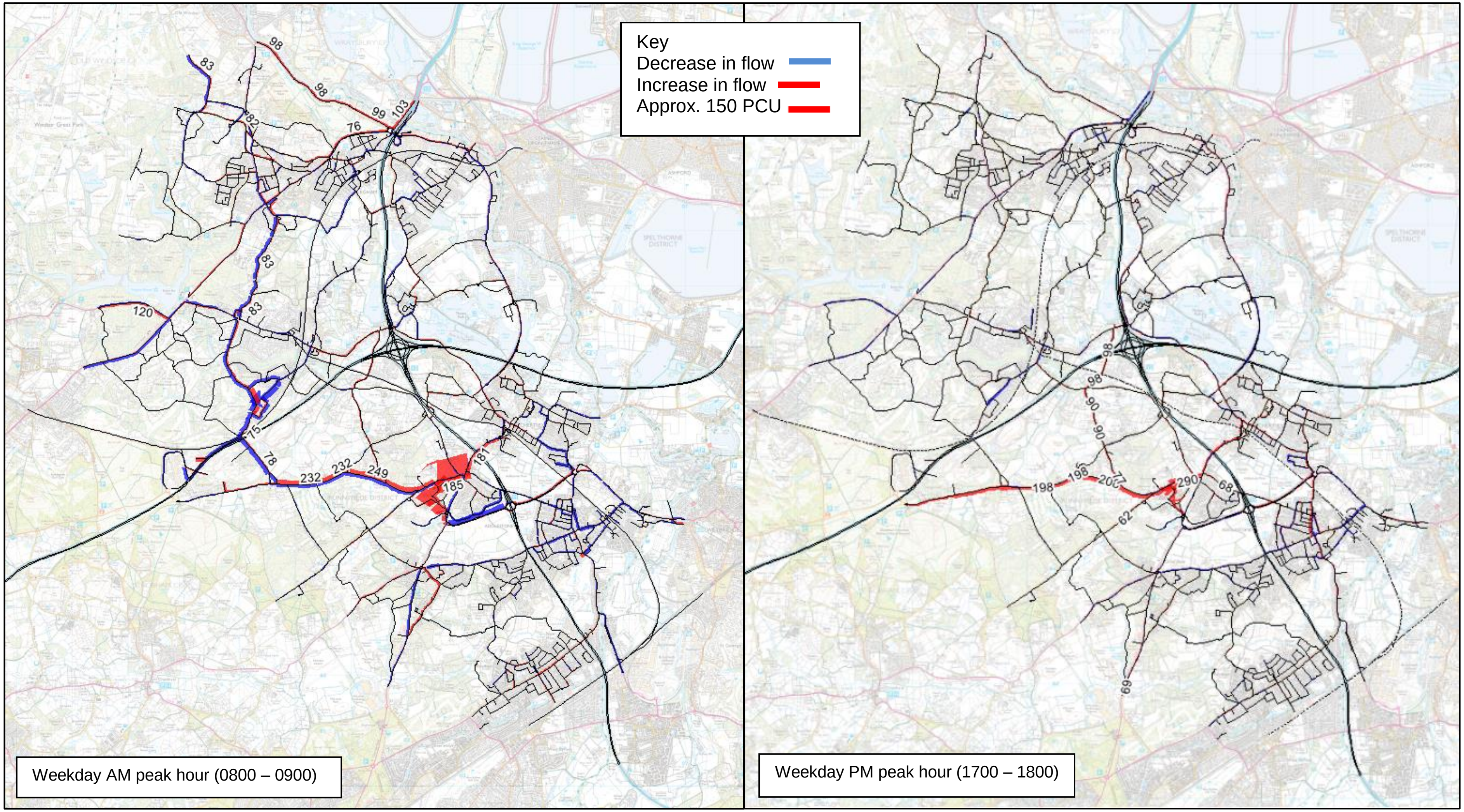
4.4.5 In the PM peak hour the Local Plan has less of an impact on traffic flow. The St Peter's Hospital area is still busy but less so than during the AM peak hour, with 895 PCU originating from St Peter's Hospital, an additional 290 PCU on the B386 Holloway Hill and 208 PCU more on the B386 Longcross Road. Elsewhere, Lyne Lane experiences an increase in vehicle flow of 98 pcu.

4.4.6 The blue bandwidths show a decrease in flow when comparing Scenarios 1 and 2. It can sometimes be due to residential development replacing commercial land uses which are considered to have more vehicle trips during the analysed time periods. Re-routeing is also an effect of local congestion. Runnymede borough is congested, and changes in local congestion cause longer distance trips to route via different motorway junctions for Runnymede origins and destinations. This is especially noticeable during the AM peak hour and is a result of vehicles changing their routes to avoid the delay in the St Peter's Hospital area. These include reductions on the A320 St Peter's Way eastbound in the AM peak hour, despite the substantial increase in vehicle trips arising from the nearby developments of St Peter's Hospital, Chertsey Bittams and Longcross South.

4.4.7 There is also a large reduction in flow along the A320 Guildford Road between the roundabout with the A320 St Peter's Way and that with the B386 Holloway Hill. This is due to the deterioration of these two junctions discouraging travel through and between them. The deterioration is due to the cumulative trip generation from the surrounding developments of St Peter's Hospital, Chertsey Bittams and Longcross South.

4.4.8 Change in vehicle flow on the M25 and M3 has not been presented here. Further analysis of the traffic impact on the borough's motorways is contained in Section 4.6.

Figure 4-1 Flow Difference Plot of Scenario 2 Compared to Scenario 1



4.4.9 Figure 4-2 and Figure 4-4 show which links are reaching their theoretical capacities for Scenario 1 and 2 in the weekday AM and PM peak hours respectively. Bandwidths are coloured as in Table 4-3 Interpretation of Level of Service Categories: green for free flow and stable flow (LoS A and B); orange for unstable flow, operating at capacity (LoS C); and red for forced or breakdown of flow (LoS D).

4.4.10 Figure 4-3 and Figure 4-5 present the difference in LoS between Scenarios 1 and 2 for the weekday AM and PM peak hours respectively. Bandwidths coloured red show a worsening in LoS, whereas those coloured blue represent an improvement in LoS, with their size being proportional to the increase or decrease.

4.4.11 The AM peak hour LoS (Figure 4-2) remains at forced or breakdown of flow (LoS D) for both Scenarios 1 and 2 on the following links:

- A308 Windsor Road, southbound, Egham;
- A308 Staines Bridge, each way;
- B388 Vicarage Road, northbound, Egham;
- Bakeham Lane, southbound, Englefield Green;
- B389 Christchurch Road, eastbound, Virginia Water;
- A30 London Road, northbound, Virginia Water;
- Trumpsgreen Road, eastbound, Trumps Green;
- Chobham Lane, eastbound, Longcross;
- B375 Bridge Road, westbound, Chertsey;
- A317 Woburn Hill, eastbound, Addlestone;
- A317 Chertsey Road, each way, Chertsey;
- A318 New Haw Road, northbound, Addlestone;
- A320 Guildford Road, northbound, Ottershaw; and
- A319 Chobham Road eastbound, Ottershaw.

4.4.12 Figure 4-3 shows the difference in LoS between Scenario 1 and 2 for the AM peak hour. The introduction of the Local Plan in Scenario 2 has caused a deterioration in LoS to forced or break down of flow (LoS D) at the following locations:

- A308 Windsor Road northbound, Egham;
- B386 Holloway Hill eastbound, Chertsey South; and
- Silverlands Close (St Peter's Hospital) each way, Chertsey South.

4.4.13 With RFC values greater than 1.0, these stretches of road with a LoS category 4 are operating above their theoretical capacity during the AM peak hour.

4.4.14 Additionally, the Local Plan in Scenario 2 has caused a deterioration in LoS to unstable flow (LoS C) in the AM peak hour at the following locations:

- A308 The Causeway eastbound, Egham;
- Wellington Avenue northbound, Virginia Water;
- Pyrcroft Road southbound, Chertsey; and
- B386 Longcross Road eastbound, Longcross.

4.4.15 The deterioration of the B386 Holloway Hill and Silverlands Close is a direct result of the development at St Peter's Hospital. Meanwhile, deterioration on the B386 Longcross Road and Wellington Avenue can be attributed to development at Longcross South.

4.4.16 The PM peak hour LoS (Figure 4-4) remains at forced or breakdown of flow (LoS D) for both Scenarios 1 and 2 on the following links:

- A308 Staines Bridge, each way;
- Village Road, each way, Thorpe;
- A30 London Road, northbound, Virginia Water;
- Access to former DERA off Chobham Lane, southbound, Longcross;
- Silverlands Close (St Peter's Hospital) each way, Chertsey South;
- A320 Guildford Road, southbound, Chertsey South; and
- A320 Guildford Road, southbound, Ottershaw.

4.4.17 These sections of road listed above and in paragraph 4.4.11 for the AM peak hour, are operating above their theoretical capacity in both model scenarios. Therefore any increase in flow, however small, will have a negative impact on their operation and exacerbate existing levels of driver stress.

4.4.18 In the PM peak hour the level of change is reduced, as shown in Figure 4-5. The introduction of the Local Plan in Scenario 2 has caused a deterioration in LoS to forced or break down of flow (LoS D) in the PM peak from Scenario 1 to 2 on the following roads:

- B386 Holloway Hill, eastbound, Chertsey South; and
- A320 Guildford Road, each way, Ottershaw.

4.4.19 Additionally, the Local Plan in Scenario 2 has caused a deterioration in LoS to unstable flow (LoS C) in the PM peak hour at the following locations:

- B386 Holloway Hill, eastbound, Chertsey South; and
- A319 Chobham Road, westbound, Ottershaw.

Figure 4-2 Level of Service in the AM (0800-0900) Peak Hour for Scenarios 1 and 2

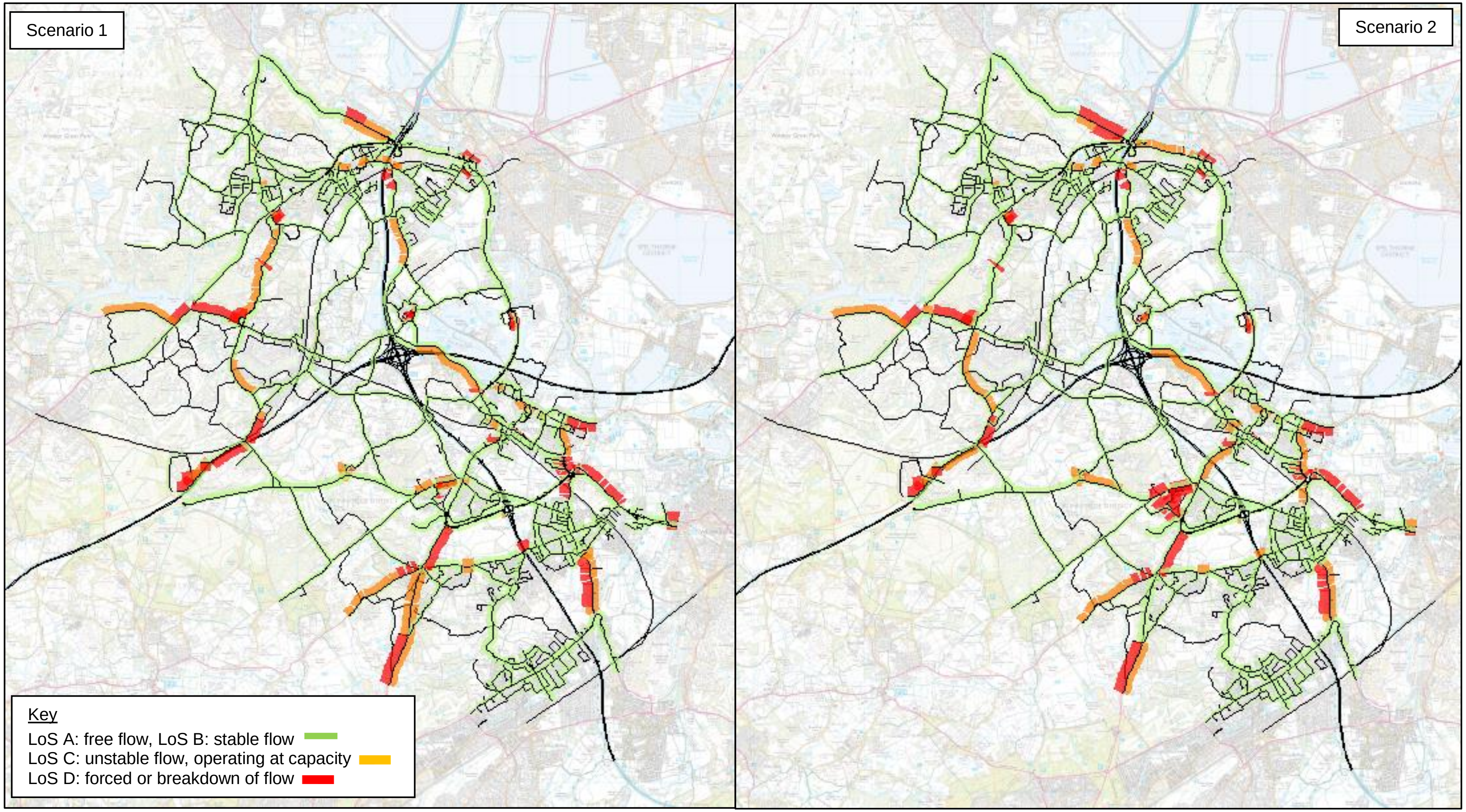


Figure 4-3 The difference in Level of Service between Scenario 1 and Scenario 2 for the AM (0800-0900) Peak Hour

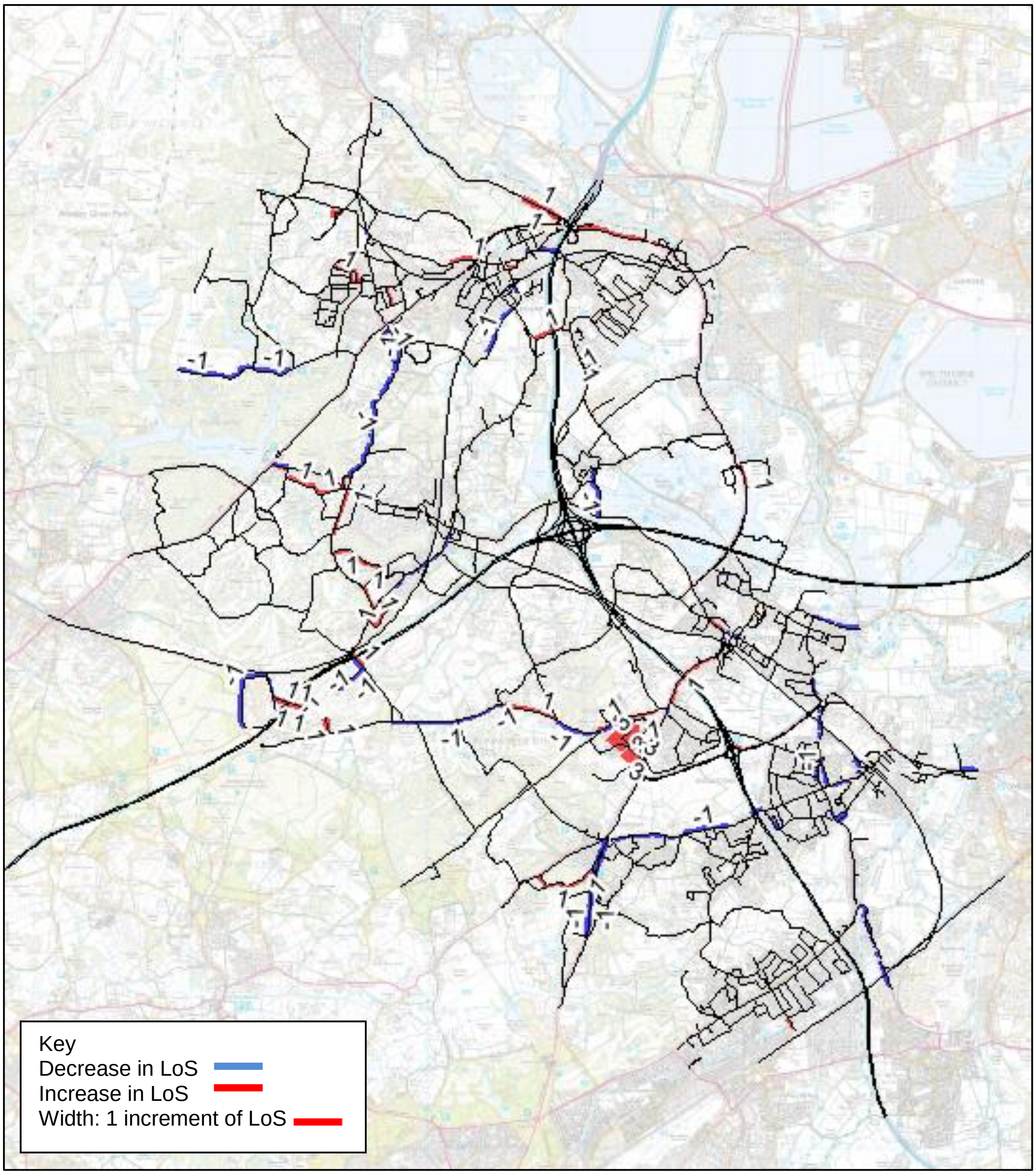


Figure 4-4 Level of Service in the PM (1700-1900) Peak Hour for Scenarios 1 and 2

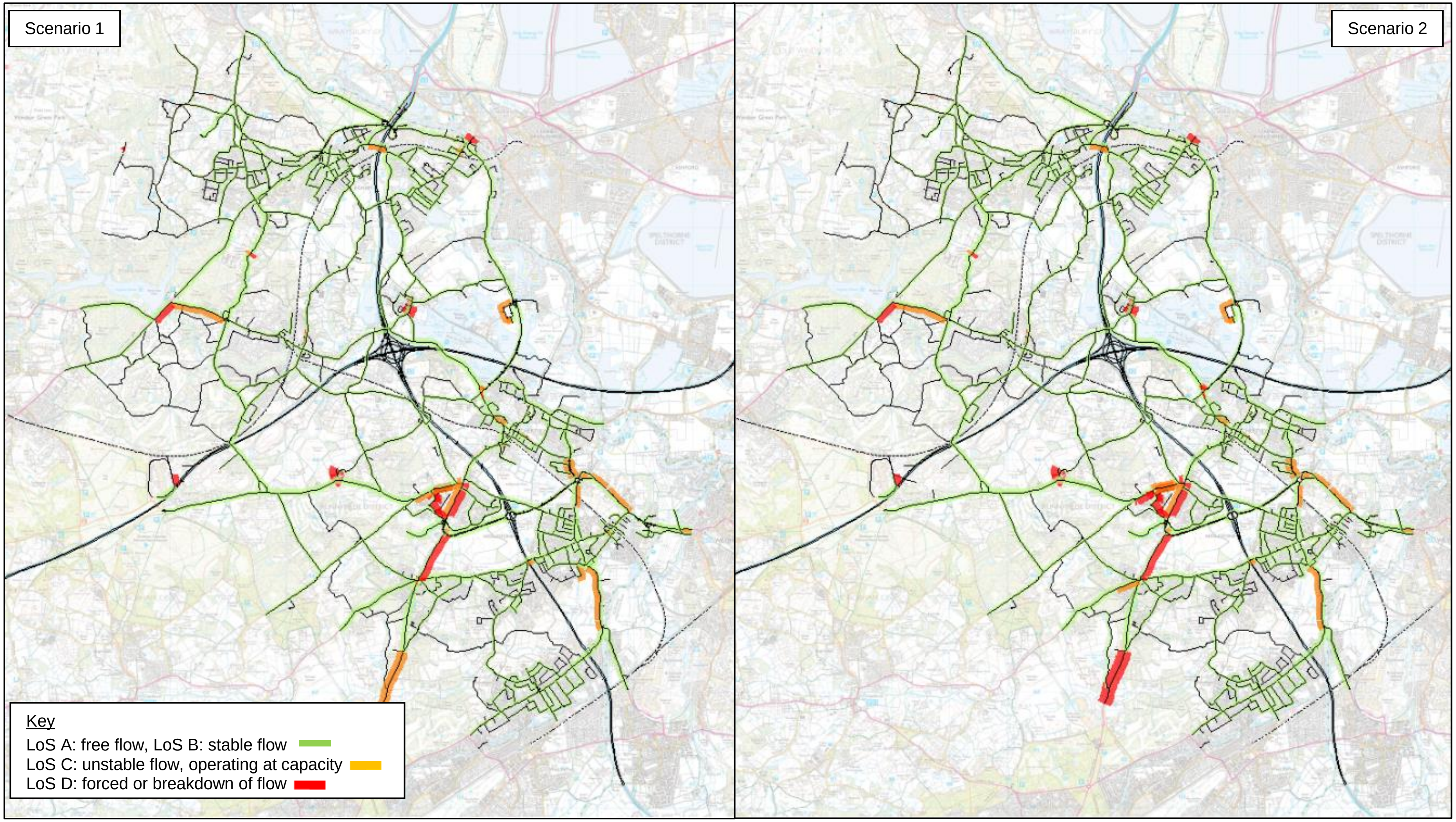
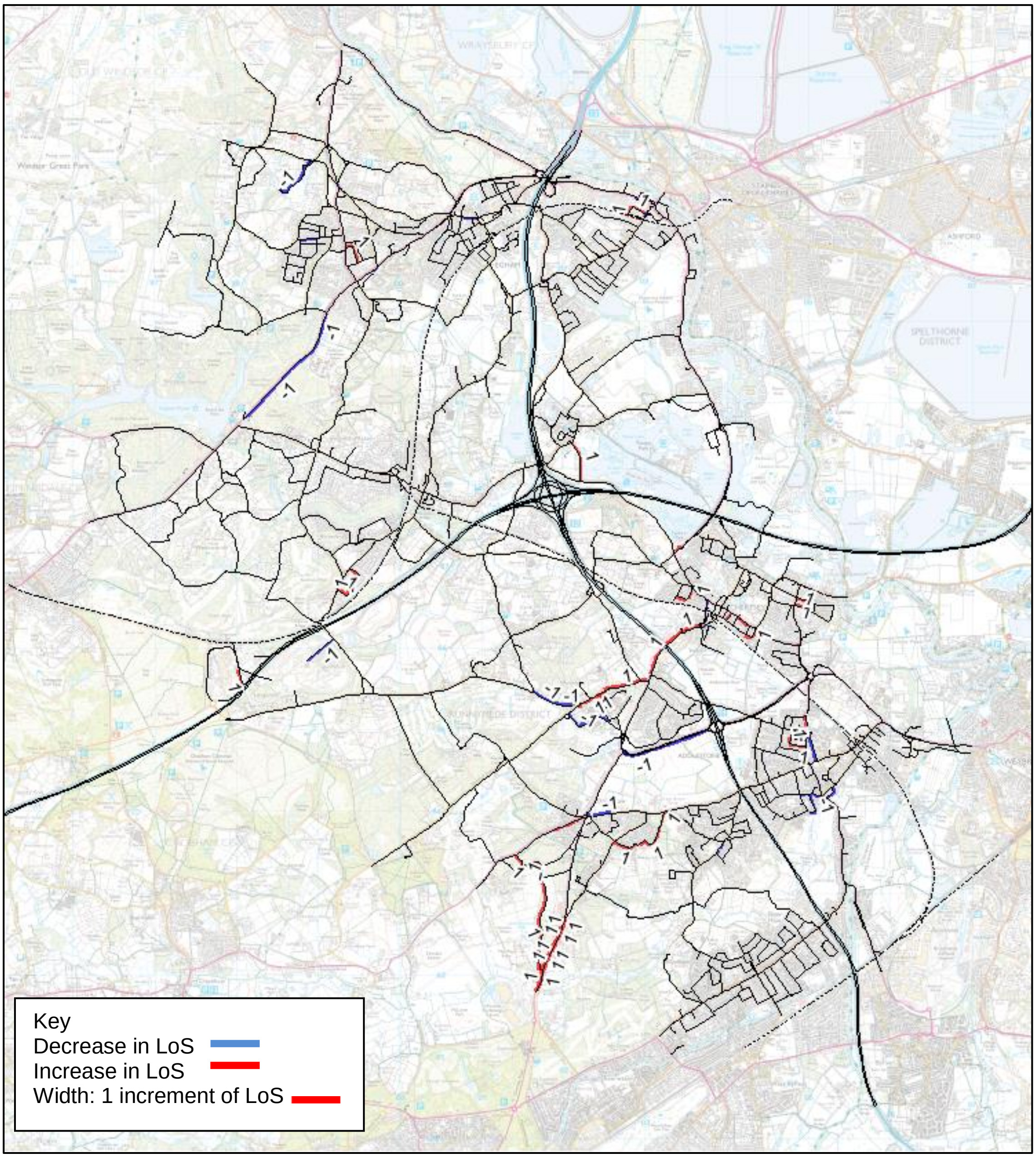


Figure 4-5 The difference in Level of Service between Scenario 1 and Scenario 2 for the PM (1700-1800) Peak Hour



4.5 Junction Analysis

4.5.1 The Level of Service at junctions is illustrated using pie charts, with two components each representing a scenario. If there is no change in overall congestion at the junction, then both the segments are the same size, but a larger section for a particular colour indicates a scenario with more congestion.

4.5.2 The diameter of the pie charts is proportional to the overall level of delay at the junction. Figure 4-6 shows junction level of service (LoS) pie charts for the AM peak hour, whilst Figure 4-7 shows the same comparison for the PM peak hour.

Figure 4-6 AM Peak Hour (0800 – 0900) Junction Level of Service Comparison

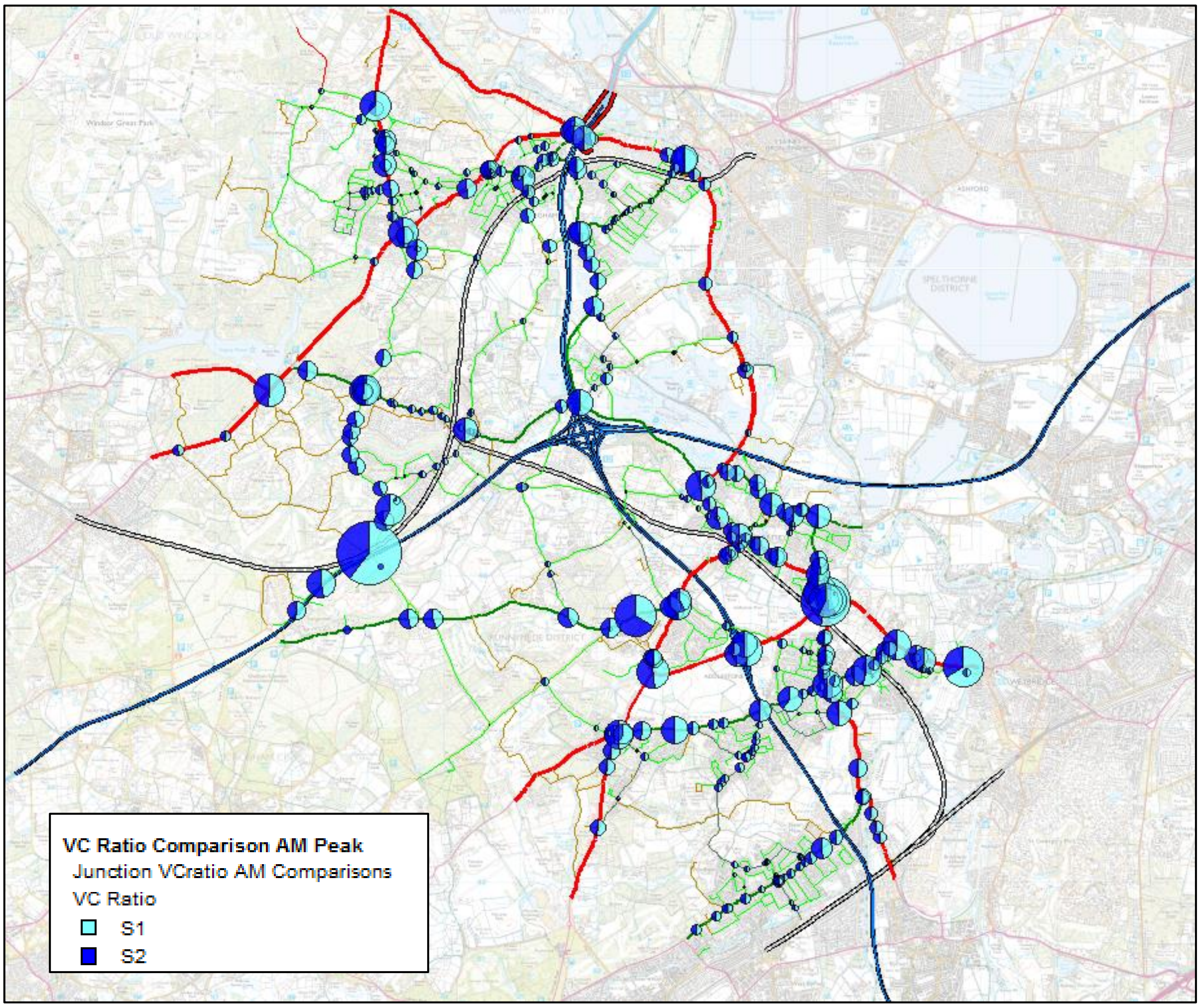
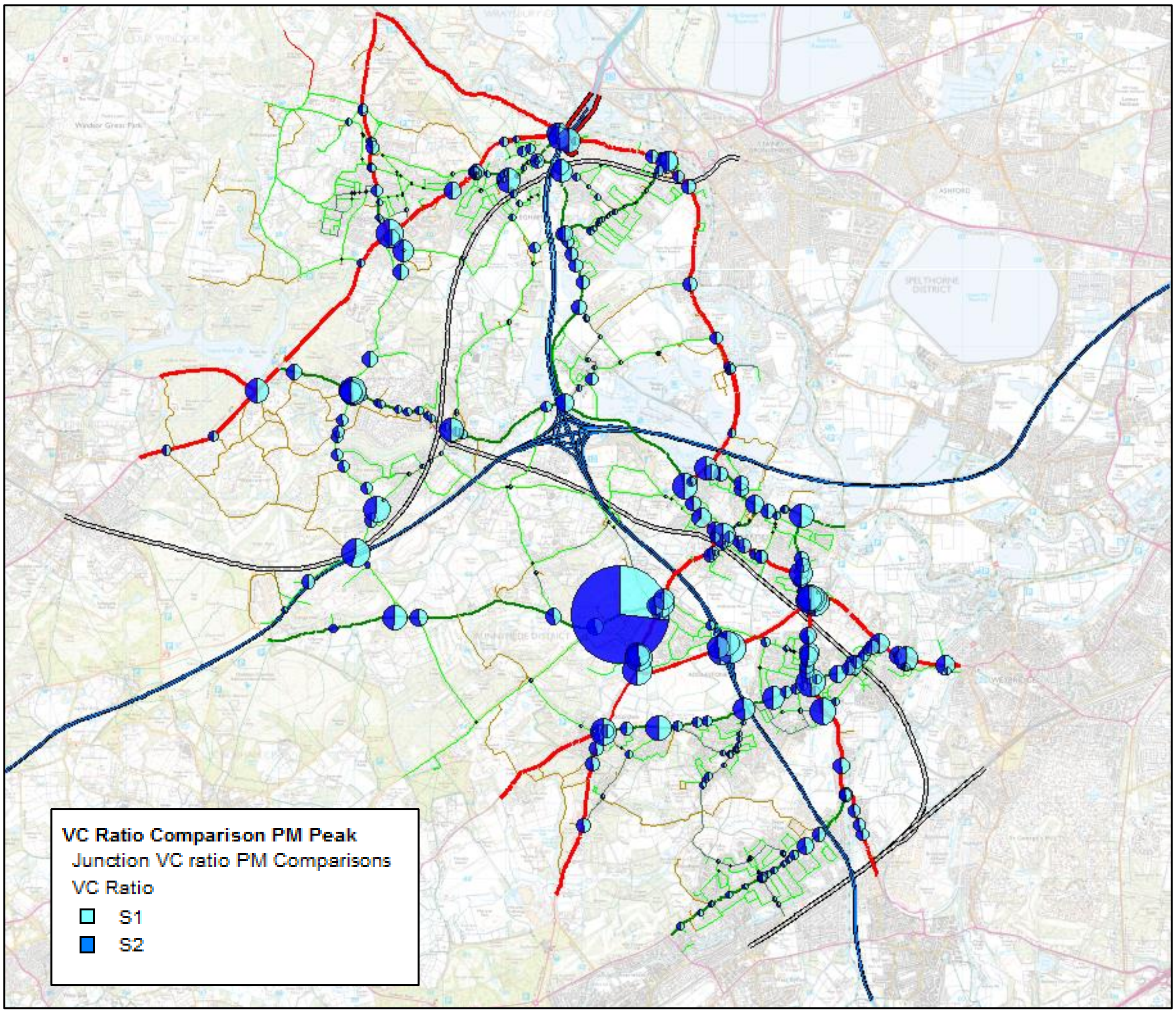


Figure 4-7 PM Peak Hour (1700 – 1800) Junction Level of Service Comparison



4.5.3 Figure 4-6 and Figure 4-7 show large increases in RFC at the junction of the B386 Holloway Hill with St Peter's Hospital in both time periods. Analysis of the junctions which experience the worst increase in delay shows that the area around St Peter's Hospital is of serious concern. Delay at the junction of the B386 Holloway Hill with the hospital increases by 332 seconds per vehicle and 212 seconds per vehicle in the AM and PM peak hours respectively. In an already congested area, these increases in delay would severely impact access to and egress from the hospital, particularly for emergency services.

4.5.4 The top junctions which have the greatest increase in average delay in scenario 2 compared to scenario 1 for the AM and PM peak hours are show in Table 4-4 and Table 4-5 respectively.

4.5.5 Aside from the junction of the B386 Holloway Hill with St Peter's Hospital, during the AM peak hour the maximum increase in delay, of 128 seconds per vehicle occurs at the junction of Chobham lane with the access to the former DERA site. In the PM peak, the maximum increase in delay is 199 seconds occurring at the signal junction of the A318 Brighton Road / High Street with B3121 Church Road / Station Road in Addlestone. This junction is already known to have capacity issues. With the introduction of several development sites in Addlestone, it is strongly recommended that capacity improvements are made to this junction.

4.5.6 Other junctions in the vicinity of St Peter's Hospital also suffer some of the largest increases in delay, including the following:

- B386 Longcross Road j/w Lyne Lane, Lyne;
- A320 Guildford Road j/w A320/ A317 St Peter's Way, Ottershaw;
- B386 Holloway Hill j/ w Hardwick Lane, Chertsey; and
- St Peter's Hospital Access approach to A320 Guildford Road roundabout.

4.5.7 All of the junctions experiencing an increase in delay are already shown to be operating over capacity (RFCs greater than 1) in scenario 1 without the additional development proposed in the Local Plan. In these locations, existing congestion would be exacerbated resulting in a reduction in driver comfort levels and increased stress, as a result of further deterioration of traffic conditions.

4.5.8 NOTE: RFC values above 1.0 should be treated with caution, as where flow exceeds capacity by such a large magnitude the metric becomes logically implausible. Nevertheless, the values highlight where the most serious congestion will occur.

Table 4-4 Top 10 Junctions with the Highest Increase in Average Vehicle Delay in Scenario 2 Compared with Scenario 1 (AM peak hour 0800 – 0900)

Rank	Name	Type	Node ID	Increase in Average Delay from Scenario 1 (seconds per vehicle)	Scenario 2 RFC*	Scenario 2 LoS*
1	B386 Holloway Hill j/w St Peter's Hospital Access	Give Way	219858	332	7.91 (4.01)	4
2	Chobham Lane j/w Longcross Station (former DERA site access)	Give Way	530291	128	4.28 (3.84)	4
3	B386 Longcross Road j/w Lyne Lane, Lyne	Give Way	431947	120	3.26 (2.36)	4
4	A320 Staines Road j/w B388 Thorpe Road, St Ann's Road and Chilsey Green Road, Chertsey	Roundabout	221105	63	4.38 (4.37)	4
5	A320 Guildford Road j/w A320/ A317 St Peter's Way, Ottershaw	Roundabout	219807	59	4.85 (4.54)	4
6	A317 St Peters Way eastbound approach to j/w A318 Chertsey Road, Chertsey	Give Way	220942	46	6.57 (7.45)	4
7	B386 Holloway Hill j/w Hardwick Lane, Chertsey	Give Way	220812	39	3.84 (2.29)	4
8	Addlestone Moor approach to A317 St Peter's Way / A318 Chertsey Road roundabout, Chertsey	Give Way	220989	34	4.88 (3.96)	4
9	A320 Chilsey Green Road j/w Cowley Avenue, Chertsey	Give Way	221068	33	3.50 (2.93)	4
10	A30 London Road j/w A328 St Jude's Road and Bakeham Lane, Englefield Green	Signalised	89735	33	4.30 (4.25)	4

**If the RFC and LoS values differ between the two comparative scenarios, the reference Scenario RFC and LoS values are displayed in brackets*

Table 4-5 Top 10 Junctions with the Highest Increase in Average Vehicle Delay in Scenario 2 Compared with Scenario 1 (PM peak hour 1700 - 1800)

Rank	Name	Type	Node ID	Increase in Average Delay from Scenario 1 (seconds per vehicle)	Scenario 2 RFC*	Scenario 2 LoS*
1	B386 Holloway Hill j/w St Peter's Hospital Access	Give Way	219858	212	20.60 (7.52)	4
2	A318 Brighton Road / High Street j/w B3121 Church Road / Station Road, Addlestone	Signalised	220259	119	4.17 (4.07)	4
3	St Peter's Hospital Access approach to A320 Guildford Road roundabout, Chertsey	Give Way	219812	114	4.21 (2.65)	4
4	A317 Woburn Hill westbound approach to j/w A318 Chertsey Road, Chertsey	Give Way	220939	99	4.26 (4.08)	4
5	A318 Brighton Road / New Haw Road j/w Liberty Lane and Crockford Park Road, Addlestone	Signalised	220210	31	3.77 (3.65)	4
6	Chobham Lane j/w Longcross Station (former DERA site access)	Give Way	530291	29	2.03 (2.00)	4
7	B389 Christchurch Rd westbound approach to j/w Callow Hill and Wellington Av, Virginia Water	Give Way	89555	27	3.86 (3.50)	4
8	Trumps Green Road j/w Wellington Avenue, Trumps Green	Signals**	89441	22	3.40 (4.02)	4
9	Callow Hill southbound approach to j/w B389 Christchurch Rd and Wellington Av, Virginia Water	Give Way	89558	12	3.88 (3.84)	4
10	A317 Chertsey Rd southbound appr to A317 St Peter's Way / A318 Chertsey Rd roundabout, Chertsey	Give Way	220991	11	3.70 (3.61)	4

**If the RFC and LoS values differ between the two comparative scenarios, the reference Scenario RFC and LoS values are displayed in brackets*

*** This junction is modelled as a give-way in scenario 1. It is changed to signals as part of the Longcross South development mitigation.*

4.6 The Motorway and Trunk Road Network

4.6.1 Runnymede borough contains sections of the M25 and M3, as well as a very small section of the A30 trunk. These roads are the responsibility of Highways England.

4.6.2 Table 4-6 presents the traffic flow along Highway England network contained within the borough for both scenarios. Difference in flow plots are also presented in Figure 4-8 and Figure 4-9 for the AM and PM peak hours respectively.

4.6.3 Holistically, there is minimal change in flow with the Local Plan in place. Totalling all vehicle flow across the motorway and trunk roads, there is only an increase of 1% during the AM peak hour and no increase during the PM peak hour. Variation does exist, however, on individual links. For example, during the AM peak hour, the M25 in an anticlockwise direction experiences increases of up to 310 PCU on the mainline which predominantly exit at junction 11. This is also apparent during the PM peak hour but in the opposite clockwise direction, reflecting the existing tidal trend on this stretch of the M25. Furthermore in the opposing directions of travel, during both peak hours, there is a reduction in vehicle flow of up to 145 PCU in the AM peak hour and 92 in the PM peak hour.

4.6.4 Runnymede borough, including the motorways, is subject to congestion. Any increase in vehicle trips at a local level results in re-routing, particularly causing longer distance trips to route via different motorway junctions for local origins and destinations. The additional congestion in the St Peter's Hospital area is causing these longer distance trips to reroute away from junction 11 of the M25 to avoid the substantial delay here. Hence the comparison between both scenarios is showing reductions in flow on the motorway network.

4.6.5 Change in flow on the M3 is also sensitive to local congestion issues. In the AM peak hour there is an increase of 182 PCU on the M3 eastbound junction 2 off-slip. In the opposite direction of travel, however, there is a maximum increase of 27 PCU for the M3 westbound junction 2 off-slip, and a reduction of 102 PCU between junctions 2 and 3. In the PM peak hour the largest increases are 164 PCU on the M3 eastbound mainline between junctions 2 and 1, and in the opposite westbound direction 106 PCU between junctions 1 and 2.

Table 4-6 Traffic Flow Summary in PCU for the Motorway and Trunk Road Network

		AM Peak Hour				PM Peak Hour			
Link ID	**Section of HE Network**	**S1**	**S2**	**Difference**	**% Change**	**S1**	**S2**	**Difference**	**% Change**
	M25 clockwise	31,665	31,466	-199	-1%	28,463	28,659	195	1%
342147_1	M25 J10 - 11	6,266	6,248	-19	0%	6,315	6,356	41	1%
77242_1	M25 J11 off-slip	728	709	-19	-3%	1,252	1,275	23	2%
90201_2	M25 J11 on-slip	2,494	2,350	-145	-6%	1,955	2,036	81	4%
72435_2	M25 J11 - 12	8,032	7,888	-144	-2%	7,018	7,117	99	1%
77307_1	M25 J12 off-slip to M3	2,445	2,397	-48	-2%	3,169	3,225	56	2%
334307_1	M25 J12 on-slip from M3	2,668	2,815	148	6%	2,090	2,000	-90	-4%
335181_1	M25 J12 - 13	9,031	9,059	27	0%	6,663	6,651	-13	0%
	M25 Anticlockwise	28,668	29,457	789	3%	30,770	30,394	-376	-1%
335270_2	M25 J13 - 12	7,748	8,024	276	4%	8,736	8,653	-82	-1%
334342_2	M25 J12 off-slip to M3	3,645	3,697	52	1%	3,963	3,871	-92	-2%
77313_2	M25 J12 on-slip from M3	916	967	51	6%	868	840	-28	-3%
72436_1	M25 J12 - 11	7,465	7,775	310	4%	7,634	7,606	-27	0%
90206_1	M25 J11 off-slip	1,917	2,062	145	8%	1,908	1,850	-58	-3%
77245_2	M25 J11 on-slip	714	610	-105	-15%	968	909	-59	-6%
342138_2	M25 J11 - 10	6,263	6,323	60	1%	6,693	6,665	-28	0%
	A30 Trunk	3,501	3,539	38	1%	3,422	3,334	-89	-3%
77353_2	A30 The Glanty southbound	1,867	1,802	-65	-3%	1,510	1,487	-24	-2%
402087_2	A30 exit from Runnymede Roundabout	1,634	1,737	103	6%	1,912	1,847	-65	-3%
	M3 Eastbound	16,464	16,655	191	1%	14,309	14,418	109	1%
332630_1	M3 J3 - J2	7,349	7,387	37	1%	6,153	6,209	56	1%
334119_1	M3 J2 off-slip to M25	5,113	5,296	182	4%	4,084	3,984	-100	-2%
90336_1	M3 J2 on-slip from M25	407	446	39	10%	522	511	-11	-2%
335380_2	M3 J2 - J1	3,595	3,527	-68	-2%	3,550	3,715	164	5%
	M3 Westbound	17,633	17,484	-149	-1%	18,912	19,032	120	1%
335365_2	M3 J1 - J2	4,086	4,084	-2	0%	3,805	3,910	106	3%
77315_2	M3 J2 off-slip to M25	1,692	1,719	27	2%	1,592	1,598	6	0%
90310_2	M3 J2 on-slip from M25	4,731	4,658	-73	-2%	5,651	5,605	-46	-1%
332626_2	M3 J2 - J3	7,124	7,023	-102	-1%	7,864	7,917	54	1%
	TOTAL	97,931	98,600	670	1%	95,876	95,836	-40	0%

Figure 4-8 Motorway Flow (PCU) Comparison for the AM Peak Hour (0800 - 0900)

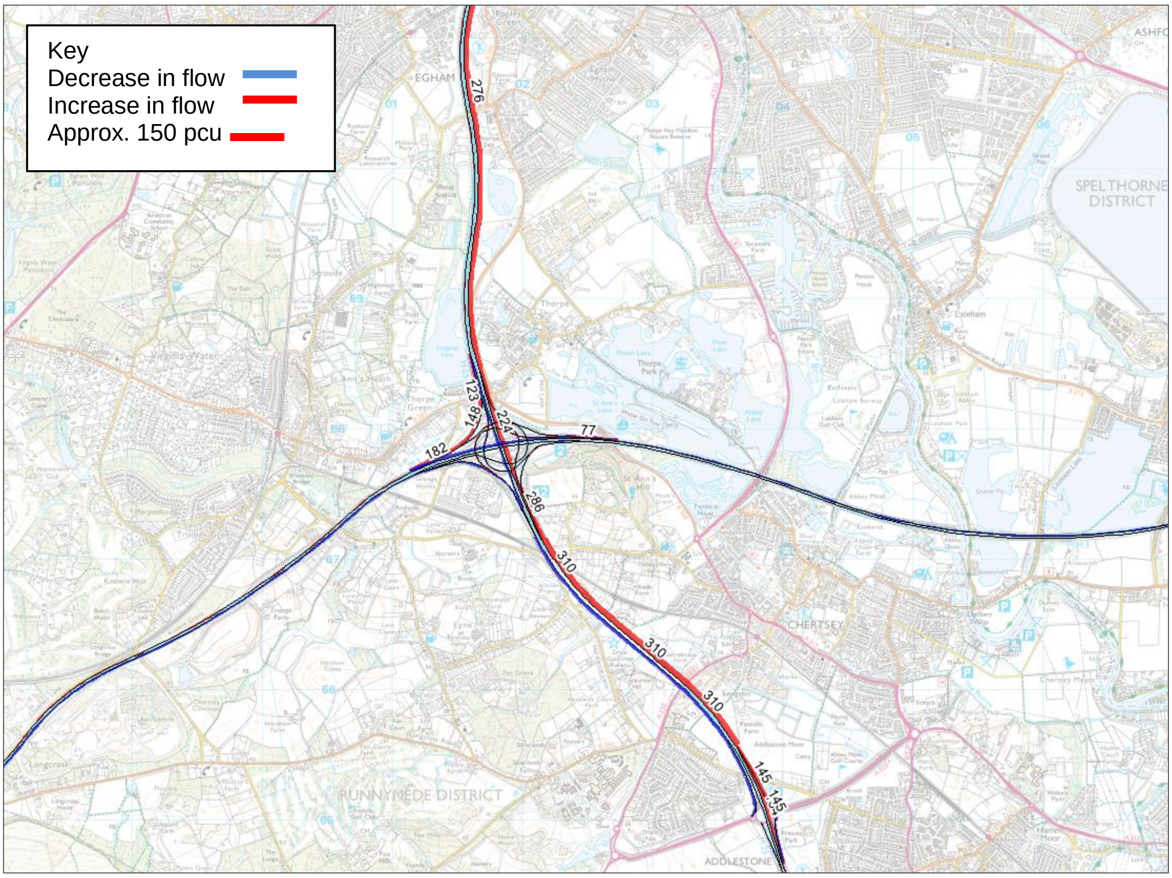
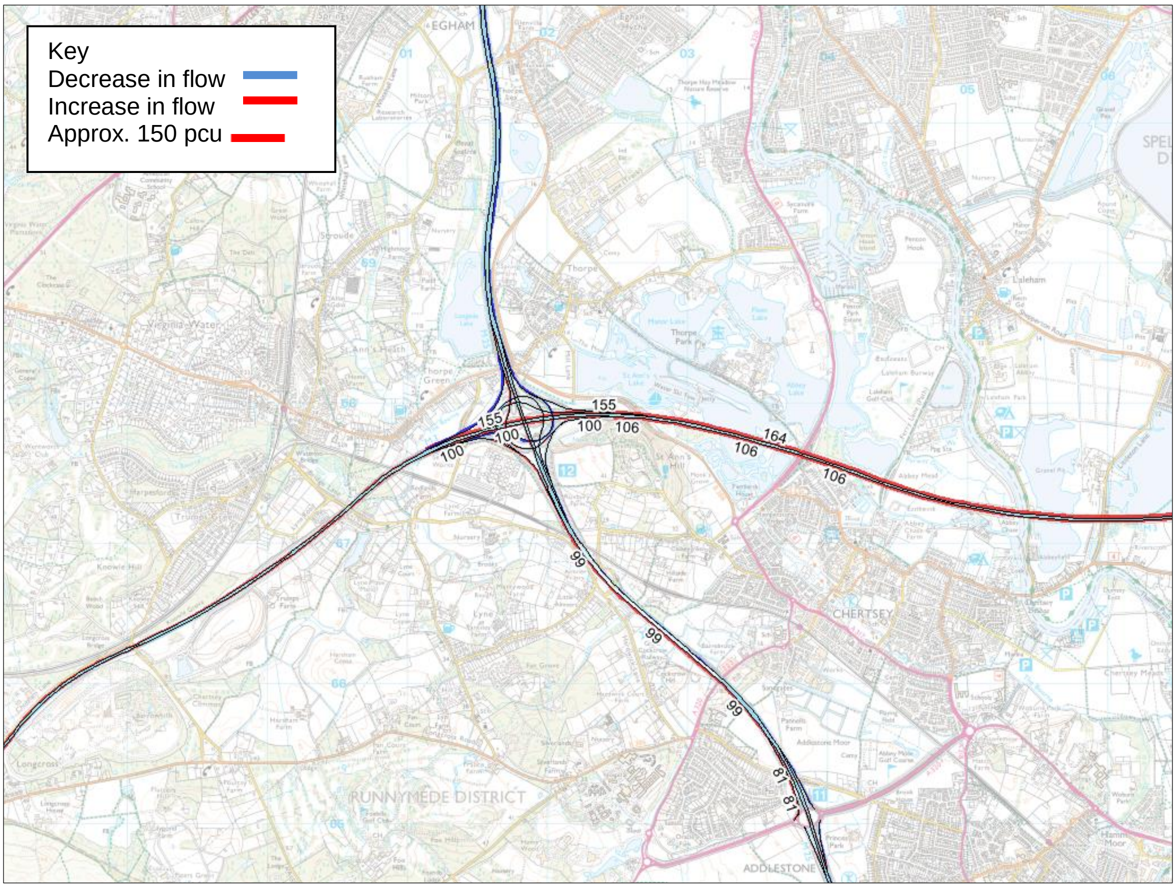


Figure 4-9 Motorway Flow (PCU) Comparison for the PM Peak Hour (1700 – 1800)



4.6.6 Figure 4-10 and Figure 4-11 present the difference in Level of Service (LoS) between scenarios 1 and 2 for the AM and PM peak hours respectively.

4.6.7 The only change in LoS arising from the Local Plan in Scenario 2 is between junctions 12 and 11 of the M25 in an anticlockwise direction and the M3 eastbound mainline within junction 2.

4.6.8 During the AM peak hour where flow on the M25 anticlockwise carriageway increases by 310 PCU between junctions 12 and 11, the LoS deteriorates from category C unstable flow to category D forced or breakdown of flow. During the PM peak hour, however, the LoS improves from category D to C due to a reduction in flow.

4.6.9 The reverse is true for the M3 eastbound mainline within junction 2. In the AM peak hour the LoS improves, but deteriorates in the PM peak hour with the Local Plan. In this case, however, the LoS does not exceed category B of stable flow with a RFC value less than 0.85.

Figure 4-10 Difference in LoS between Scenarios 1 and 2 for the AM Peak Hour (0800 - 0900)

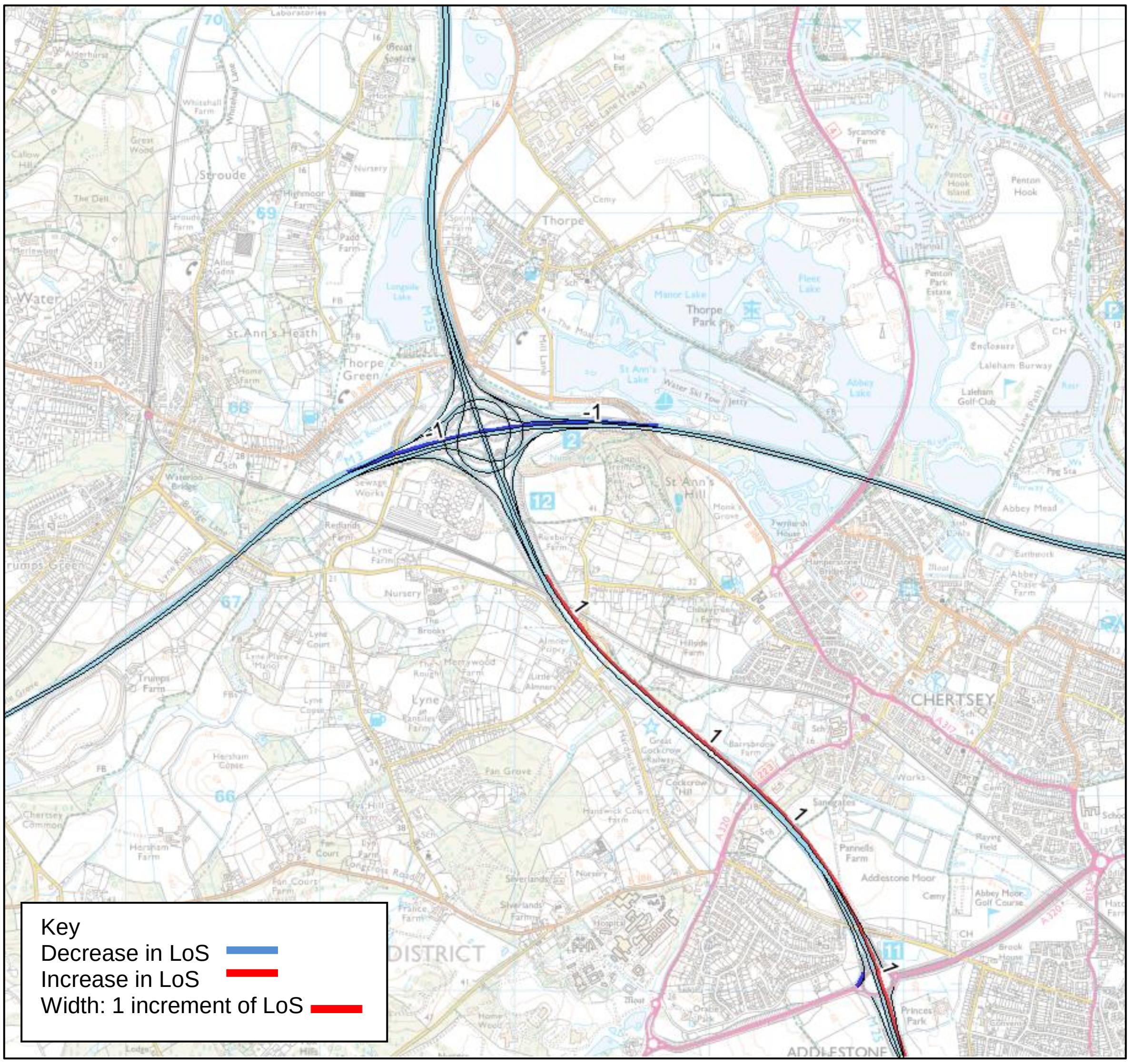
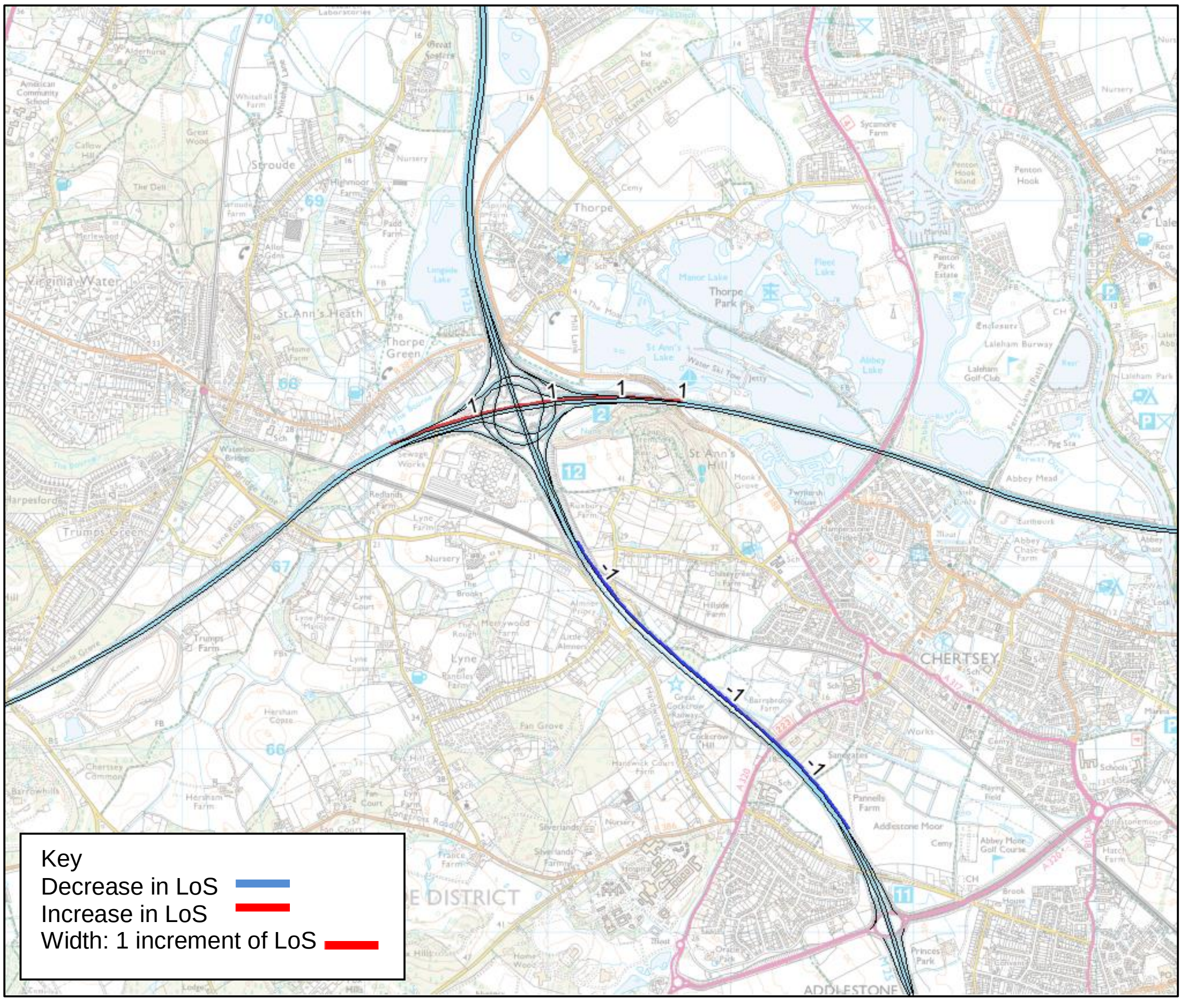


Figure 4-11 Difference in LoS between Scenarios 1 and 2 for the PM Peak Hour (1700 - 1800)



4.6.10 The delay at motorway merges has been calculated in the model using the formula specified in WebTAG[7]. The result of which is added to the calculated link generalised cost used in assignment[8].

4.6.11 Table 4-7 presents the calculated merge delay for all on-slips on the M25 and M3 within the borough of Runnymede.

Table 4-7 Calculated Additional Motorway Merge Delay (seconds per vehicle)

On-Slip Merge	AM Peak Hour (0800 – 0900)			PM Peak Hour (1700 – 1800)		
	S1 Delay (s/veh)	S2 Delay (s/veh)	Difference	S1 Delay (s/veh)	S2 Delay (s/veh)	Difference
M25 J11 clockwise	58	53	-5	28	31	3
M25 J12 clockwise	59	67	7	0	0	0
M25 J12 anticlockwise	54	69	15	46	46	-1
M25 J11 anticlockwise	0	2	2	18	17	-1
M3 J2 eastbound	0	0	0	0	0	0
M3 J2 westbound	130	123	-7	211	210	-1

[7] WebTAG unit M3.1 (DfT, 2014) *Highway Assignment Modelling*: Appendix D.9 Merge Modelling on High Speed Roads
[8] More detail regarding this method is provided in *TN5: SINTRAM Model Technical Report*

4.6.12 Similar to the link flow analysis, the AM peak hour experiences a larger increase in merge delay compared with the PM peak hour. Vehicles at the M25 junction 12 are estimated to incur a 7 second increase in delay for the clockwise direction of travel and 15 seconds in the opposing anticlockwise direction.

4.6.13 During the PM peak hour the only increase in additional merge delay arising from the Local Plan in Scenario 2 is 3 seconds per vehicle at the M25 junction 11 clockwise on-slip.

4.6.14 There is no negative impact on the M3 merges during both time periods.

4.7 Cross Boundary Impacts

4.7.1 Traffic flows on A principal and B roads which cross into neighbouring authorities have been analysed and compared in Table 4-8. The roads have been listed in a clockwise direction, starting with the borough of Spelthorne.

4.7.2 Comparing Scenario 2 Local Plan with Scenario 1 Do Minimum, it can be seen that there are marginal increases and decreases in flow along roads crossing Runnymede's borough boundary.

4.7.3 During the AM peak hour, the largest absolute increase of 120 PCU is along the A329 London Road exiting Runnymede at its boundary with Windsor and Maidenhead. This is due to localised re-routeing. It can be seen that on the A30 London Road boundary there is a reduction of 162 PCU, the majority of which have changed routes to the A329 to avoid local congestion. This can also be viewed in Figure 4-1.

4.7.4 At the boundary with Surrey Heath, there is an increase is 93 PCU along the B386 Longcross Road exiting Runnymede. This equates to a 14% increase in traffic flow. In the opposite direction of travel there is a 2% reduction of 19 PCU.

4.7.5 During the PM peak hour, the largest absolute increase is only 94 PCU situated on the B368 Longcross Road where it enters Runnymede at its boundary with Surrey Heath. This equates to a 9% increase in traffic flow. In the opposite direction of travel there is a 2% increase of just 12 PCU. These increases along the B386 Longcross Road at its boundary with Surrey Heath are similar in the AM peak hour, but the directions are reversed. It appears that Scenario 2 introduces a small amount of tidality to this stretch of road. In part this is due to the proposed development at the Longcross South site, but is also a result of the re-routeing of vehicles to avoid local congestion. Nevertheless, in all instances, the Level of Service (LoS) category does not change with the introduction of the Local Plan in Scenario 2, and is categorised as either A free flow or B stable flow, with plenty of reserve capacity to accommodate any further growth.

Table 4-8 Traffic flow summary for A principal and B roads which cross the Runnymede borough boundary into neighbouring authorities

Link ID	Road	Crosses Boundary with	AM Peak Hour				PM Peak Hour			
			S1	S2	Difference	% Change	S1	S2	Difference	% Change
Vehicles Entering Runnymede (PCU)										
90549_2	A308 Staines Bridge	Spelthorne	1,247	1,234	-13	-1%	867	863	-4	0%
90292_1	B375 Chertsey Bridge	Spelthorne	1,225	1,210	-15	-1%	738	755	17	2%
90191_2	A317 Weybridge Road	Elmbridge	1,277	1,260	-18	-1%	1,100	1,077	-23	-2%
85019_1	A318 Oyster Lane	Elmbridge	710	651	-59	-8%	792	799	7	1%
84947_1	B385 Woodham Lane	Woking	643	639	-4	-1%	488	459	-29	-6%
340891_2	A320 Guildford Road	Woking	1,340	1,292	-48	-4%	1,182	1,210	28	2%
120602_1	A319 Chobham Road	Surrey Heath	1,274	1,303	29	2%	810	796	-14	-2%
332570_1	B386 Longcross Road	Surrey Heath	889	908	19	2%	1,013	1,106	94	9%
4294_2	A30 London Road	Windsor and Maidenhead	846	872	25	3%	410	389	-21	-5%
332703_1	A329 London Road	Windsor and Maidenhead	1,553	1,496	-57	-4%	813	771	-43	-5%
319249_2	A328 Priest Hill	Windsor and Maidenhead	916	945	29	3%	737	727	-10	-1%
343282_1	A308 Windsor Road	Windsor and Maidenhead	1,238	1,336	98	8%	905	909	4	0%
Vehicles Exiting Runnymede (PCU)										
90549_1	A308 Staines Bridge	Spelthorne	978	1,039	60	6%	1,037	1,034	-3	0%
90292_2	B375 Chertsey Bridge	Spelthorne	728	660	-69	-9%	796	794	-2	0%
90191_1	A317 Weybridge Road	Elmbridge	1,248	1,151	-97	-8%	912	932	20	2%
85019_2	A318 Oyster Lane	Elmbridge	880	811	-70	-8%	602	592	-10	-2%
84947_2	B385 Woodham Lane	Woking	595	582	-12	-2%	430	455	25	6%
340891_1	A320 Guildford Road	Woking	1,166	1,138	-28	-2%	1,199	1,239	40	3%
120602_2	A319 Chobham Road	Surrey Heath	570	574	4	1%	1,001	1,029	28	3%
332570_2	B386 Longcross Road	Surrey Heath	665	758	93	14%	573	585	12	2%
4294_1	A30 London Road	Windsor and Maidenhead	629	466	-162	-26%	734	685	-49	-7%
332703_2	A329 London Road	Windsor and Maidenhead	418	538	120	29%	1,101	1,054	-46	-4%
319249_1	A328 Priest Hill	Windsor and Maidenhead	822	799	-23	-3%	659	656	-3	0%
343282_2	A308 Windsor Road	Windsor and Maidenhead	1,144	1,166	22	2%	896	914	19	2%

4.8 Network Hotspots and Mitigation

4.8.1 To summarise the traffic impacts identified in this study, Table 4-9 lists the junctions and sections of road which experience large vehicle delay, termed 'hotspots'. The hotspots are shown geographically in Figure 4-12, and refer to potential problems arising from the implementation of the Local Plan.

4.8.2 Please note that these do not include links already categorised, without the Local Plan in place, as operating above their theoretical capacity with Level of Service of forced or breakdown of flow (LoS D), as set out in paragraphs 4.4.11 and 4.4.16.

4.8.3 Hotspots are areas of stress where drivers are subject to considerable delay and are likely to require mitigation to facilitate any development in the local area. This could be 'hard' or 'soft' measures, or most likely a combination of both. Hard engineering measures could involve increasing the number of lanes of the carriageway or introducing a cycle lane, for example, whilst soft measures could be the implementation of a travel plan to encourage travel by sustainable modes.

4.8.4 The hotspots provide a preparatory list of where potential mitigation should be focused, to inform the borough's Infrastructure Delivery Plan (IDP) and subsequent Community Infrastructure Levy (CIL).

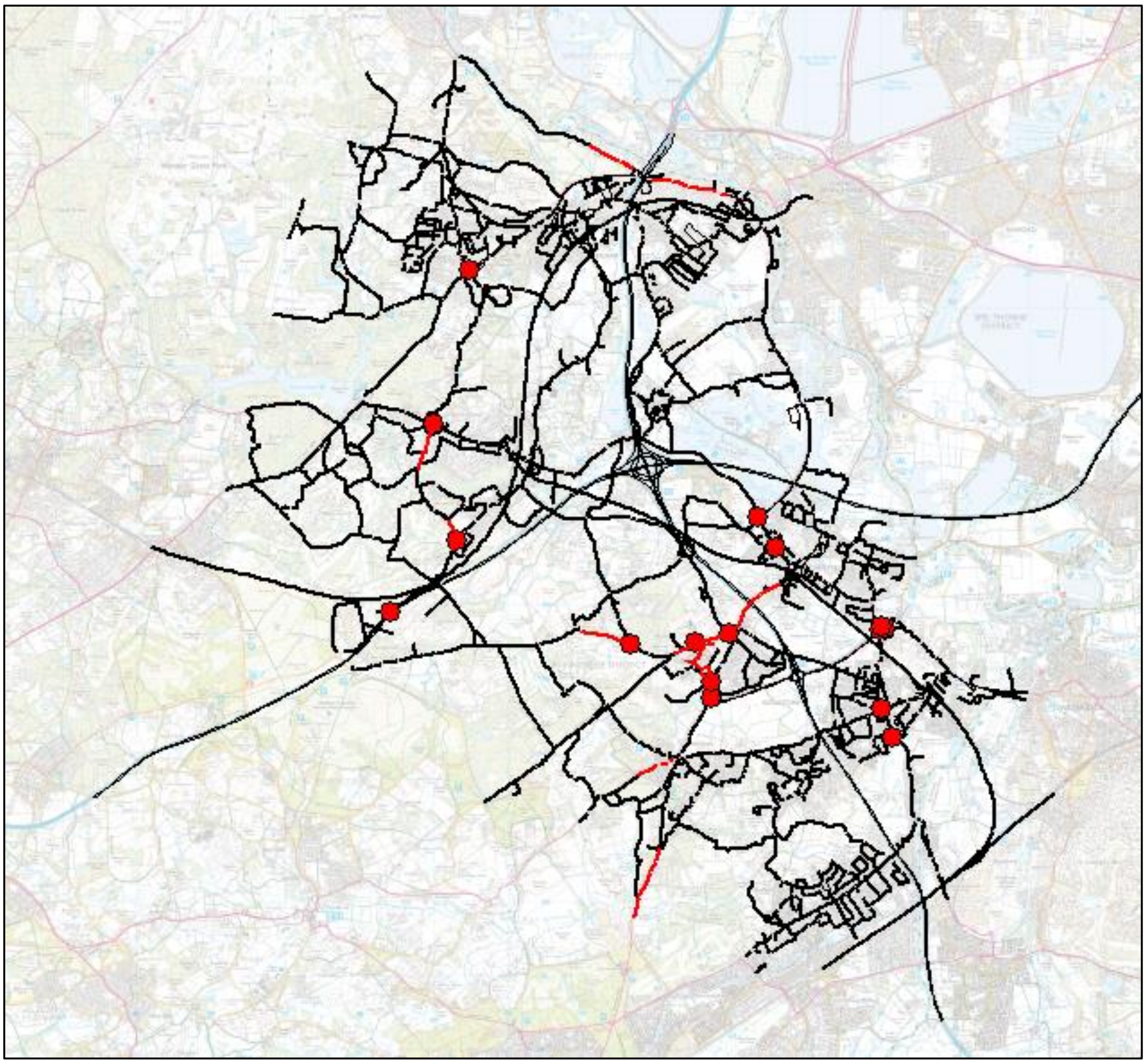
4.8.5 NOTE: in accordance with the National Planning Policy Framework all individual developments that generate significant amounts of movement should be supported by a specific Transport Statement or Transport Assessment. These are submitted as part of the planning application process.

Table 4-9 Network Hotspots

Area	Location
LINKS	
Chertsey	B386 Holloway Hill
	Pycroft Road
	Silverlands Close (St Peter's Hospital)
	A308 The Causeway
Egham	A308 The Causeway
	A308 Windsor Road
Longcross	B386 Longcross Road
Ottershaw	A319 Chobham Road
	A320 Guildford Road
Virginia Water	Wellington Avenue
JUNCTIONS	
Addlestone	A318 Brighton Road / High Street j/w B3121 Church Road / Station Road
	A318 Brighton Road / New Haw Road j/w Liberty Lane and Crockford Park Road
Chertsey	A317 Chertsey Road southbound approach to A317 St Peter's Way / A318 Chertsey Road roundabout
	A317 St Peters Way eastbound approach to j/w A318 Chertsey Road
	A317 Woburn Hill westbound approach to j/w A318 Chertsey Road
	A320 Chilsey Green Road j/w Cowley Avenue
	A320 Staines Road j/w B388 Thorpe Road, St Ann's Road and Chilsey Green Road
	B386 Holloway Hill j/w Hardwick Lane
	B386 Holloway Hill j/w St Peter's Hospital Access
	Addlestone Moor approach to A317 St Peter's Way / A318 Chertsey Road roundabout
	St Peter's Hospital Access approach to A320 Guildford Road roundabout
Englefield Green	A30 London Road j/w A328 St Jude's Road and Bakeham Lane
Longcross	Chobham Lane j/w Longcross Station (former DERA site access)

Area	Location
Lyne	B386 Longcross Road j/w Lyne Lane
Ottershaw	A320 Guildford Road j/w A320/ A317 St Peter's Way
Trumps Green	Trumps Green Road j/w Wellington Avenue
Virginia Water	B389 Christchurch Road westbound approach to j/w Callow Hill and Wellington Avenue
	Callow Hill southbound approach to j/w B389 Christchurch Rd and Wellington Avenue

Figure 4-12 Network Hotspots



4.8.6 Of notable concern is the impact of the proposed development on access to and egress from the St Peter’s Hospital, which contains a major accident and emergency department for the area. The three relatively large sites of St Peter’s Hospital, Chertsey Bittams and Longcross South aim to provide an additional 2,274 dwellings and 1,214 jobs. This, however, generates a significant number of vehicle trips, causing substantial delay on the immediate and surrounding network of St Peter’s Hospital, notably the A317 and B386. This not only gives rise to driver frustration, risk taking and can have a negative impact on other users, including bus passengers, pedestrians and cyclists, but has the potential to effect emergency vehicle access to the accident and emergency department.

4.8.7 If development is progressed at this site, it is likely that major investment will be required to mitigate against this impact and ensure that hospital emergency access is not compromised. Since, at the time of writing, no mitigation has been identified, the cumulative progression of these sites has to be classed as having the potential to have a **severe transport impact**. Unless suitable mitigation measures can be shown to resolve this issue, it is recommended that these sites are not progressed together in their current size and composition.

4.8.8 The impacts of the other development sites are not considered to be of notable concern with regards to transport. Nevertheless, given the congested nature of the roads in the borough and the resultant local impacts summarised in Table 4-9, it is advised that corridor studies, particularly on the A320, are undertaken with (but not limited to) the following objectives:

a) Optimise available highway capacity, and increase capacity where necessary and feasible;

b) Review and improve the infrastructure available for non-motorised modes of travel (walk, cycle), including access to public transport; and

c) Review and improve the bus infrastructure and services.

5 OVERVIEW OF FINDINGS

5.1.1 The potential highway impacts of Runnymede borough’s draft Regulation 19 Local Plan have been assessed using Surrey County Council’s strategic transport model for the forecast year 2036.

5.1.2 Two model scenarios have been created:

a) Scenario 1 is the Do Minimum scenario which presents a future where there is only the currently committed development in Runnymede borough. It also takes into account the nearby proposed developments at Martyrs Lane, Woking and Fairoaks Airport in Surrey Heath.

b) Scenario 2 is the Local Plan scenario. It contains all the development in Scenario 1 together with the addition of the preferred options for development as contained in the emerging Runnymede Local Plan.

5.1.3 The potential highway impacts of the draft Regulation 19 Local Plan have therefore been identified by comparing Scenario 1 Do Minimum with Scenario 2 Local Plan in Section 4.

5.1.4 Links and junctions within the borough which have been forecasted to be under stress, where drivers will be subject to considerable delay, have been defined as ‘hotspots’. These hotspots, set out in Section 4.8, are likely to require mitigation to reduce the impact of any development in the local area, and provide a preparatory list to inform the borough’s Infrastructure Delivery Plan (IDP) and subsequent Community Infrastructure Levy (CIL).

5.2 Key Points

5.2.1 The primary impacts of the Runnymede borough’s draft Regulation 19 Local Plan on the highway network can be summarised as follows:

1) As would be expected, the worst increases in link flows and junction delay, arising from the Local Plan, are found on routes which surround the proposed new development sites. Of most concern is the area surrounding St Peter’s Hospital.
2) Runnymede borough, including the motorways, is subject to congestion. Any increase in vehicle trips at a local level results in rerouting, particularly causing longer distance trips to alter their motorway junctions for local origins and destinations. The additional congestion in the St Peter’s Hospital area is causing these longer distance trips to reroute away from junction 11 of the M25 to avoid the substantial delay here.
3) The AM peak hour is most sensitive to vehicles altering their routes to avoid local congestion.
4) Changes in traffic flow arising from the Local Plan are considered marginal at Runnymede borough’s border with neighbouring authorities.

5.2.2 The greatest concern is the impact on the St Peter’s Hospital area. The increase in vehicle trips, primarily from the development sites of St Peter’s Hospital, Chertsey Bittams and nearby Longcross South, create substantial increases in delay in this area, which could compromise emergency vehicle access to and egress from the Hospital.

5.2.3 If development is progressed at this site, it is likely that major investment will be required to mitigate against this impact and ensure that hospital emergency access is not compromised. Since, at the time of writing, no mitigation has been identified, the cumulative progression of these sites has to be classed as having the potential to have a **severe transport impact**. Unless suitable mitigation measures can be shown to resolve this issue, it is recommended that these sites are not progressed together in their current size and composition.

6 APPENDIX

6.1 SINTRAM72 Latent Demand

Table 6-1 Latent Demand by Scenario and Time Period for Car Users

Mode	Car_User		
Sum of Trips	**Column Labels**		
Row Labels	**AM_Av_Hourly**	**IP_Av_Hourly**	**PM_Av_Hourly**
Latent Demand [2036_DM_Demand_Latent]			
home_education	1,364,154	204,402	77,376
home_empbusiness	394,548	105,087	60,277
home_other	752,246	1,216,123	1,085,658
home_shop	587,580	916,427	792,761
home_visit	341,266	523,689	493,997
home_work	3,613,341	370,071	346,919
NHBEB	178,846	318,148	127,923
NHBO	398,097	662,095	480,962
Latent Demand [2036_DM_Demand_Latent] Total	**7,630,078**	**4,316,042**	**3,465,873**
Latent Demand [2036_S1_Demand_Latent]			
home_education	1,369,759	205,242	77,694
home_empbusiness	395,538	105,351	60,428
home_other	752,881	1,217,150	1,086,574
home_shop	586,531	914,791	791,347
home_visit	342,216	525,146	495,372
home_work	3,628,085	371,581	348,334
NHBEB	179,143	318,677	128,135
NHBO	399,692	664,748	482,889
Latent Demand [2036_S1_Demand_Latent] Total	**7,653,845**	**4,322,686**	**3,470,773**
Latent Demand [2036_S2_Demand_Latent]			
home_education	1,370,057	205,286	77,711
home_empbusiness	395,533	105,350	60,427
home_other	752,906	1,217,191	1,086,611
home_shop	586,547	914,816	791,368
home_visit	342,266	525,223	495,444
home_work	3,628,618	371,636	348,386
NHBEB	179,149	318,688	128,139
NHBO	399,718	664,791	482,920
Latent Demand [2036_S2_Demand_Latent] Total	**7,654,794**	**4,322,981**	**3,471,006**

Table 6-2 Non-Incremental Changes for Scenarios 1 & 2 – All Modes and Time Periods

PA		Production					
Sum of Future Trips		Column Labels					
		S1 Greenfield Change			S2 Greenfield Change		
Row Labels	Zone Name	Active	Car_User	Public Transport	Active	Car_User	Public Transport
673	Longcross Railway Station	524	1847	103	521	1856	104
677	Land at Dashwood Lang Road, Bourne Business Park	24	152		24	153	
680	Chertsey Bittams A, B, C, D, E				75	243	27
811	Fairoaks	294	1148	49	294	1148	49
1068	Martyr's Lane	423	1583	70	423	1582	70
1600	Longcross South				197	699	
634	Crockford Open Space Car Park	503	551		501	551	
679	Former Brunel University	71	84		70	83	
631	St Peters Hospital					153	
678	LAND AT Hanworth Lane					57	
681	Virginia Water South					21	
1599	Ottershaw East					25	
Grand Total		1839	5365	222	2105	6571	250

Table 6-3 S1 Greenfield Changes for Selected Trip Purposes (SINTRAM72 Zones)

Scenario	PA	Purpose	Mode	Car Availabil	Zone	Base Trips	Future Trips
S1 Greenfield Change	Production	HB_Work	Car_User	CA_All	673	-	40
S1 Greenfield Change	Production	HB_Work	Car_User	CA_All	811	-	436
S1 Greenfield Change	Production	HB_Work	Car_User	CA_All	1,068	-	581
S1 Greenfield Change	Attractions	HB_Work	Car_User	CA_All	673	42	965
S1 Greenfield Change	Attractions	HB_Work	Car_User	CA_All	677	2	159
S1 Greenfield Change	Production	HB_Work	Public_Transport	NCA_All	811	-	25
S1 Greenfield Change	Production	HB_Work	Public_Transport	NCA_All	1,068	-	32
S1 Greenfield Change	Attractions	HB_Work	Public_Transport	NCA_All	673	-	30
S1 Greenfield Change	Production	HB_Work	Active	NCA_All	811	-	47
S1 Greenfield Change	Production	HB_Work	Active	NCA_All	1,068	-	63
S1 Greenfield Change	Production	HB_Shopping	Car_User	CA_All	811	-	185
S1 Greenfield Change	Production	HB_Shopping	Car_User	CA_All	1,068	-	255
S1 Greenfield Change	Attractions	HB_Shopping	Car_User	CA_All	634	46	175
S1 Greenfield Change	Attractions	HB_Shopping	Car_User	CA_All	673	9	196
S1 Greenfield Change	Attractions	HB_Shopping	Public_Transport	NCA_All	673	-	75
S1 Greenfield Change	Production	HB_Shopping	Active	NCA_All	811	-	66
S1 Greenfield Change	Production	HB_Shopping	Active	NCA_All	1,068	-	91
S1 Greenfield Change	Attractions	HB_Shopping	Active	NCA_All	634	16	80
S1 Greenfield Change	Production	HB_Education	Car_User	CA_All	811	-	119
S1 Greenfield Change	Production	HB_Education	Car_User	CA_All	1068	-	181
S1 Greenfield Change	Attractions	HB_Education	Car_User	CA_All	673	9	512
S1 Greenfield Change	Production	HB_Education	Public_Transport	NCA_All	811	-	24
S1 Greenfield Change	Production	HB_Education	Public_Transport	NCA_All	1,068	-	38
S1 Greenfield Change	Attractions	HB_Education	Public_Transport	NCA_All	673	-	21
S1 Greenfield Change	Production	HB_Education	Active	NCA_All	811	-	68
S1 Greenfield Change	Production	HB_Education	Active	NCA_All	1,068	-	112
S1 Greenfield Change	Production	HB_Other	Car_User	CA_All	673	-	21
S1 Greenfield Change	Production	HB_Other	Car_User	CA_All	811	-	254
S1 Greenfield Change	Production	HB_Other	Car_User	CA_All	1,068	-	351
S1 Greenfield Change	Attractions	HB_Other	Car_User	CA_All	634	33	83
S1 Greenfield Change	Attractions	HB_Other	Car_User	CA_All	653	20	209
S1 Greenfield Change	Attractions	HB_Other	Car_User	CA_All	673	2	61
S1 Greenfield Change	Attractions	HB_Other	Car_User	CA_All	679	-	33
S1 Greenfield Change	Production	HB_Other	Active	NCA_All	811	-	77
S1 Greenfield Change	Production	HB_Other	Active	NCA_All	1,068	-	106
S1 Greenfield Change	Attractions	HB_Other	Active	NCA_All	634	12	49

Table 6-4 S2 Greenfield Changes for Selected Trip Purposes (SINTRAM72 Zones)

Scenario	PA	Purpose	Mode	Car Availabil	Zone	Base Trips	Future Trips
S2 Greenfield Change	Production	HB_Work	Car_User	CA_All	631	28	83
S2 Greenfield Change	Production	HB_Work	Car_User	CA_All	673	-	40
S2 Greenfield Change	Production	HB_Work	Car_User	CA_All	678	-	36
S2 Greenfield Change	Production	HB_Work	Car_User	CA_All	680	-	85
S2 Greenfield Change	Production	HB_Work	Car_User	CA_All	681	-	21
S2 Greenfield Change	Production	HB_Work	Car_User	CA_All	811	-	436
S2 Greenfield Change	Production	HB_Work	Car_User	CA_All	1,068	-	581
S2 Greenfield Change	Production	HB_Work	Car_User	CA_All	1,599	-	25
S2 Greenfield Change	Production	HB_Work	Car_User	CA_All	1,600	-	262
S2 Greenfield Change	Attractions	HB_Work	Car_User	CA_All	673	83	965
S2 Greenfield Change	Attractions	HB_Work	Car_User	CA_All	677	4	159
S2 Greenfield Change	Production	HB_Work	Public_Transport	NCA_All	680	-	27
S2 Greenfield Change	Production	HB_Work	Public_Transport	NCA_All	811	-	25
S2 Greenfield Change	Production	HB_Work	Public_Transport	NCA_All	1,068	-	32
S2 Greenfield Change	Attractions	HB_Work	Public_Transport	NCA_All	673	-	30
S2 Greenfield Change	Production	HB_Work	Active	NCA_All	811	-	47
S2 Greenfield Change	Production	HB_Work	Active	NCA_All	1,068	-	63
S2 Greenfield Change	Production	HB_Work	Active	NCA_All	1,600	-	33
S2 Greenfield Change	Production	HB_Shopping	Car_User	CA_All	631	6	30
S2 Greenfield Change	Production	HB_Shopping	Car_User	CA_All	680	-	42
S2 Greenfield Change	Production	HB_Shopping	Car_User	CA_All	811	-	185
S2 Greenfield Change	Production	HB_Shopping	Car_User	CA_All	1,068	-	255
S2 Greenfield Change	Production	HB_Shopping	Car_User	CA_All	1,600	-	106
S2 Greenfield Change	Attractions	HB_Shopping	Car_User	CA_All	634	49	165
S2 Greenfield Change	Attractions	HB_Shopping	Car_User	CA_All	673	39	222
S2 Greenfield Change	Attractions	HB_Shopping	Public_Transport	NCA_All	673	3	77
S2 Greenfield Change	Production	HB_Shopping	Active	NCA_All	680	-	22
S2 Greenfield Change	Production	HB_Shopping	Active	NCA_All	811	-	66
S2 Greenfield Change	Production	HB_Shopping	Active	NCA_All	1,068	-	91
S2 Greenfield Change	Production	HB_Shopping	Active	NCA_All	1,600	-	42
S2 Greenfield Change	Attractions	HB_Shopping	Active	NCA_All	634	17	71
S2 Greenfield Change	Production	HB_Education	Car_User	CA_All	680	-	37
S2 Greenfield Change	Production	HB_Education	Car_User	CA_All	811	-	119
S2 Greenfield Change	Production	HB_Education	Car_User	CA_All	1,068	-	181
S2 Greenfield Change	Production	HB_Education	Car_User	CA_All	1,600	-	72
S2 Greenfield Change	Attractions	HB_Education	Car_User	CA_All	630	-	40

Table 6-5 Trip Productions by Scenario - with and without External (EE) Trips

Row Labels	All Day Av Hourly Trip Productions (no EE)	All Day Av Hours Total Trip Productions
Latent Demand[2036_DM_Demand_Latent]		
home_education	213,618	8,149,807
home_empbusiness	32,847	1,338,091
home_other	235,952	10,154,939
home_shop	190,359	8,207,482
home_visit	108,831	4,700,510
home_work	387,681	13,719,132
NHBEB	45,767	1,672,302
NHBO	177,794	7,159,925
Latent Demand[2036_DM_Demand_Latent] Total	**1,392,849**	**55,102,188**
Latent Demand[2036_S1_Demand_Latent]		
home_education	214,417	8,148,753
home_empbusiness	33,082	1,340,850
home_other	236,132	10,143,879
home_shop	190,788	8,180,286
home_visit	109,270	4,708,668
home_work	388,868	13,730,199
NHBEB	46,870	1,677,748
NHBO	182,138	7,180,186
Latent Demand[2036_S1_Demand_Latent] Total	**1,401,565**	**55,110,569**
Latent Demand[2036_S2_Demand_Latent]		
home_education	215,098	8,150,144
home_empbusiness	33,060	1,340,796
home_other	236,098	10,144,105
home_shop	191,035	8,180,980
home_visit	109,319	4,709,148
home_work	389,240	13,732,610
NHBEB	46,927	1,677,879
NHBO	182,210	7,180,432
Latent Demand[2036_S2_Demand_Latent] Total	**1,402,987**	**55,116,094**

6.2 Local Model Vehicle Demand

Table 6-6 Vehicle Matrix Trip Numbers and Growth Relative to 2036 Do Minimum

	2014_Ref		2036_DM		2036_S1		2036_S2	
Row Labels	**Average of Relative to DM**	**Sum of Trips**	**Average of Relative to DM**	**Sum of Trips**	**Average of Relative to DM**	**Sum of Trips**	**Average of Relative to DM**	**Sum of Trips**
All_Purposes, Car, AM_Peak_Hour_8_9, All_Users	0.89	87,262	1.00	97,863	1.02	99,463	1.02	99,830
All_Purposes, Car, IP_Av_Hourly, All_Users	0.91	60,582	1.00	66,891	1.03	69,067	1.04	69,710
All_Purposes, Car, PM_Peak_Hour_5_6, All_Users	0.85	78,751	1.00	92,598	1.02	94,767	1.03	95,022
All_Purposes, HGV, AM_Peak_Hour_8_9, All_Users	1.00	4,211	1.00	4,229	0.99	4,204	0.99	4,190
All_Purposes, HGV, IP_Av_Hourly, All_Users	0.97	6,512	1.00	6,699	1.00	6,667	1.00	6,678
All_Purposes, HGV, PM_Peak_Hour_5_6, All_Users	0.96	2,442	1.00	2,537	1.00	2,533	1.00	2,530
All_Purposes, LGV, AM_Peak_Hour_8_9, All_Users	0.87	31,950	1.00	36,926	1.00	36,787	0.99	36,731
All_Purposes, LGV, IP_Av_Hourly, All_Users	0.62	28,970	1.00	46,870	0.99	46,594	0.99	46,577
All_Purposes, LGV, PM_Peak_Hour_5_6, All_Users	0.85	20,521	1.00	24,272	1.00	24,173	1.00	24,178
Grand Total	**0.88**	**321,201**	**1.00**	**378,885**	**1.01**	**384,255**	**1.01**	**385,446**

Figure 6-1 AM Peak Hour Car Trip Ends: S1 v DM – Main Sites

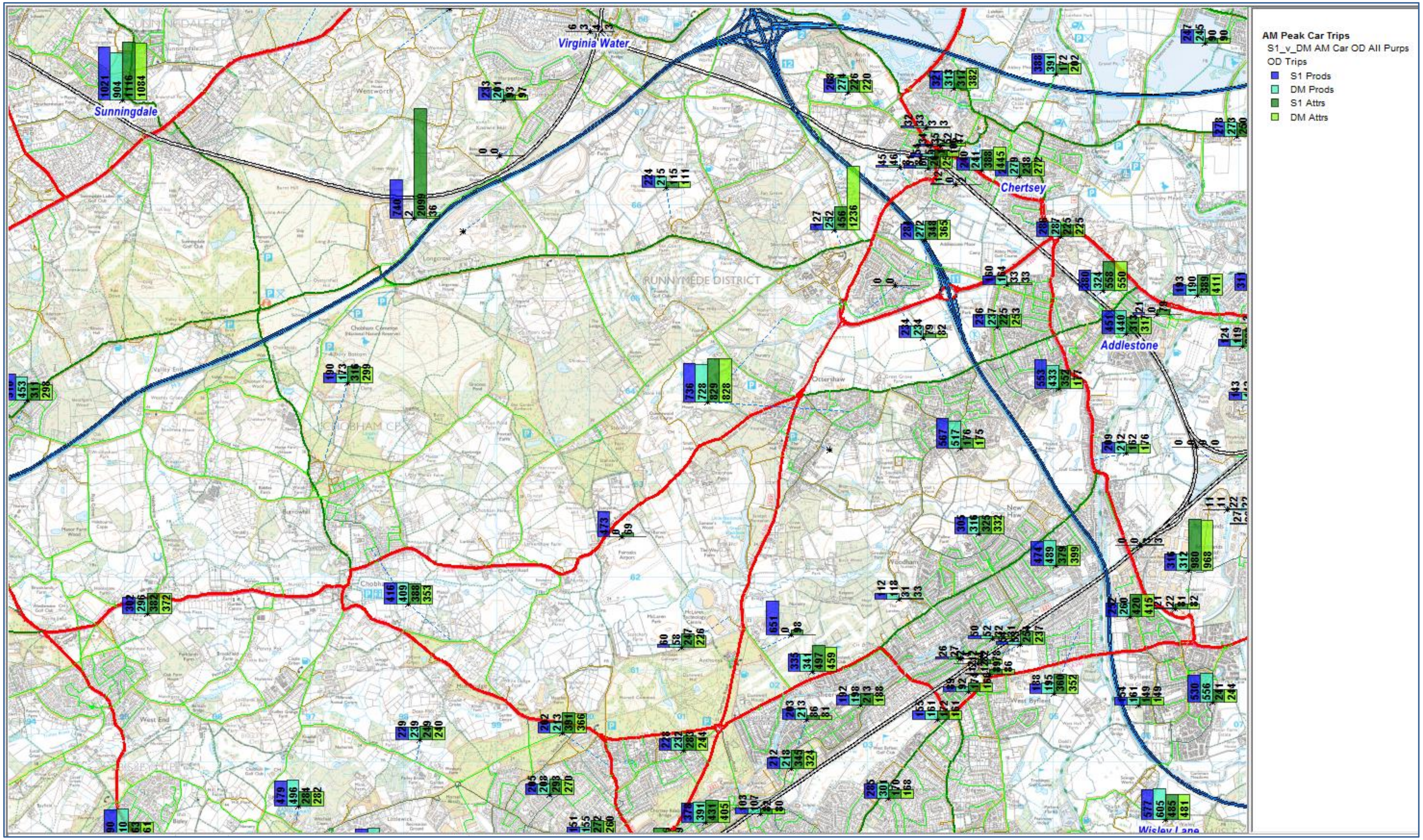


Figure 6-2 PM Peak Hour Car Trip Ends: S1 v DM – Main Sites

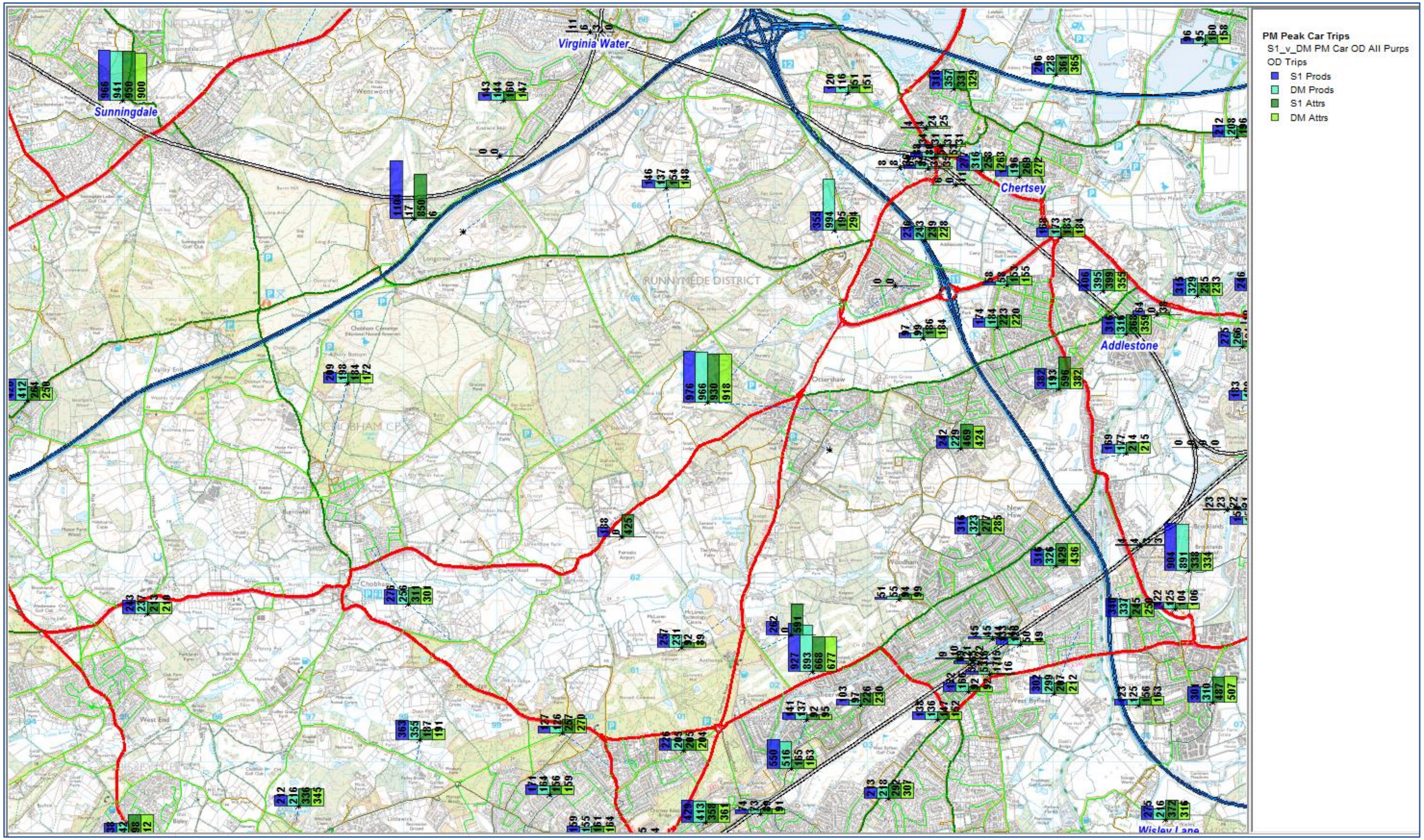


Figure 6-3 AM Peak Hour Car Trip Ends: S1 v DM – Non-Motorway Roads

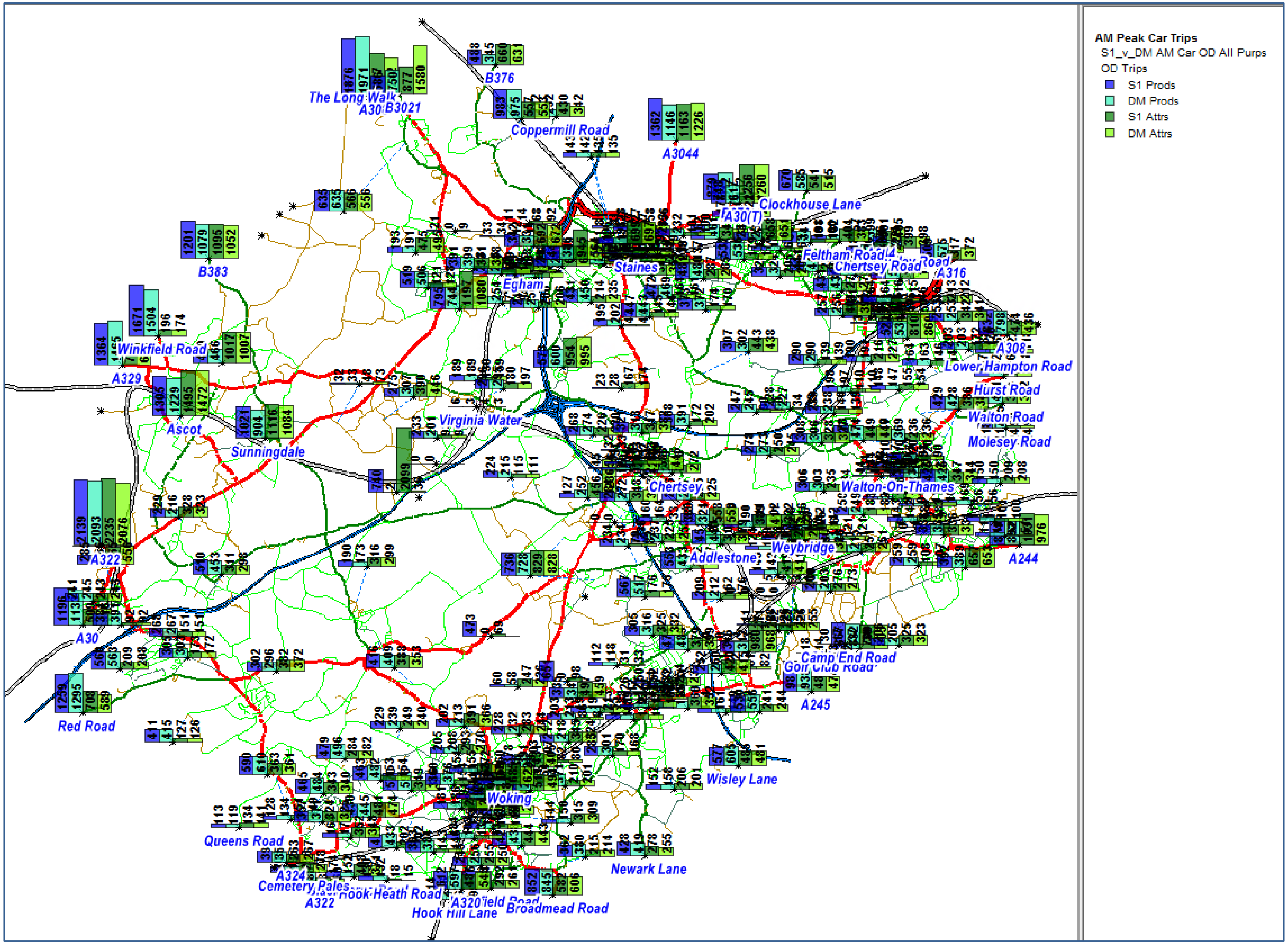


Figure 6-4 AM Peak Hour Car Trip Ends: S1 v DM – Motorway Roads

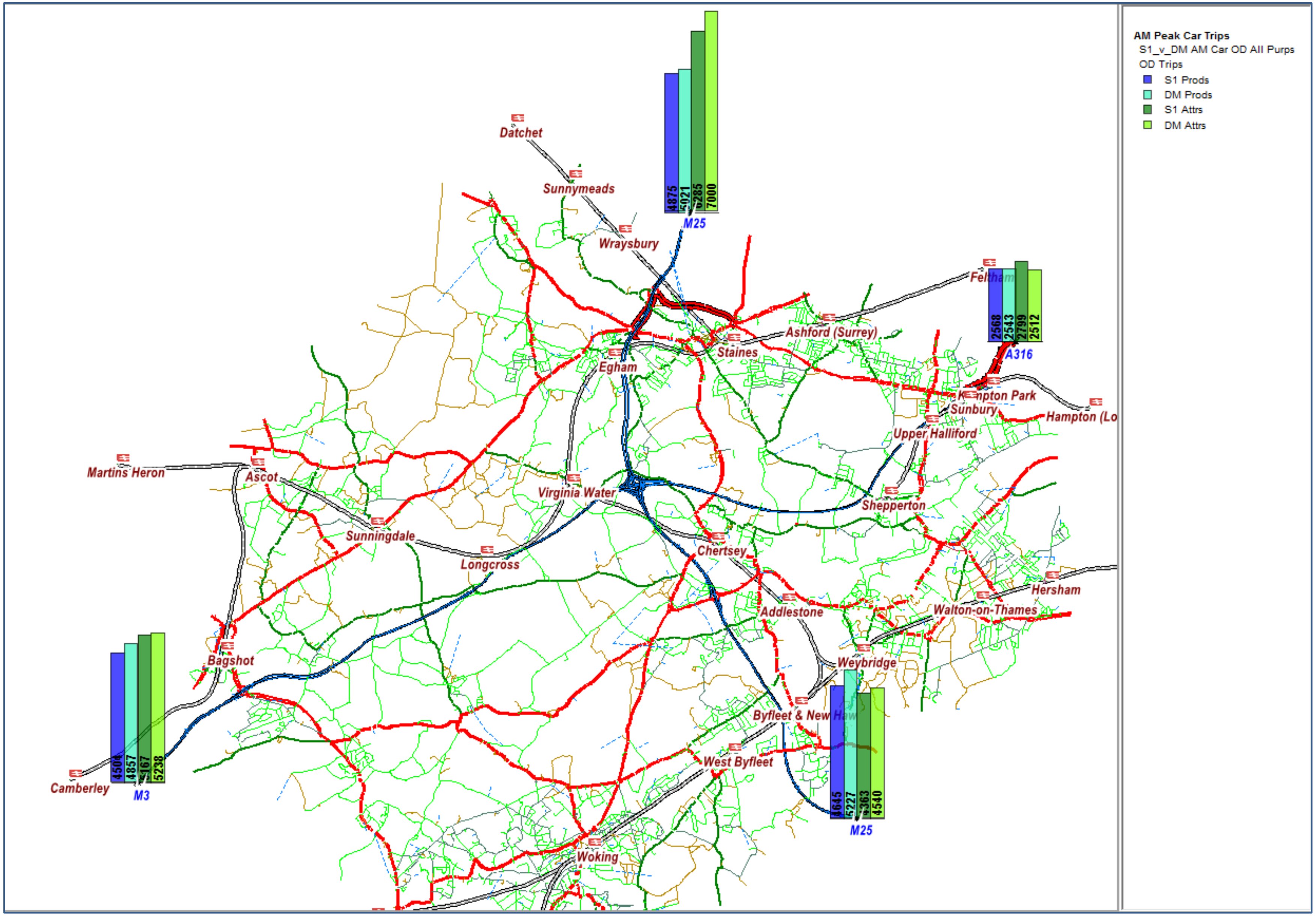
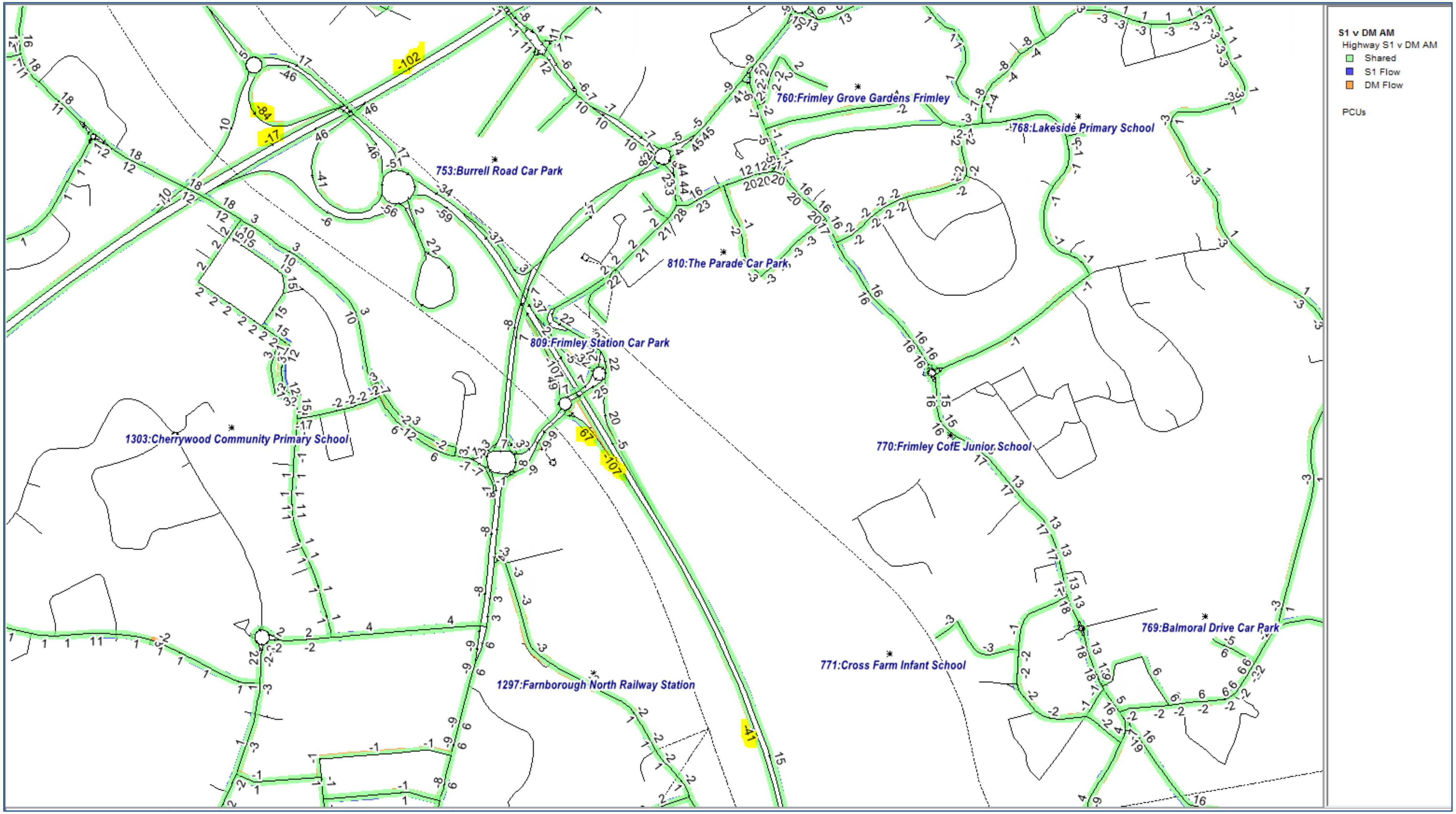


Figure 6-5 Changes in All Vehicle AM Peak Hour Flows Near M3 Southern Cordon Point



6.3 Link Capacities

Figure 6-6 Link Capacities: Grouped Values as Bandwidths