Technical Note 7 – Sustainable Accessibility Ranking, Mapping & Analysis

13th July 2016 – Final (Updated with additional / modified SLAA sites)

1. Introduction

A meeting was held at Epping Forest District Council (EFDC) offices on 9th December 2014 to discuss the sustainable travel element of a transport evidence base for the District's Local Plan. A brief of work was subsequently drawn up to undertake the following:

- Rank the latest Strategic Land Availability Assessment (SLAA) development site locations (as of July 2016) based on their level of sustainable accessibility

In total, 354 residential development sites were identified for inclusion in the assessment. These sites comprised of developments in excess of 25 units. Smaller developments were understood to be under consideration by the District Council but would not be modelled as part of the study. Employment sites would be the subject of a separate study using a different method of appraisal.

At a follow-up meeting held on the 17th February 2015, it was suggested that the results of the sustainable accessibility work should then be considered alongside the earlier junction capacity modelling (as reported in Technical Note 4 – June 2014). This would then present an appraisal of Epping Forest District's latest SLAA site allocation, taking into account opportunities to reduce the impact of traffic growth via sustainable travel means.

This technical note is therefore presented in two parts. The first documents the methodology used to rank the SLAA sites on sustainable accessibility, whilst the second reappraises the future traffic impact on key junctions in the District with more focussed consideration of the potential for adopting sustainable initiatives as a mitigating measure.

2. Part One: Sustainable Accessibility Ranking

This sustainability study develops on the accessibility planning work documented in Technical Note 6 (TN6) – Dec 2014. Mapped datasets assembled for the earlier study have been utilised again for this latest work. However, it should be pointed out that outputs contained within TN6 have been superseded by this latest study following the significant increase in the number of SLAA sites assessed, and an effort made to develop a more quantified weighting/scoring system.

For ease of reference, a summary of findings is presented at the start of this section. This is then followed by a detailed description of the methodology used in the development of the ranking and scoring system.

2.1 Summary of Findings

Complete ranked tables of 354 potential residential SLAA sites have been produced to accompany this technical note. Site rankings have been based on the combined existing and potential levels of sustainable accessibility at the SLAA site locations.

A summary of findings from the site ranking process is presented below.

- Loughton contains the largest number of SLAA sites with a high level of sustainable accessibility. This is due to:
  - The close proximity of Loughton and Debden London Underground stations
  - The comparatively high number of schools and GP surgeries spread across the local area
  - The proximity of Loughton town centre
  - The frequent and direct bus services that connect the residential areas of Loughton/Debden to the town centre and tube stations
  - The existing propensity for local residents to travel to work via modes other than car/van

Figure 1 - Average level of existing and potential sustainable accessibility achieved by SLAA sites in towns and villages in Epping Forest District

- Urban areas of Debden, Buckhurst Hill, Theydon Bois and Epping also house multiple SLAA sites that are considered to have a high level of sustainable accessibility.

- With reference to Figure 1 above, these towns and suburbs, along with Chigwell and Waltham Abbey both have good levels of sustainable access in place, but would likely benefit from bus route extensions and/or improved walking and cycling links to realise the potential for sustainable transport uptake.
- SLAA sites located in towns and large villages in rural areas of Epping Forest District might expect to have limited sustainable accessibility. These sites are likely to have access to peak hour bus services, but may be located considerable distances from town centres, rail/tube stations and secondary schools. Consequently, developments on SLAA sites in these areas may still expect to generate car/van trip rates typical of a rural location.
- Of the towns and villages deemed to have a current limited level of sustainable accessibility, Chipping Ongar and North Weald Bassett have the largest existing populations to facilitate the provision of additional sustainable transport infrastructure. In North Weald Bassett this could include a Park and Ride service to Epping station, whilst improved bus services between Chipping Ongar and Brentwood could be linked to wider Crossrail access.
- SLAA sites located in small rural villages in Epping Forest District are shown in the study to have the lowest level of sustainable accessibility. These include sites in: Willingdale, Moreton, Fyfield and Stapleford Abbotts.
  SLAA sites in these areas are likely to have low potential for encouraging uptake in sustainable travel options given their location away from town centres, local services and rail/tube stations. At the same time, the economic viability of providing better sustainable travel infrastructure in these villages will be limited, given the comparative sparseness of the rural population.
- In this assessment a positive correlation was assumed between the quantum of development at a proposed SLAA site and the potential for encouraging sustainable travel uptake – either through improved bus services or targeted travel planning for example. Discussions with Essex County Council's Passenger Transport team determined levels of development estimated in the region of 400-600 dwellings[1] as appropriate to facilitate provision of a new bus service.
- All but one of five top ranked sites shown below for sustainable access potential have large quantities of development proposed and score highly on the assumption that better bus accessibility will be developed to accommodate potential demand. For this

[1] Provision of a bus service would be dependent on site location both in regard to general services and the rest of the bus network, social mix, design of the development etc. Isolated developments in rural areas would be less likely to sustain a service than those on the edge of town. It should also be noted that a small development (20 to 30 houses) could support a change to an existing bus service (i.e. looping through the estate and re-joining the existing route) if required resources were limited to kick-starting and marketing/publicity for example.

assumption to be realised, it will be important to engage with local commercial bus companies at the planning stage.

Site	Approximate Capacity	Area	Site Description	Nearest Peak Hour Bus Services
SR-0372	855	Waltham Abbey	Land west of Woodgreen Road, including Southend Lane and Skillet Hill Farm	66 (2) - EOS
SR-0332	846	Waltham Abbey	Waltham Abbey, North East Area	213 - Regal Busways
SR-0065	685	Waltham Abbey	Land south of Honey Lane, north of M25 and west of Junction 26 of M25	66 (2) - EOS
SR-0158a	600	North Weald Bassett	Land at North Weald Bassett, South of Vicarage Lane	419 (4) - Trusty Bus 420 (2) Trusty Bus
SR-0113a	200	Epping	Land South of Brook Road, Epping	-

Table 1 – 5 of the joint top ranked sites for sustainable accessibility potential

Whilst mapped 2011 Census data illustrates a general correlation between lower car ownership and lower journey-to-work trips made by car/van, it was noted that large areas of Epping and Loughton have below-average proportions of journey-to-work trips made by car/van, despite higher than average levels of car ownership. This is likely due to the comparatively high proportion of commuter trips made via the Central Line into London, and suggests that Tube travel remains favourable amongst local commuters into London - irrespective of their level of affluence.

2.2 Methodology: Sustainable Accessibility Weighting

Step 1: Derive and weigh measurements of sustainable accessibility:

The indicators of sustainable accessibility, along with the weighting system adopted for this study, have been structured around a number of the sub-objectives contained within the WebTAG Appraisal Summary Table (AST).[2]

AST Objective	AST Sub-Objectives	Interpretation for Accessibility Appraisal	Ref No.
Economy	Business users & transport providers	Typical commuter journey time	1
	Reliability impact on Business users	Commuter journey time reliability	2
Environment	Noise	Noise and air quality linked to vehicle flow and congestion	3
	Local air quality		
Social	Commuting and Other users	Typical non-commuter journey time	4
	Reliability impact on Commuting and Other users	Non-commuter journey time reliability	5
	Physical activity	Physical activity related to walking/cycling	6
	Access to services	Access to local services (shops, schools, GP's etc.)	7

[2] https://www.gov.uk/government/publications/webtag-appraisal-tables

Table 2 – Measurement of sustainable accessibility linked to WebTAG Appraisal Summary Table Sub-Objectives

Each measurement of sustainable accessibility has been given a weighted score based on perceived importance – as shown in Table 3 below. It should be noted that this weighting can be changed to alter the overall scores for each SLAA site.

Weighting		
Appraisal objectives	**Ref No.**	**Weighting**
Economy		
Typical commuter journey time	1	10.0
Commuter journey time reliability	2	30.0
Environment		
Noise and air quality linked to vehicle flow and congestion	3	10.0
Social (health, education etc.)		
Typical non-commuter journey time	4	10.0
Non-commuter journey time reliability	5	10.0
Physical activity related to walking/cycling	6	15.0
Access to local services	7	15.0
	Total	**100.0**

Table 3 – Weighted score for each SA Measurement

Step 2: Determine a list of 'indicators' of sustainable accessibility:

A list of indicators used to appraise each SLAA site has subsequently been drawn up and is shown in Table 4 below. Each indicator can be linked to one or more sustainable accessibility measurements as referenced in Table 2.

	Indicators	Appraisal (AST) objectives addressed
	Walking distance to nearest bus stop (with at least peak hourly day service)	1, 4, 7
Rail access	Distance to nearest rail/tube station	1, 2, 4, 5
	Bus service frequency to rail/tube station (av. per hr of AM & PM peaks)	2, 5
	Typical bus journey time to nearest rail/tube station	1, 4
Town access	Distance to nearest town centre	1, 2, 4, 5, 7
	Bus service frequency to town centre (av. per hr of AM & PM peaks)	2, 5, 7
	Typical bus journey time to town centre	1, 4
Health access	Distance to nearest GP surgery	4, 5, 7
	Bus service frequency to nearest GP surgery (av. per hr of AM & PM peaks)	5, 7
	Typical bus journey time to nearest GP surgery	4
Education access	Distance to nearest nursery/pre-school	4, 5, 7
	Distance to nearest infant/primary school	4, 5, 7
	Distance to nearest secondary school	4, 5, 7
	Bus service frequency to nearest secondary school	5, 7
	Proximity of bus route to nearest secondary school	4, 7
Ped / Cycle access	Current level of cycle access to/from LP site	3, 6, 7
	Current level of pedestrian facilities in vicinity of LP site	3, 6, 7
Traffic Impact	Proximity of LP site access to an identified key congested junction	2, 3, 5
	Scale of peak hour congestion expected in vicinity of site	2, 3, 5
	Existing local residents' propensity to drive to work based on 2011 Census	N/A
Potential	Distance to nearest bus route if no nearby bus stop (assuming potential for new stop to be added)	1, 4, 7
	Potential to direct bus services to serve LP development (based on proximity of nearest bus route and size of site)	1, 2, 4, 5, 7
	Potential for better public transport serviced to/from site (based on size of development proposed)	1, 2, 4, 5, 7
	Potential for encouraging cycle use to/from LP site (based on proximity of local services)	3, 6, 7
	Potential for encouraging walking to/from LP site (based on proximity of local services)	3, 6, 7

Table 4 – Indicators of sustainable accessibility linked to AST objective measurements

Step 3: Calculate an overall score for each indicator:

With reference to Table 5 below, a score has then been calculated for each indicator from the sum of the weighted scores of sustainability measurements that each indicator can be attributed to. For example, the indicator ‘Walking distance to nearest bus stop’ can be attributed to the measurement of ‘Typical Commuter Journey Time’, ‘Typical Non-Commuter Journey Time’ and ‘Access to Local Services’.

	Indicators	Indicator Score	Weighting Factor
	Walking distance to nearest bus stop (with at least peak hourly day service)	35	0.94
Rail access	Distance to nearest rail/tube station	60	1.61
	Bus service frequency to rail/tube station (av. per hr of AM & PM peaks)	40	1.07
	Typical bus journey time to nearest rail/tube station	20	0.54
Town access	Distance to nearest town centre	75	2.01
	Bus service frequency to town centre (av. per hr of AM & PM peaks)	55	1.47
	Typical bus journey time to town centre	20	0.54
Health access	Distance to nearest GP surgery	35	0.94
	Bus service frequency to nearest GP surgery (av. per hr of AM & PM peaks)	25	0.67
	Typical bus journey time to nearest GP surgery	10	0.27
Education access	Distance to nearest nursery/pre-school	35	0.94
	Distance to nearest infant/primary school	35	0.94
	Distance to nearest secondary school	35	0.94
	Bus service frequency to nearest secondary school	25	0.67
	Proximity of bus route to nearest secondary school	25	0.67
Ped / Cycle access	Current level of cycle access to/from LP site	40	1.07
	Current level of pedestrian facilities in vicinity of LP site	40	1.07
Traffic Impact	Proximity of LP site access to an identified key congested junction	50	1.34
	Scale of peak hour congestion expected in vicinity of site	50	1.34
	Existing local residents' propensity to drive to work based on 2011 Census	37	1.00
Potential	Distance to nearest bus route if no nearby bus stop (assuming potential for new stop to be added)	35	1.32
	Potential to direct bus services to serve LP development (based on proximity of nearest bus route and size of site)	75	2.83
	Potential for better public transport serviced to/from site (based on size of development proposed)	75	2.83
	Potential for encouraging cycle use to/from LP site (based on proximity of local services)	40	1.51
	Potential for encouraging walking to/from LP site (based on proximity of local services)	40	1.51

Table 5 – Indicator scores and weighting factors used in the SLAA site accessibility scoring

Step 4: Calculate a weighting factor for each indicator:

The score for each indicator has then been used to calculate weighting factors to be applied to the scoring of each SLAA site. Weighting factors have been determined by normalising scores around an average of 1.00 (representing a score of 37.4).

Site potential indicators:

Site ‘potential’ indicators have been included in the assessment to ensure that SLAA sites with no pre-existing sustainable travel facilities are not scored poorly on sustainable accessibility if there is a possibility that such developments, once built, would facilitate the provision and/or encourage the uptake of sustainable travel modes.

Weighting factors have been calculated separately for the five site ‘potential’ indicators and the resultant values have been doubled to help provide a better balance to the scoring system. Through iterative testing of the weighting system, a double weighting applied to these indicators was shown to offer the best means of redressing subsequent poor scores in the evaluation of existing sustainable accessibility.

2.3 Methodology: Sustainable Accessibility Scoring

Each SLAA site has been scored under the 25 sustainable accessibility indicators listed in Table 5 above. The basic scoring system assigns 0, 10, or 20 points under each indicator based on the criteria outlined in Table 6 below.

	Indicators	Score System
	Walking distance to nearest bus stop (with at least peak hourly day service)	>1km = 0 points, 400-1000m = 10 points, <400m = 20 points
Rail access	Distance to nearest rail/tube station	>4km = 0 points, 1-4km = 10 points, <1km = 20 points
	Bus service frequency to rail/tube station (av. per hr of AM & PM peaks)	0 = 0 points, 1-2 = 10 points, 3+ = 20 points
	Typical bus journey time to nearest rail/tube station	>30 mins = 0 points, 15-30 mins = 10 points, <15 mins = 20 points
Town access	Distance to nearest town centre	>4km = 0 points, 1-4km = 10 points, <1km = 20 points
	Bus service frequency to town centre (av. per hr of AM & PM peaks)	0 = 0 points, 1-2 = 10 points, 3+ = 20 points
	Typical bus journey time to town centre	>30 mins = 0 points, 15-30 mins = 10 points, <15 mins = 20 points
Health access	Distance to nearest GP surgery	>4km = 0 points, 1-4km = 10 points, <1km = 20 points
	Bus service frequency to nearest GP surgery (av. per hr of AM & PM peaks)	0 = 0 points, 1-2 = 10 points, 3+ = 20 points
	Typical bus journey time to nearest GP surgery	>30 mins = 0 points, 15-30 mins = 10 points, <15 mins = 20 points
Education access	Distance to nearest nursery/pre-school	>4km = 0 points, 1-4km = 10 points, <1km = 20 points
	Distance to nearest infant/primary school	>4km = 0 points, 1-4km = 10 points, <1km = 20 points
	Distance to nearest secondary school	>4km = 0 points, 1-4km = 10 points, <1km = 20 points
	Bus service frequency to nearest secondary school	0 = 0 points, 1-2 = 10 points, 3+ = 20 points
	Proximity of bus route to nearest secondary school	>1km = 0 points, 400-1000m = 10 points, <400m = 20 points
Ped / Cycle access	Current level of cycle access to/from LP site	none = 0 points, limited = 10 points, good = 20 points
	Current level of pedestrian facilities in vicinity of LP site	none = 0 points, limited = 10 points, good = 20 points
Traffic Impact	Proximity of LP site access to an identified key congested junction	<500m = 0 points, 500-1000m = 10 points, >1km = 20 points
	Scale of peak hour congestion expected in vicinity of site	moderate congestion = 0 points, low level congestion = 10 points, uncongested = 20 points
	Existing local residents' propensity to drive to work based on 2011 Census	>40% drive to work = 0 points, 30-40% = 10 points, <30% = 20 points
Potential	Distance to nearest bus route if no nearby bus stop (assuming potential for new stop to be added)	>1km = 0 points, 400-1000m = 10 points, <400m = 20 points
	Potential to direct bus services to serve LP development (based on proximity of nearest bus route and size of site)	low = 0 points, medium = 10 points, high = 20 points
	Potential for better public transport serviced to/from site (based on size of development proposed)	low = 0 points, medium = 10 points, high = 20 points
	Potential for encouraging cycle use to/from LP site (based on proximity of local services)	car dependent = 0 points, limited = 10 points, good = 20 points
	Potential for encouraging walking to/from LP site (based on proximity of local services)	car dependent = 0 points, limited = 10 points, good = 20 points

Table 6 – Basic scoring system adopted for SLAA site sustainable accessibility appraisal

Where applicable, the scoring system has incorporated DfT guidelines[3] for acceptable walking and cycling distances as follows:

- Acceptable Walking Distance - 1km (0.6 miles)
- Acceptable Cycling Distance - 4km (2.4 miles)

A review of similar sustainable accessibility studies determined an acceptable bus journey time for commuters to be typically around 30 minutes. This figure has therefore been used to define the scoring system for bus journey time indicators.

Indicators covering the existing level of cycling and pedestrian provision are more subjective, and have been largely scored on the location of established cycle routes and pedestrian crossing facilities in close proximity to the SLAA sites.

Traffic impact indicators:

For the purposes of this study, the location of SLAA sites close to areas of network congestion has been deemed a negative indicator of sustainability due to the concentration of additional development traffic in areas that are more likely to be sensitive to noise and local air quality.

There is however, an argument to suggest that the presence of network congestion could encourage greater use of sustainable modes of travel, and could therefore be viewed as a positive indicator of sustainability. This is indirectly acknowledged when scoring the potential for development sites in urban areas to encourage cycling and walking modes.

2011 Census data:

In order to better understand the propensity to drive amongst residents in Epping Forest District, 2011 Census data was used to provide analysis of the proportion of journeys to work made by car or van, as well as to determine the level of car ownership in the District. The journey-to-work analysis has been used as an indicator for site appraisal – on the assumption that, without intervention, it might be reasonable to expect future residents to adopt similar travel patterns to those of the current local population.

Although not used in the site appraisal scoring, Census car ownership data has been included in this study as a means of identifying areas within town centres where car ownership is proportionally lower than in surrounding areas. It is understood that SLAA site location in these areas could encourage lower trip rates - assuming a similar development make-up to that existing.

[3] DfT LTN 1/04 3.10.13 – acceptable walking limits

A mapping analysis tool provided on the Datashine website[4] has been used to illustrate the patterns of car use and ownership in Epping Forest District. Screenshots for each town in the District are provided in the appendices of this technical note.

Connecting the indicators:

There is an inherent difficulty in determining a combined score and then subsequently ranking SLAA sites based on a set of 25 indicators. This is because to do so requires all indicators to form a balanced appraisal that does not introduce bias towards one particular aspect of sustainability, or illogically penalise a site where certain indicators are not as applicable.

To best derive a fair scoring assessment, the following assumptions have been adopted:

Existing Accessibility

1) Sites that are located within a 1km walking distance of a town centre / rail station / GP surgery / secondary school have not be penalised for having a limited bus service, since the maximum acceptable walking distance to a bus stop has already been set at 1km. Therefore, irrespective of the quality of bus service, sites within walking distance have been allocated a maximum score for the associated bus service frequency indicator.
2) Sites that are not considered to be within walking distance of the nearest bus stop, are therefore considered inaccessible by bus. Consequently, such sites receive no score for those indicators related to bus frequency and journey time.
   This places additional emphasis on ensuring sufficient points can be 'recovered' for sites with the potential for developing better public transport links, and helps to justify the double weighting applied to such indicators.

Potential Accessibility

3) Sites that are within an acceptable walking distance (1km) of both a town centre and rail/tube station are considered to have the demand potential to encourage walking trips, and therefore score maximum points for this indicator. This is regardless of the existing infrastructure in the area to accommodate pedestrians.
4) Sites that are within an acceptable cycling distance (4km) of both a town centre and rail/tube station (but not within walking distance of both) are considered to have the demand potential to encourage cycle use, and therefore score maximum points for this indicator. Again, this is irrespective of the existing infrastructure in the area to support cycling uptake.

[4] http://datashine.org.uk/

5) Sites located within walking distance of a town centre and rail station – where there is an available choice of sustainable travel mode - are assumed likely to have a bias towards walking over cycling as a preference. Subsequently, these sites score a maximum of '10' points for cycling potential.

2.4 Methodology: Data Sources

Mapped Data:

This latest study utilises existing mapped datasets compiled for the earlier accessibility planning work documented in Technical Note 6 (TN6) - Dec 2014.

The following data was mapped to present an overview of the location of potential Local Plan development sites in the district and their proximity to public services and the sustainable transport network (walking, cycling, bus and rail):

- SLAA July 2016 Local Plan development site areas
- The bus network, bus stop locations and service frequencies (thematically mapped)
    - Weekday (Wednesday): 0700-0800, 0800-0900, 1700-1800, 1800-1900
    - Saturday: 1300-1400
- The National Rail and London Underground network and station locations
- The National Cycle Network and local cycle network (Harlow)
- Location of nursery, infant/primary/secondary schools
- Location of GP surgeries

SLAA 2016 Local Plan development data and location mapping layers were obtained from ARUP in July 2016. In total, 354 residential development sites were included for assessment. These sites comprised developments in excess of 25 residential units. Additional smaller sites are under consideration by the District Council but are not modelled as part of this study.

As reported in TN6: June 2014 service frequency data across the district's bus route network was obtained from Essex County Council's Passenger Transport team. The data is link-based and covers two-way bus service frequencies per hour surveyed across 7 consecutive days.

The location of bus stops in Epping Forest District was determined using a 2014 National Public Transport Access Nodes (NaPTAN) dataset obtained from the data.gov.uk website: http://data.gov.uk/dataset/naptan

Where available, nursery/school/GP data used in the accessibility mapping was initially extracted from an Essex Highways 2008 database built for use with previous transport studies.

The data was then cross-referenced and updated where necessary using up-to-date 2014 datasets from the following sources:

- Nursery schools and day care centres in Epping Forest District - Used 2014 directory taken from the daynurseries.co.uk website: http://www.daynurseries.co.uk
- Infant and Junior schools (non-private) in Epping Forest District – Existing 2008 data updated using October 2014 information provided on the Schools Web Directory website: http://www.schoolswebdirectory.co.uk
- Secondary schools (non-private) in Epping Forest District – Existing 2008 data updated using October 2014 information provided on the Schools Web Directory website: http://www.schoolswebdirectory.co.uk
- GP surgeries (non-private) in Epping Forest District – using August 2014 database taken from the Health & Social Care Information Centre website: http://systems.hscic.gov.uk/data/ods/datadownloads/index

Separate peak hour congestion plots were also referenced in order to identify the levels of peak hour congestion present in the vicinity of the SLAA sites. These congestion plots derive from 2014/15 TrafficMaster journey time data for a neutral month period and display the percentage of the free-flow speed achieved on the main roads in Essex in the peak hours.

Reference Web Sites:

In addition to the mapped data, web-based information was used to assist the sustainable accessibility scoring of each SLAA site, as follows:

- Google Maps "Get Directions" – Used to determine frequency of bus services and journey times specifically between SLAA sites and services/amenities
- http://datashine.org.uk/ - Used to determine the proportion of Census 2011 journey-to-work trips per output area made by car/van; and the level of car ownership per 2011 Census output area

3. Part Two: Re-appraisal of key junctions in Epping Forest District – linked to the consideration of sustainable mitigation measures

This section of the study re-evaluates the impact of traffic growth on key junctions in Epping Forest District with the aim of determining the level of unmet future demand at congested junctions. This revised approach to junction appraisal utilises the same model outputs as those used to determine flow-capacity ratios in earlier studies. However, through consideration of unmet demand, it has been possible to determine the extent to which sustainable measures could help accommodate excess demand – and thus address capacity shortfalls at junctions.

This study subsequently highlights existing and potential sustainable measures that could accommodate demand surplus as a short/medium-term alternative to junction infrastructure improvements. The reappraisal is qualitative in nature and is only intended to provide a broad evaluation of the extent of sustainable measures potentially required to accommodate unmet demand.

3.1 Summary of Findings:

- Results of the capacity appraisal show that the assessed junctions in Epping Forest District fall into four main categories:

    1) Those that have no excess demand in the future year
    2) Those that generate excess demand through the introduction of Local Plan development traffic on top of background traffic
    3) Those that generate excess demand through the growth in background traffic alone
    4) Those that already generate excess demand in the current day

  Table 7 below lists the junctions in Epping Forest District ranked by the level of unmet demand modelled at each. At the same time, junctions are colour coded based on the level of opportunity considered possible for implementing sustainable measures to accommodate unmet demand.

Level of unmet demand	Junction	Ranking
Existing unmet demand	Wake Arms Roundabout, Epping Forest	1
	Thornwood Road Signalised Junction, Epping	2
	Meridian Way Signalised Junction, Waltham Abbey	3
	Sun Street Signalised Junction, Waltham Abbey	4
	Bury Lane Roundabout, Epping	5
Unmet demand w/background traffic	Station Road/St.John's Road Double Mini Roundabout, Epping	6
	M25 J26 Southern Roundabout, Waltham Abbey	7
	Theydon Road Signalised Junctions, Epping	8
	Coopers Hill Mini Roundabout, Chipping Ongar	9
	Piercing Hill Priority Junction, Theydon Bois	10
	Honey Lane Mini-Roundabout, Waltham Abbey	11
Unmet demand w/Local Plan traffic	Four Wantz Roundabout, Chipping Ongar	12
	Talbot Roundabout, North Weald Bassett	13
	Highbridge Street Roundabout, Waltham Abbey	14
No unmet demand	Sewardstone Road Roundabout, Waltham Abbey	15
	Crooked Mile Roundabout, Waltham Abbey	16
	M25 J26 Northern Roundabout, Waltham Abbey	17

Opportunity for implementing sustainable measures:

Very Limited	Limited	Good

Table 7 – Junctions in Epping Forest District ranked on level of unmet demand

- There are likely to be limited opportunities for the use of sustainable travel initiatives to address unmet demand at junctions in rural/inter-urban locations – such as at the Wake Arms Roundabout.
- The economic viability of providing improved cross-district bus services would likely be hampered by a comparably low level of potential patronage expected for longer distance bus journeys. Walking and cycling would unlikely be considered viable alternatives to car travel for journeys routing through rural areas and along inter-urban corridors.
- In such instances, infrastructure improvements are likely to be considered most appropriate Infrastructure improvements at the Wake Arms Roundabout would be expected to encroach on forested land. However, the negative impact of land-take might potentially be off-set by a reduction in vehicle carbon emissions at the junction.

3.2 Methodology:

The latest SLAA development assumptions (quantum and location as of April 2015) have been obtained from EFDC for this latest appraisal. This assumes 11,188 additional dwellings and

425,800m^2 of employment sites in the district up to the forecast year 2036[5]. It is envisaged that sensitivity testing with different housing figures will be carried out at a later stage of the appraisal process.

A list of the April 2015 SLAA sites modelled can be found in the appendices of this technical note.

Unmet demand has been calculated from existing junction model outputs produced for the earlier forecast capacity modelling. 2036 forecast year assessments were not undertaken previously on account of the significant congestion already modelled by 2026. This reappraisal will therefore only consider the 2026 forecast year – with half the quota of development stated.

Specific model outputs used in the calculation are as follows:

- Total Demand (PCU/hr) - Capacity (PCU/hr) = Unmet Demand (PCU/hr)

Demand and capacity values have been taken from the busiest quarter hour period of both AM and PM peak hours.

Interpretation of Results / Caveats:

- It is acknowledged that the development scenario used in this assessment may change during the ongoing development of the Local Plan. Reported outputs are representative of this development allocation and should therefore only be considered indicative of the scale of unmet demand that might be expected at the various junctions under assessment with similar levels of development.
- As has been the case throughout the Local Plan appraisal, the future-year junction modelling utilises flows from a fixed demand spreadsheet model. Modelled outputs are therefore indicative of a robust scenario where all demand flows are assigned through the assessed junctions.
- In reality however, it might be expected that drivers will avoid congestion by travelling along different routes or travelling outside the peak hours. In effect, the unmet demand at a junction represents the demand that cannot be accommodated during the peak hour assessment period.

[5] Numbers taken from a SLAA site list submitted by EFDC in March 2015 for testing with the Harlow VISUM model.

3.3 Results

The following tables highlight the unmet demand modelled at the key assessed junctions in Epping Forest District in 2026 with development traffic. For the purpose of analysis, unmet demand has been disaggregated so that the quantity generated by each of the following can be identified:

- 2013 base flows
- Background growth to 2026
- Development traffic (50% to 2026)

By disaggregating unmet demand, it is possible to determine the main contributor towards peak hour congestion at junctions and then formulate an appropriate mitigation measure to address growth in unmet demand.

For example, excess demand made up primarily of development traffic could be addressed by revising housing allocation numbers, relocating sites, or focussing travel plans on new developments; whereas excess demand made up of existing traffic flows or background growth would need to be addressed by improving access to public transport services and/or local infrastructure improvements.

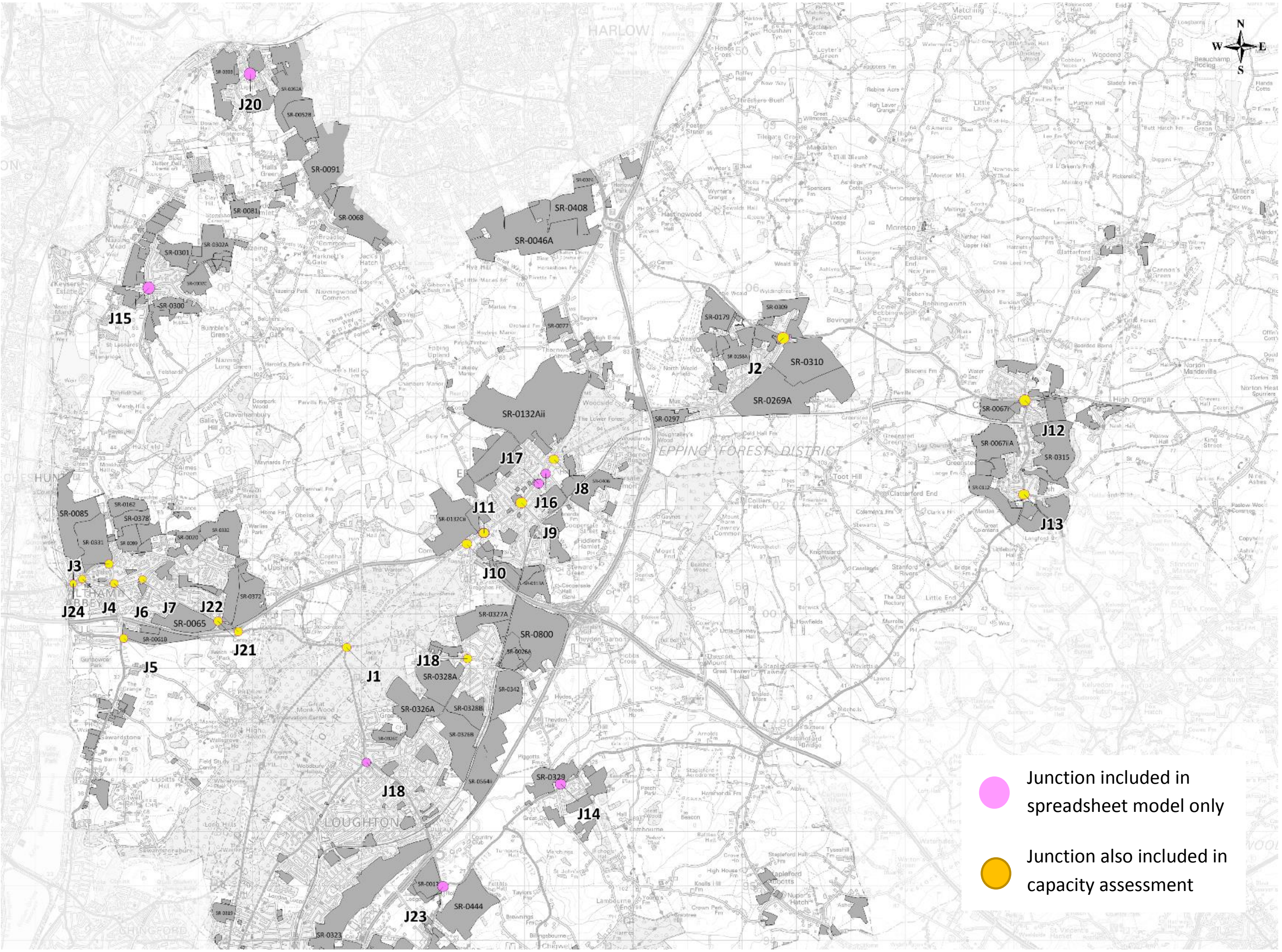

Figure 2 – Location map of assessed junctions in Epping Forest District

Junction 1 - Wake Arms Roundabout, Epping Forest

Junction 1 (Wake Arms PH) - Epping Forest						***Roundabout junction***
Arm	**AM PEAK**			**PM PEAK**		
	Base	2026 Bgd	2026 Dev	Base	2026 Bgd	2026 Dev
B1393 Epping Road	0	0	199	0	0	0
B172	0	8	285	0	94	156
A121 Golding's Hill	296	160	218	22	116	236
A104 Epping New Road	0	35	9	102	95	400
A121 Woodridden Hill	0	0	123	145	87	209
Total	**296**	**203**	**834**	**269**	**392**	**1001**

Table 8 – Peak hour unmet demand (PCUs) at Junction 1 - Wake Arms Roundabout

By 2026, around 1,350 AM and 1,650 PM peak hour modelled vehicle trips are left unaccommodated by the Wake Arms roundabout. This equates to around 27% and 31% of AM and PM peak demand respectively. A proportion will be queued on approach arms, whilst others will likely shift to travelling in the peak shoulders or will seek alternative modes of transport.

Given the location of the roundabout away from urban centres, the absence of SLAA sites in the immediate vicinity, and the level of existing (2013) unmet demand modelled; efforts to accommodate excess traffic flow through sustainable means will likely require intervention at a district-wide level. This might include a review of longer-distance and inter-urban bus services, specifically with regards to coverage, frequency, cost and promotion.

The success of any sustainable intervention targeted at the Wake Arms roundabout will likely be limited, however, given that a significant proportion of trips are understood to access the roundabout for onward journeys via the M25. The economic viability of providing improved cross-district bus services may also be hampered by the comparably low level of potential patronage expected for longer distance bus journeys. Consequently, it might be reasonable to expect infrastructure upgrades to offer the best means of addressing the high volumes of unmet demand at the junction.

Infrastructure improvements at the Wake Arms Roundabout would be expected to encroach on forested land. However, the negative impact of land-take might potentially be off-set by a reduction in vehicle carbon emissions at the junction.

Junction 1 – Wake Arms Roundabout : Summary

• Relative level of unmet demand	**High**
• Main contributor(s) to unmet demand	Base, background growth & SLAA developments
• Urban or Rural junction?	Rural
• Sustainable options to consider	Improvements to and promotion of inter-urban bus services
• Opportunity for sustainable measures	**Very Limited**
• Capacity infrastructure improvements?	Likely in short-term

Junction 2 – Talbot Roundabout, North Weald Bassett

Junction 2 (Talbot PH) - North Weald Bassett						*Roundabout junction*
Arm	**AM PEAK**			**PM PEAK**		
	Base	2026 Bgd	2026 Dev	Base	2026 Bgd	2026 Dev
B181 Weald Bridge Road	0	0	0	0	0	0
A414 High Road	0	0	297	0	0	0
B181 High Road	0	0	0	0	0	0
A414	0	0	0	0	0	198
Total	**0**	**0**	**297**	**0**	**0**	**198**

Table 9 – Peak hour unmet demand (PCUs) at Junction 2 – Talbot (PH) Roundabout

In contrast to Junction 1, unmet modelled demand at the Talbot Roundabout to the north of North Weald Bassett is generated almost entirely by the addition of SLAA development trips. By 2026 this amounts to around 300 unaccommodated development trips in the AM peak and 200 in the PM peak.

Forecast turning flows in the Epping Spreadsheet Model attribute a proportion of this excess demand to the large residential and commercial developments proposed around Harlow. Based on Census Journey-to-Work distributions, it is conceivable that large developments to the south and east of Harlow will increase flows along the A414 to the east.

Adopting a sustainable approach, unmet demand could be partly addressed locally through the promotion of the regular peak hour 20/21 Townlink bus service between Chipping Ongar and Epping, and ensuring good pedestrian access between the nearby SLAA development sites and the bus service.

2011 Census Data Journey to Work (from home to work) distributions in Chipping Ongar, shown in Figure 3 below, demonstrate significant flow proportions heading to both Epping and London. These trips would be geographically in-scope of the bus service to Epping town centre and rail station. It is therefore reasonable to expect the active promotion of bus travel through Personal Travel Planning (PTP) and/or travel incentives for local residents to increase uptake and help reduce the level of unmet demand at the junction.

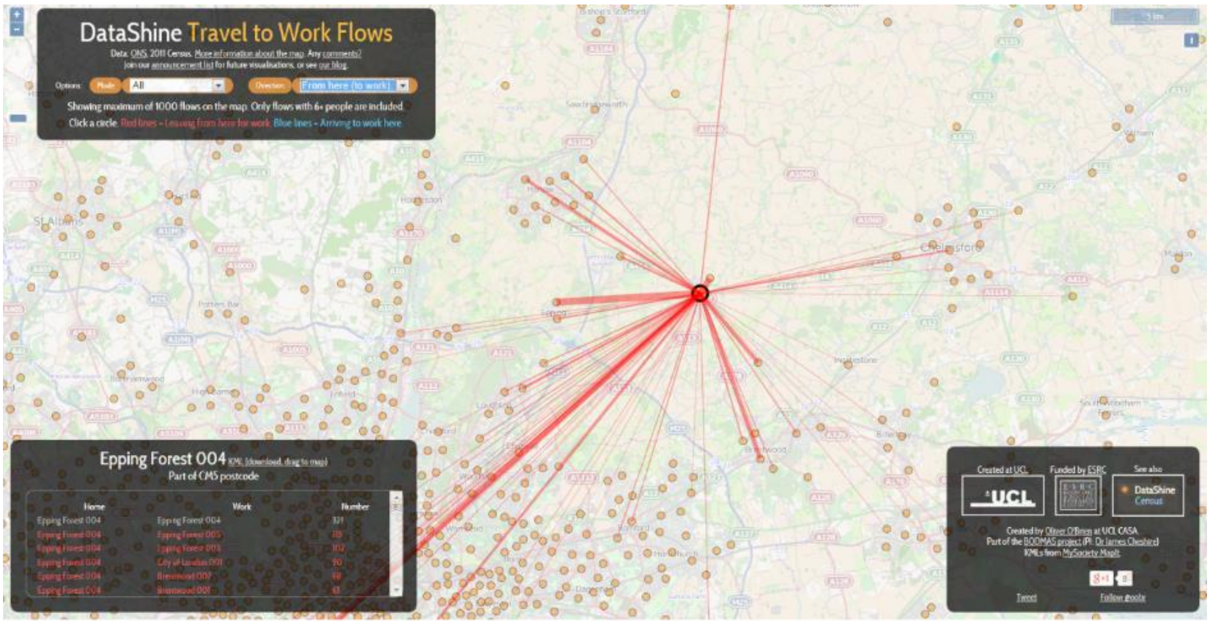

Figure 3 – 2011 Census Journey to Work (from home to work) distribution plot from Chipping Ongar (mapping taken from DataShine website - http://commute.datashine.org.uk/)

It should, however, be added that the viability of a proposed Park and Ride service in North Weald Bassett (to address congestion at junctions in Epping) may be dependent on demand from nearby villages and towns such as Chipping Ongar. This would appear to be in contradiction with the suggested promotion of local bus services to reduce car trips between Chipping Ongar and North Weald Bassett in order to relieve pressure on the Talbot and Four Wantz Roundabouts on the A414.

Longer-distance A414 trips to/from developments around Harlow may prove harder to accommodate sustainably. However, the impact felt at the Talbot Roundabout would likely be lessened by a reduction in the scale of development proposed.

Junction 2 – Talbot Roundabout : Summary

• Relative level of unmet demand	**Moderate**
• Main contributor(s) to unmet demand	SLAA developments
• Urban or Rural junction?	Urban
• Sustainable options to consider	Promotion of existing bus services + Personal Travel Planning. Re-evaluation of development in Harlow
• Opportunity for sustainable measures	**Good**
• Capacity infrastructure improvements?	Unlikely in short/medium-term

Junction 3 – Crooked Mile Roundabout, Waltham Abbey

No unmet demand is modelled at the junction in a 2026 forecast year.

Junction 4 – Highbridge Street Roundabout, Waltham Abbey

Junction 4 (Highbridge St) - Waltham Abbey						***Roundabout junction***
Arm	**AM PEAK**			**PM PEAK**		
	Base	2026 Bgd	2026 Dev	Base	2026 Bgd	2026 Dev
B194 Abbeyview	0	0	0	0	0	0
Highbridge Street	0	0	0	0	0	0
B194 Highbridge Street	0	0	0	0	0	153
Powdermill Lane	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**153**

Table 10 – Peak hour unmet demand (PCUs) at Junction 4 – Highbridge Street Roundabout

Unmet modelled demand forecast at the junction of Highbridge Street and the B194 Abbeyview in Waltham Abbey is again generated largely by the addition of local SLAA development trips. By 2026 with a projection of around 480 additional dwellings in Waltham Abbey, this amounts to just over 150 unaccommodated development trips in the PM peak.

Excess demand at the junction would likely be best addressed sustainably by promoting bus or cycle travel between SLAA sites and the rail station at Waltham Cross. To best achieve this, sites should have good pedestrian access to bus routes, and good cycle access to the rail station (if located within a reasonable cycling distance). Working with the neighbouring local authority to provide a dedicated cycle route along the A121 between Waltham Abbey and Waltham Cross, and providing greater connectivity to/from the existing cycle route along the B194, would help to reduce the level of demand at the Highbridge Street Roundabout.

Junction 4 – Highbridge Street Roundabout : Summary

- Relative level of unmet demand — **Low**
- Main contributor(s) to unmet demand — SLAA developments
- Urban or Rural junction? — Urban
- Sustainable options to consider — Pedestrian access to bus routes + improved cycle links to rail station
- Opportunity for sustainable measures — **Good**
- Capacity infrastructure improvements? — Unlikely in short/medium-term

Junction 5 – Sewardstone Road Roundabout, Waltham Abbey

No unmet demand is modelled at the junction in a 2026 forecast year.

Junction 6 – Sun Street Signalised Junction, Waltham Abbey

Junction 6 (Sun St) - Waltham Abbey						***Signalised junction***
Arm	**AM PEAK**			**PM PEAK**		
	Base	2026 Bgd	2026 Dev	Base	2026 Bgd	2026 Dev
A121 Crooked Mile	0	0	0	0	0	0
Monkswood Avenue	0	0	0	0	0	0
Sun Street - Left/Ahead	0	0	0	0	0	0
Sun Street - Right	0	0	0	0	57	100
Sewardstone Road NB - Left/Ahead	0	0	0	0	0	0
Sewardstone Road NB - Right/Ahead	0	0	0	0	0	0
Sewardstone Road SB - Left/Ahead	0	0	0	0	0	0
Sewardstone Road SB - Ahead	0	0	0	0	0	0
Farm Hill Road	74	98	178	32	73	226
Sewardstone Road NB	0	0	0	43	87	91
Total	**74**	**98**	**178**	**75**	**217**	**417**

Table 11 – Peak hour unmet demand (PCUs) at Junction 6 – Sun Street Signalised Junction

Base 2013 modelling of peak hour congestion at the junction of Farm Hill Road and Sewardstone Road is symptomatic of the quantity of unmet demand at the junction. This is expected to increase further with the addition of background growth and SLAA development traffic. Despite optimised signal timings to minimise delay at the junction, excess demand is modelled on Sun Street and Sewardstone Road (from the south) in the PM peak, and most notably on Farm Hill Road in both peak periods.

Given the town centre location and the availability of outer route alternatives for through-traffic, it might be reasonable to assume that a high proportion of trips at the junction would have local origins and/or destinations. This assumption is largely supported by Census Journey to Work data shown in Figure 4 below, which shows significant movement between housing areas in the east of Waltham Abbey and both the town centre and rail station at Waltham Cross.

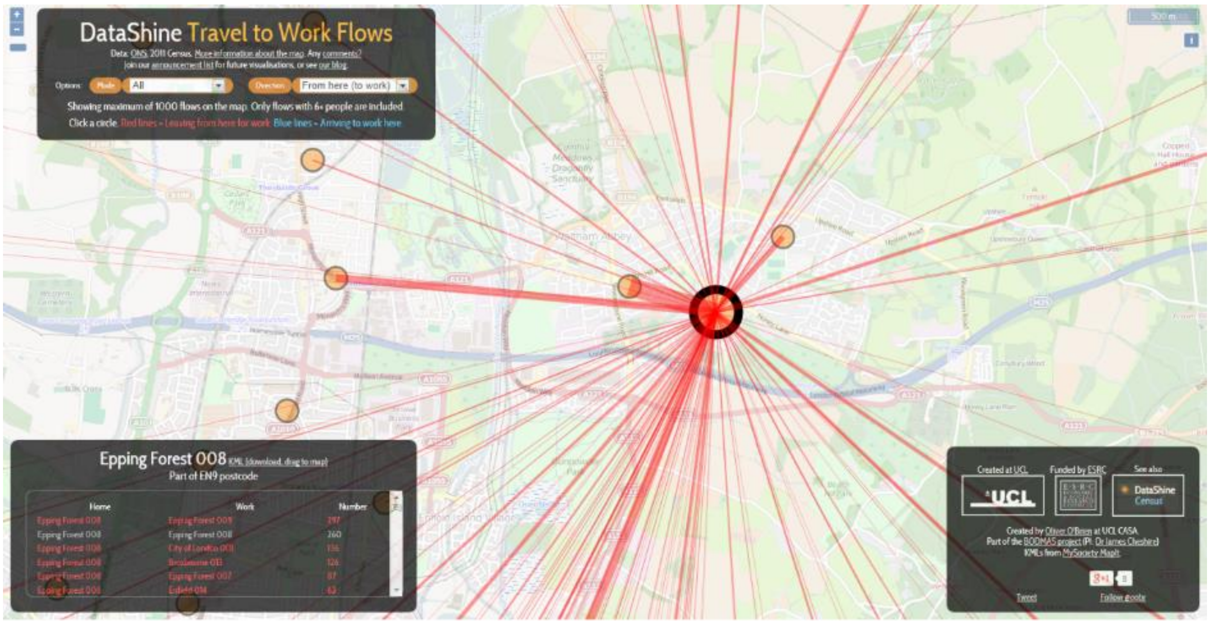

Figure 4 – 2011 Census Journey to Work (from home to work) distribution plot from Waltham Abbey

With this in mind, existing unmet demand and a proportion of future demand at the junction could potentially be addressed through the promotion of existing bus services and the provision of cycle routes along Honey Lane and Farm Hill Road.

Junction 6 – Sun Street Signalised Junction : Summary

• Relative level of unmet demand	**High**
• Main contributor(s) to unmet demand	Base, background growth & SLAA developments
• Urban or Rural junction?	Urban
• Sustainable options to consider	Promotion of existing bus services + improved cycle links along Honey Lane and Farm Hill Road
• Opportunity for sustainable measures	**Good**
• Capacity infrastructure improvements?	Unlikely in short/medium-term

Junction 7 – Honey Lane Mini-Roundabout, Waltham Abbey

Junction 7 (Honey Ln) - Waltham Abbey						***Roundabout junction***
Arm	**AM PEAK**			**PM PEAK**		
	Base	2026 Bgd	2026 Dev	Base	2026 Bgd	2026 Dev
Broomstick Hall Road	0	0	0	0	0	0
Honey Lane	0	20	215	0	0	234
Farm Hill Road	0	0	0	0	0	0
Total	**0**	**20**	**215**	**0**	**0**	**234**

Table 12 – Peak hour unmet demand (PCUs) at Junction 7 – Honey Lane Mini-Roundabout

Unmet demand at Honey Lane mini-roundabout is modelled to occur largely following the addition of SLAA development traffic, in both the AM and PM peaks. Given the proximity of the roundabout to the Sun Street signalised junction, it is reasonable to expect that the same sustainable travel initiatives will help to address the excess demand.

Junction 7 – Honey Lane Mini-Roundabout : Summary

- Relative level of unmet demand — Moderate
- Main contributor(s) to unmet demand — SLAA developments
- Urban or Rural junction? — Urban
- Sustainable options to consider — Promotion of existing bus services + improved cycle links along Honey Lane and Farm Hill Road
- Opportunity for sustainable measures — Good
- Capacity infrastructure improvements? — Unlikely in short/medium-term

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Junction 8 – Thornwood Road Signalised Junction, Epping

Junction 8 (Thornwood Road) - Epping						*Signalised junction*
Arm	**AM PEAK**			**PM PEAK**		
	Base	2026 Bgd	2026 Dev	Base	2026 Bgd	2026 Dev
B1393 Thornwood Road - Left/Ahead	0	0	319	56	6	11
B181 The Plain - Left/Ahead	0	0	0	5	54	45
B1393 Palmers Hill - Right/Ahead	0	0	0	217	190	580
Total	**0**	**0**	**319**	**278**	**250**	**636**

Table 13 – Peak hour unmet demand (PCUs) at Junction 8 – Thornwood Road Signalised Junction

It is clear from the modelling that a significant amount of unmet demand exists at the junction in the base year PM peak hour – particularly on the B1393 approach from the centre of Epping. Excess demand is modelled to then increase significantly with the addition of development traffic. In the AM peak, modelled unmet demand at the junction occurs only once development traffic is included alongside background growth to 2026.

With total unmet demand of over 300 vehicle trips in the AM Peak and over 1,150 in the PM peak, Thornwood Road junction is second only to the Wake Arms Roundabout in terms of the quantity of excess demand anticipated in 2026.

The proportional split of local traffic and through-traffic at the junction is proposed to be estimated using mobile phone data as part of a future study. However, it might be reasonable to expect a quantity of background and development traffic from North Weald Bassett, Chipping Ongar and Harlow to be accommodated by a proposed Park and Ride service in North Weald Airfield (the latter being dependent on the location of the Park and Ride site).

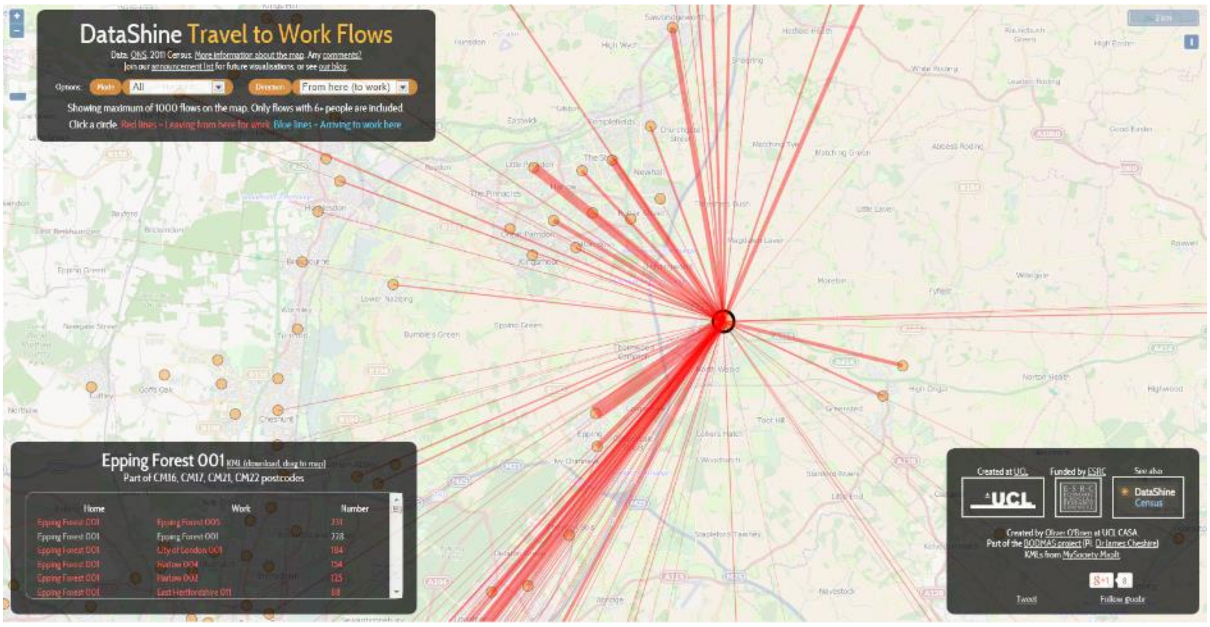

Figure 5 – 2011 Census Journey to Work (from home to work) distribution plot from North Weald Bassett

2011 Census Data Journey to Work (from home to work) distributions in North Weald Bassett, shown in Figure 5 above, demonstrate significant flow proportions heading to both Epping and London. These trips would be geographically in-scope of a Park and Ride service to Epping town centre and rail station.

Nevertheless, given the extent of unmet demand at the junction, modelling suggests that a Park and Ride service alone may struggle to fully address the anticipated excess. As with the Wake Arms Roundabout, it might be reasonable to assume that longer distance trips through the junction will be less likely to adopt sustainable alternatives. Consequently, there may still be a need for infrastructure improvement measures at the junction alongside provision of a Park and Ride service at North Weald Airfield.

Junction 8 – Thornwood Road Signalised Junction : Summary

- Relative level of unmet demand — **High**
- Main contributor(s) to unmet demand — Base, background growth & SLAA developments
- Urban or Rural junction? — Urban
- Sustainable options to consider — Park & Ride at North Weald Airfield
- Opportunity for sustainable measures — **Limited (dependent on volume of through trips)**
- Capacity infrastructure improvements? — Possible in medium-term

Junction 9a/b – Station Road/St. John's Road Double Mini Roundabout, Epping

Junction 9a (Station Rd) - Epping						***Roundabout junction***
Arm	**AM PEAK**			**PM PEAK**		
	Base	2026 Bgd	2026 Dev	Base	2026 Bgd	2026 Dev
B1393 High Street RAB Link	0	0	368	0	28	187
Station Road	0	0	54	0	0	0
B1393 High Street	0	28	187	0	0	521
Total	**0**	**28**	**609**	**0**	**28**	**708**

Junction 9b (St. John's Rd) - Epping						***Roundabout junction***
Arm	**AM PEAK**			**PM PEAK**		
	Base	2026 Bgd	2026 Dev	Base	2026 Bgd	2026 Dev
St. John's Road	0	0	38	0	25	104
B1393 High Street	0	0	567	0	92	197
B1393 High Street RAB Link	0	0	179	0	0	322
Total	**0**	**0**	**784**	**0**	**117**	**623**

Table 14 – Peak hour unmet demand (PCUs) at Junctions 9a/b - Station Road / St.John's Road Double Mini Roundabout

Whilst a proportion of unmet demand at the double-mini-roundabout is shown in the modelling to occur with background traffic growth in 2026, a significant majority is modelled with the addition of development traffic. The proposed North Weald Park and Ride service will likely help to reduce flows through the junction, whilst the provision and promotion of walking and cycling routes from the proposed new developments in Epping to the rail station and town centre, may help further lower the levels of unmet demand.

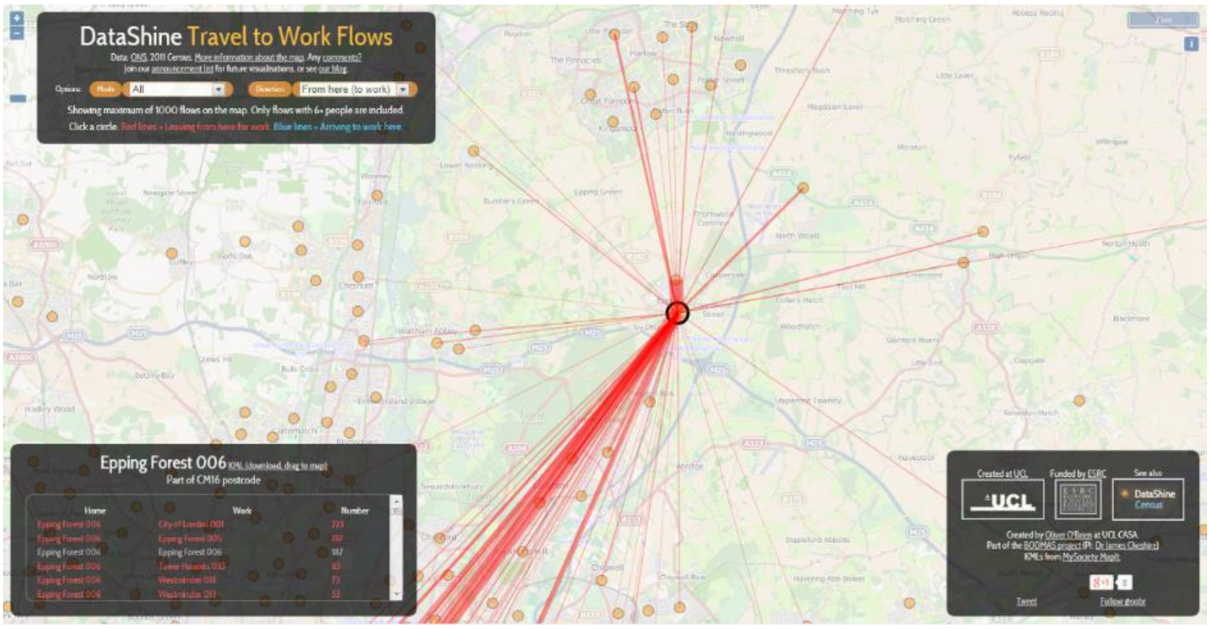

Figure 6 – 2011 Census Journey to Work (from home to work) distribution plot from Epping

2011 Census Data Journey to Work (from home to work) distributions in central Epping, shown in Figure 6 above, demonstrate significant flow proportions travelling within Epping and to London. It might therefore be reasonable to expect a considerable proportion of existing and future development trips in Epping to be amenable to the uptake of sustainable travel modes.

The extent of local development traffic passing through the town centre roundabouts in the peak hours could also be managed by influencing the type of development proposed in Epping. Higher density, 1-2 bedroom dwellings with limited parking availability would be expected to generate lower trip rates and attract London commuters with a greater propensity to travel via local Underground rail services. Census car ownership data (documented at the end of this technical note) illustrates that households in close proximity to Epping rail station have a lower-than-average level of car ownership – despite the relative affluence of the area.

Junction 9 a/b – Station Road/St.John's Road Double Mini Roundabout : Summary

- Relative level of unmet demand — **High**
- Main contributor(s) to unmet demand — 2026 Background growth & SLAA developments
- Urban or Rural junction? — Urban
- Sustainable options to consider — Improve pedestrian and cycle links to town centre and rail station. Encourage high-density, single-occupancy housing close to rail station.
- Opportunity for sustainable measures — **Good (dependent on volume of through trips)**
- Capacity infrastructure improvements? — Possible in medium-term

Junction 10 – Theydon Road Signalised Junction, Epping

Junction 10 (Theydon Road) - Epping						*Signalised junction*
Arm	**AM PEAK**			**PM PEAK**		
	Base	2026 Bgd	2026 Dev	Base	2026 Bgd	2026 Dev
B1393 Epping Road (East) - Left/Ahead	0	0	123	0	0	371
Theydon Road	0	75	210	0	0	321
B1393 Epping Road (West) - Right/Ahead	0	0	509	0	0	155
Total	**0**	**75**	**842**	**0**	**0**	**847**

Table 15 – Peak hour unmet demand (PCUs) at Junction 10 – Theydon Road Signalised Junction

The majority of unmet peak demand at the Theydon Road signals is caused by the addition of SLAA development modelled trips on top of 2026 forecast background traffic flows. Given the more rural nature of the junction, it might be reasonable to assume (as with the Wake Arms Roundabout) that a significant proportion of unmet demand would be made up of longer distance inter-urban trips that would be less receptive to the adoption of sustainable travel alternatives.

The development of pedestrian/cycle links and an increase in the frequency of bus services from areas in the south of Epping to the rail station and town centre, could help accommodate some of the excess trips modelled. However, given the scale of unmet demand anticipated, measures to reduce – rather than accommodate – flows at the junction would likely be required. This could include encouraging high-density residential development tailored more towards London commuters, and/or avoiding the development of large sites in the south of Epping.

Junction 10 – Theydon Road Signalised Junction : Summary

- Relative level of unmet demand: **High**
- Main contributor to unmet demand: SLAA developments
- Urban or Rural junction?: Rural
- Sustainable options to consider: Improve pedestrian and cycle links to town centre and rail station. Encourage development of high-density, single-occupancy housing. Consider relocation of SLAA development sites.
- Opportunity for sustainable measures: **Very Limited**
- Capacity infrastructure improvements?: Likely in medium-term

Junction 11 – Bury Lane Roundabout, Epping

Junction 11 (Bury Ln) - Epping						***Roundabout junction***
Arm	**AM PEAK**			**PM PEAK**		
	Base	2026 Bgd	2026 Dev	Base	2026 Bgd	2026 Dev
B182 Bury Lane	0	0	40	0	0	0
B1393 High Road (East)	18	105	477	0	106	212
B1393 High Road (West)	0	0	63	0	0	556
Total	**18**	**105**	**580**	**0**	**106**	**768**

Table 16 – Peak hour unmet demand (PCUs) at Junction 11 – Bury Lane Roundabout

Modelling suggests that a proportion of unmet demand at Bury Lane Roundabout might expect to be generated by 2026 background traffic growth, whilst the inclusion of SLAA development traffic will lead to a greater increase in excess demand at the junction.

Sustainable measures would therefore need to target proposed developments in the area whilst also being of use to existing residences in Epping. However, the location of the Bury Lane roundabout on the south-western periphery of the town suggests that the morning peak outflow and evening peak inflow are more likely to contain a higher proportion of longer-distance car trips that would again be harder to accommodate through the provision of sustainable travel alternatives.

With this in mind, sustainable measures to mitigate unmet demand at the junction would likely be similar to those suggested for the signalised junction at Theydon Road.

Junction 11 – Bury Lane Roundabout : Summary

- Relative level of unmet demand — **High**
- Main contributor to unmet demand — 2026 Background growth & SLAA developments
- Urban or Rural junction? — Rural
- Sustainable options to consider — Improve pedestrian and cycle links to town centre and rail station. Encourage development of high-density, single-occupancy housing. Consider relocation of SLAA development sites.
- Opportunity for sustainable measures — **Very Limited**
- Capacity infrastructure improvements? — Likely in medium-term

Junction 12 – Four Wantz Roundabout, Chipping Ongar

Junction 12 (Four Wantz Roundabout) - Chipping Ongar						*Roundabout junction*
Arm	**AM PEAK**			**PM PEAK**		
	Base	2026 Bgd	2026 Dev	Base	2026 Bgd	2026 Dev
B184 Fyfield Road	0	0	9	0	0	0
A414 Chelmsford Road	0	0	231	0	0	0
B184 High Street	0	0	0	0	0	138
A414 Epping Road	0	0	0	0	0	259
Total	**0**	**0**	**240**	**0**	**0**	**397**

Table 17 – Peak hour unmet demand (PCUs) at Junction 12 – Four Wantz Roundabout

The introduction of SLAA development traffic in Chipping Ongar on top of background traffic growth appears to be the key contributor to the levels of unmet demand modelled at the Four Wantz Roundabout in Chipping Ongar by 2026.

As an urban roundabout located in close proximity to the surrounding SLAA development sites, the junction is therefore likely to be particularly sensitive to the location and size of both employment and residential sites proposed in the town. Because of this, the amount of unmet demand at the roundabout could likely be managed through the considered selection of development sites in Chipping Ongar.

Similar to the Talbot Roundabout on the A414 in North Weald, a proportion of unmet demand could also be addressed by reducing the flow of traffic between Chipping Ongar and North Weald Bassett/Epping. This could similarly be achieved through the promotion of the regular peak hour 20/21 Townlink bus service between Chipping Ongar and Epping, through use of PTP, and by ensuring good pedestrian access between the nearby SLAA development sites and the bus service. However, given the extent of unmet demand modelled at the junction, it is questionable whether the entire excess could be accommodated by the promotion of sustainable travel modes alone.

Junction 12 – Four Wantz Roundabout : Summary

• Relative level of unmet demand	**Moderate**
• Main contributor(s) to unmet demand	SLAA developments
• Urban or Rural junction?	Urban
• Sustainable options to consider	Promotion of existing bus services + Personal Travel Planning. Consider relocation and size of SLAA development sites.
• Opportunity for sustainable measures	**Limited**
• Capacity infrastructure improvements?	Unlikely in short/medium-term – dependent on final site allocations

Junction 13 – Coopers Hill Mini Roundabout, Chipping Ongar

Junction 13 (Coopers Hill) - Marden Ash (Chipping Ongar)						*Roundabout junction*
Arm	**AM PEAK**			**PM PEAK**		
	Base	2026 Bgd	2026 Dev	Base	2026 Bgd	2026 Dev
A113 Coopers Hill	0	57	245	0	0	76
A128 Brentwood Road	0	0	0	0	0	0
A113 Stanford Rivers Road	0	0	0	0	0	118
St. James Avenue	0	0	0	0	0	0
Total	**0**	**57**	**245**	**0**	**0**	**194**

Table 18 – Peak hour unmet demand (PCUs) at Junction 13 – Coopers Hill Mini Roundabout

Patterns of unmet demand at the Coopers Hill mini roundabout junction south of Chipping Ongar are very similar to those at the Four Wantz Roundabout, with development traffic to sites in Chipping Ongar again leading to the greatest volume of unmet demand modelled. Excess traffic could again be reduced through changes to the size and location of development sites, or could, in part, be accommodated through the promotion of and improved access to local bus services.

Junction 13 – Coopers Hill Roundabout : Summary

- Relative level of unmet demand — **Moderate**
- Main contributor(s) to unmet demand — SLAA developments
- Urban or Rural junction? — Urban
- Sustainable options to consider — Promotion of existing bus services + Personal Travel Planning. Consider relocation and size of SLAA development sites.
- Opportunity for sustainable measures — **Limited**
- Capacity infrastructure improvements? — Unlikely in short/medium-term – dependent on final site allocations

Junction 19 – Piercing Hill Priority Junction, Theydon Bois

Junction 19 (Piercing Hill) - Theydon Bois						*Priority junction*
Arm	**AM PEAK**			**PM PEAK**		
	Base	2026 Bgd	2026 Dev	Base	2026 Bgd	2026 Dev
Piercing Hill	0	0	0	0	0	2
B172 Coppice Road (East) R-T	0	0	0	0	0	0
The Green	0	21	24	0	0	0
B172 Coppice Road (West) R-T	0	0	0	0	0	0
Total	**0**	**21**	**24**	**0**	**0**	**2**

Table 19 – Peak hour unmet demand (PCUs) at Junction 19 – Piercing Hill Priority Junction

Excess demand modelled at the priority junction of Piercing Hill and the B172 Coppice Road is comparatively small compared with other junctions assessed, and is generated by both background traffic growth and development traffic in near equal measure. It might be reasonable to assume that the small quantity of unmet demand could be accommodated by an increased uptake of walking and cycling modes to the nearby tube station – assuming an adequate provision of facilities at the station and improved connectivity to existing and proposed housing areas.

Junction 19 – Piercing Hill Priority Junction : Summary

- Relative level of unmet demand — **Low**
- Main contributor(s) to unmet demand — 2026 Background growth & SLAA developments
- Urban or Rural junction? — Rural
- Sustainable options to consider — Improved pedestrian/cycle access and facilities at rail station.
- Opportunity for sustainable measures — **Good**
- Capacity infrastructure improvements? — Unlikely in short/medium-term

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Junction 21 – M25 J26 – Northern Roundabout, Waltham Abbey

No unmet demand is modelled at the junction in a 2026 forecast year.

Junction 22 – M25 J26 – Southern Roundabout, Waltham Abbey

Junction 22 (M25 J26 Southern RAB) - Waltham Abbey						*Roundabout junction*
Arm	**AM PEAK**			**PM PEAK**		
	Base	2026 Bgd	2026 Dev	Base	2026 Bgd	2026 Dev
M25 Off Slip	0	0	0	0	0	0
A121 Honey Lane	0	102	305	0	0	78
A121 Dowding Way	0	0	0	0	0	0
Honey Lane RAB Link	0	0	0	0	0	0
Total	**0**	**102**	**305**	**0**	**0**	**78**

Table 20 – Peak hour unmet demand (PCUs) at Junction 22 – M25 J26 Southern Roundabout, Waltham Abbey

The southern roundabout of the M25 Junction 26 is shown in the AM peak modelling to leave unmet demand on the A121 Honey Lane approach by 2026 with growth in background traffic flow. The addition of SLAA development traffic produces a further increase in excess demand at the junction.

2011 Census Journey to Work distributions on which the spreadsheet modelling is based, suggest that few vehicle trips approaching the junction from the A121 Honey Lane (via the Wake Arms Roundabout) have local destinations in Waltham Abbey. Consequently, the scope to address unmet demand at the junction with sustainable initiatives would appear limited to improving the coverage, frequency cost and promotion of longer-distance and inter-urban bus services. However, as highlighted earlier, such initiatives would likely struggle to be economically viable given the comparably low level of potential patronage expected for longer distance bus journeys.

It might therefore be reasonable to expect carriageway widening along the A121 Honey Lane approach to offer the best means of accommodating unmet demand and subsequently tackling congestion at the junction in the future.

Junction 22 – M25 Junction 26 Southern Roundabout : Summary

- Relative level of unmet demand — **High**
- Main contributor(s) to unmet demand — 2026 Background growth & SLAA developments
- Urban or Rural junction? — Rural
- Sustainable options to consider — Improvements to and promotion of inter-urban bus services
- Opportunity for sustainable measures — **Very Limited**
- Capacity infrastructure improvements? — Likely in medium-term

Junction 24 – Meridian Way Signalised Junction, Waltham Abbey

Junction 24 (Meridian Way) - Waltham Abbey						*Signalised junction*
Arm	**AM PEAK**			**PM PEAK**		
	Base	2026 Bgd	2026 Dev	Base	2026 Bgd	2026 Dev
Beaulieu Drive	0	0	0	0	0	0
B194 Highbridge Street (East)	86	134	262	0	0	124
Meridian Way	0	0	58	0	0	0
B194 Highbridge Street (West)	0	0	0	0	0	227
Total	**86**	**134**	**320**	**0**	**0**	**351**

Table 21 – Peak hour unmet demand (PCUs) at Junction 24 – Meridian Way Signalised Junction, Waltham Abbey

The signalised junction at Meridian Way / Highbridge Street is modelled as experiencing moderate volumes of unmet demand in the AM 2013 base year. This excess demand is more than doubled following the addition of 2026 background traffic growth, and again with the addition of SLAA development traffic. In the PM peak, modelled unmet demand is created by the addition of SLAA development traffic alone.

As with Junction 4 (Highbridge Street Roundabout) immediately to the east, excess demand at the junction might be best addressed sustainably through the promotion of bus or cycle travel between SLAA sites and the rail station at Waltham Cross. To best achieve this, sites should have good pedestrian access to bus routes, and good cycle access to the rail station (if located within a reasonable cycling distance). Working with the neighbouring local authority to provide a dedicated cycle route along the A121 between Waltham Abbey and Waltham Cross, and providing greater connectivity to/from the existing cycle route along the B194, would help to reduce the level of vehicle demand at the signals with Meridian Way.

With approximately 3,075 AM peak vehicle demand modelled at the junction in 2026 using the latest development assumptions, approximately 17.5% would need to be accommodated by alternative sustainable modes (bus, cycling, walking etc.) in order for unmet demand to be fully accommodated. Whether this figure is achievable will govern whether junction capacity upgrades might be required in the short/medium-term.

Junction 24 – Meridian Way Signalised Junction : Summary

• Relative level of unmet demand	**High**
• Main contributor(s) to unmet demand	Base, background growth & SLAA developments
• Urban or Rural junction?	Urban
• Sustainable options to consider	Pedestrian access to bus routes + improved cycle links to rail station
• Opportunity for sustainable measures	**Good**
• Capacity infrastructure improvements?	Possible in short/medium-term

Appendix A: SLAA Site List – April 2015 – for use in latest junction capacity modelling

Settlement	Site Unique Ref: SR-####x	Address/Site Location	Parish	Size (ha) - From Site Boundary	Site Notes and Description	Dwellings (Units)	Commercial (sqm)	Retail/Leisure (sqm)
Harlow	SR-0006	Dorrington Farm, Rye Hill Road, Harlow, Essex, CM18 7JF	North Weald Bassett	2.35	Existing farm building, warehouse and adjacent field.	70	9,400	0
	SR-0046	Latton Priory Farm, London Road, Harlow	North Weald Bassett	252.31	Residential led urban extension to Harlow on existing agricultural fields	2,250	150,000	0
	SR-0074	Land to the east of the A414, New House Farm, Harlow	North Weald Bassett	10.34	Vacant agricultural land	155	20,680	0
	SR-0092	Latton Park, London Road, Harlow	North Weald Bassett	17.81	Agricultural fields	0	71,240	0
	SR-0139	Riddings Lane, Hastingwood Road, Hastingwood, North Harlow, Essex, CM18 7HT	North Weald Bassett	1.50	Vacant and derelict nursery site	50	0	0
	SR-0091	Land to the west of Harlow between Old House Lane, Epping Road, Water Lane and Katherines (also partly within Harlow DC)	Roydon	74.1	Agricultural fields and glasshouses/nurseries	1100	33,000	0
Buckhurst Hill	SR-0176	St Just, 1 Powell Road, Buckhurst Hill, Essex, IG9 5RD	Buckhurst Hill	1.23	Site comprises a large residential garden	60	0	0
	SR-0230	Former electricity sub-station, off station way, Roding Valley, Buckhurst Hill, IG9	Buckhurst Hill	0.17	Urban site comprising former sub-station building	12	0	0
Chigwell	SR-0014	Land adjoining 40A Hainault Road, Chigwell, Essex, IG7 6QX	Chigwell	0.39	Empty plot adjacent to housing and community hall	10	0	0
	SR-0433	Former Beis Shammai School, High Road, Chigwell, IG7 5DN	Chigwell	2.03	Vacant school premises.	75	0	0
	SR-0478	Chigwell Nurseries, 245 High Road, Chigwell, Essex, 1G75BL	Chigwell	7.49	Nursery.	175	0	0
Chipping Ongar	SR-0022	Rear of 101-103 High Street, Chipping Ongar	Ongar	0.10	Urban site to the rear of Royal Oak pub	5	0	0
	SR-0112	Land to the west of Stanford Rivers Road, Ongar	Ongar	31.88	Agricultural fields	765	25,500	0
	SR-0268	Land to the South of Kettlebury Way, Ongar	Ongar	1.44		43	0	0
	SR-0120	Bowes Field, Chipping Ongar	Ongar	3.3	Vacant greenfield plot	100	0	0
	SR-0390	Greenstead Road, Ongar	Ongar	9.08		272	0	0

Epping Forest District

Local Plan Highway Impact Assessment

Settlement	Site Unique Ref: SR-####x	Address/Site Location	Parish	Size (ha) - From Site Boundary	Site Notes and Description	Dwellings (Units)	Commercial (sqm)	Retail/Leisure (sqm)
Epping	**SR-0281**	St Johns Road Area, Epping Town Centre	Epping	3.05		**50**	0	4,000
	SR-0347	Epping Sports Centre	Epping	0.43	Existing sports centre building and car park	**35**	0	2,000
	SR-0005	54 Centre Drive, Epping	Epping	0.19	1970's Office Block in Urban Area of Epping	**12**	0	0
	SR-0278	Bower Hill Industrial Estate, Employment	Epping	0.38		**0**	1,520	0
	SR-0208	Theydon Place, Epping	Epping	5.93	Fallow fields and paddocks	**60**	0	0
	SR-0466	Broadbanks, 23 Ivy Chimneys Road, Epping, Essex, CM16 4EL	Epping	1.97	Residential dwelling, stables and ménage.	**44**	0	0
	SR-0406	Land South of Coopersale, East & West of Houblons Hill	Epping	41.15		**604**	0	0
Loughton / Debden	**SR-0058**	Land to North of Clay's Lane, Loughton, Essex, IG10 2RZ	Loughton/ Debden	2.59	Agricultural field/stable paddocks	**78**	0	0
	SR-0289	Vere Road, Loughton Broadway	Loughton/ Debden	0.97	Car parking and garages to the rear of Loughton Broadway	**41**	0	0
	SR-0286	Burton Road, Loughton Broadway	Loughton/ Debden	1.28	Urban site comprising of three plots along Burton Road	**80**	0	1,000
	SR-0059	Land at 20 Albion Hill, Loughton	Loughton/ Debden	0.29	Existing dwelling house, garages and gardens	**10**	0	0
	SR-0284	Sainsbury's Supermarket Site, Loughton Broadway Town Centre	Loughton/ Debden	0.52	Sainsbury's supermarket and retail units	**41**		3,800
	SR-0446	Debden Hall, England's Lane/Debden Lane, Debden, Loughton, Essex, IG10	Loughton/ Debden	3.88	Undeveloped site completely covered by trees and	**80**	0	0
	SR-0436	9 Goldings Rise, Loughton, IG10 2QP	Loughton/ Debden	0.26	In part domestic garden and in part landlocked open space.	**4**	0	0
Lower Sheering	**SR-0121**	Land at Sheering Lower Road, Sawbridgeworth	Sheering	0.48	Vacant Greenfield land covered in trees.	**14**	0	0
Sheering	**SR-0472**	The Yard, R/O 16 Sheering Lower Road, Sawbridgeworth, Essex, CM21 9LF	Sheering	1.12	Residential and amenity land.	**34**	0	0
	SR-0146	Land East of Harlow, North of Church Langley and South of Sheering Road	Sheering	317.43	Large strategic site on edge of Harlow, with only part of site	**1500**	50,000	0
	SR-0073	Land to the East of the M11, Sheering	Sheering	4.7	Greenfield plot between Sheering and the M11.	**71**	0	9,400
	SR-0449	Bramleys land to the rear of Holmcroft, Chatfield House and Builders Yard, Sheering. (hatched red)	Sheering	0.33	Residential dwelling, amenity land and additional kept land.	**6**	0	0
	SR-0450	Bramleys land to the rear of Holmcroft, Chatfield House and Builders Yard, Sheering. (hatched blue)	Sheering	0.11	Open site with considerable tree coverage to the rear of a	**3**	0	0

Epping Forest District

Local Plan Highway Impact Assessment

Settlement	Site Unique Ref: SR-####x	Address/Site Location	Parish	Size (ha) - From Site Boundary	Site Notes and Description	Dwellings (Units)	Commercial (sqm)	Retail/Leisure (sqm)
North Weald Bassett including North Weald Airfield	**SR-0036**	Land at Blumans, North Weald (two sites)	North Weald Bassett	10.78	Agricultural fields	**323**	0	0
	SR-0501	Playing field at New House Lane, North Weald	North Weald Bassett	2.33	Playing field.	**70**	0	0
	SR-0158a	Land at North Weald Bassett, South of Vicarage Lane	North Weald Bassett	29.06	Agricultural fields	**1093**	0	0
	SR-0409	Land at J7 of M11	North Weald Bassett	7.17	Agricultural field	**0**	28,680	0
	SR-0417	Land east of Church Lane/West of Harrison Drive, North Weald Bassett	North Weald Bassett	1.83	Agricultural field	**55**	0	0
Roydon	**SR-0197**	Land adjacent to Kingsmead, Epping Road, Roydon, Essex	Roydon	0.48	Lawn, part of large domestic garden	**5**	0	0
	SR-0306	Roydon, South East Area	Roydon	17.42	Broad Area South East of Roydon	**522**	0	0
Theydon Bois	**SR-0080**	Coppice Farm, Coppice Row, Theydon Bois, Essex, CM16 7OS	Theydon Bois	2.28	Horse paddocks	**68**	0	0
Thornwood	**SR-0271**	(Former Coachworks) Popplewells, High Road, Thornwood, Epping, Essex	North Weald Bassett	0.3		**10**	0	0
	SR-0149	Tudor House, High Road, Thornwood, with adjacent land.	North Weald Bassett	3.58	Dwelling house and adjacent land (fields)	**175**	0	0
Waltham Abbey	**SR-0380**	Abbey Gardens/Darby Drive Car Park	Waltham Abbey	0.51	Pay and Display Car park	**41**	0	3,000
	SR-0381	Town Mead/Green Yard Car Park	Waltham Abbey	0.97	Pay and Display Car park	**15**	0	1,700
	SR-0021	Land lying to the North of Honey Lane and west of Mason Way, Ninefields, Waltham Abbey, Essex	Waltham Abbey	0.24	Small area of vacant/amenity open land	**10**	0	0
	SR-0384	King Harold School (Business & Enterprise Academy)	Waltham Abbey	6.89	Existing School and Playing Fields	**199**	0	0
	SR-0089a	Land Lying to the West side of Galley Hill Road, Northern Portion	Waltham Abbey	11.37	Agricultural field	**341**	0	0
	SR-0099	Lea Valley Nursery, Crooked Mile, Waltham Abbey	Waltham Abbey	16.67	Derelict agricultural nursery/garden centre with a	**100**	0	0
	SR-0104	Land adjoining Parklands, Waltham Abbey	Waltham Abbey	4.34	Agricultural field	**150**	0	0
	SR-0376	Abbeyview Nursery, Parklands	Waltham Abbey	2.72	Existing nursery and Glasshouses	**81**	10,880	0
	SR-0482	Land adjoining Mason Way, Waltham Abbey	Waltham Abbey	0.71	Open amenity space.	**21**	0	0
TOTAL						**11188**	**400,900**	**24,900**

Appendix B: 2011 Census Journey-to-Work – travel to work by car/van

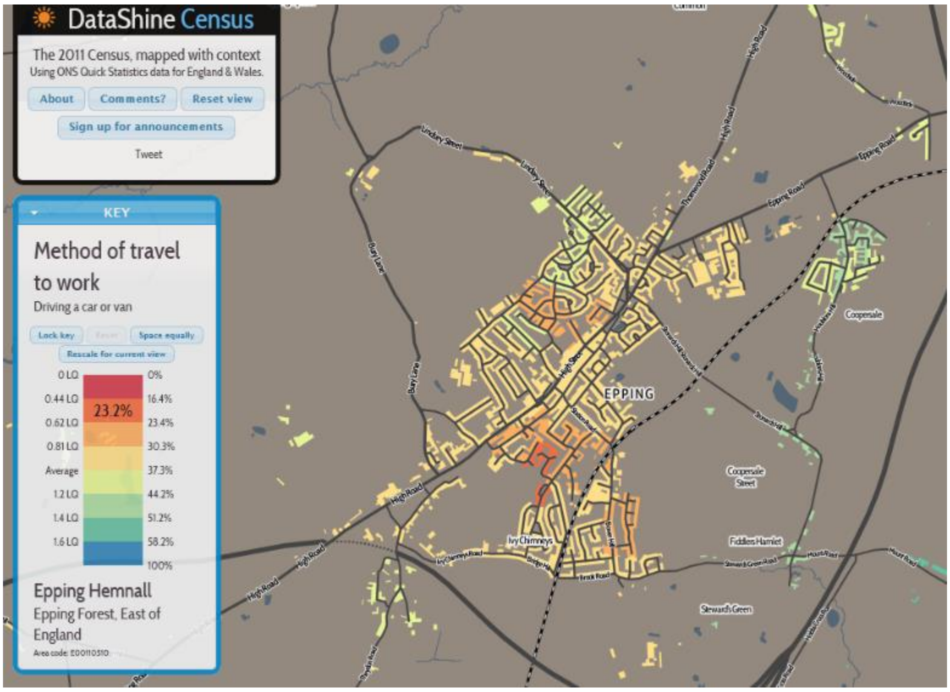

Figure A1 – Method of travel to work in Epping - % driving a car or van

(As illustrated: Lowest = 23.2% in Census Output Area Code: E00110510)

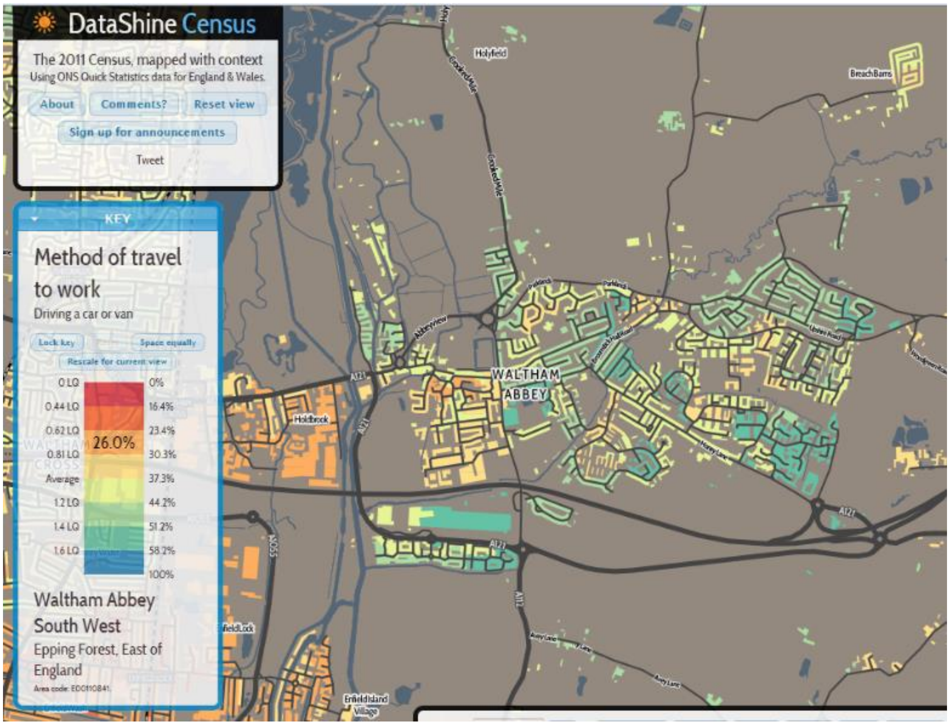

Figure A2 – Method of travel to work in Waltham Abbey - % driving a car or van

(As illustrated: Lowest = 26% in Census Output Area Code: E00110841)

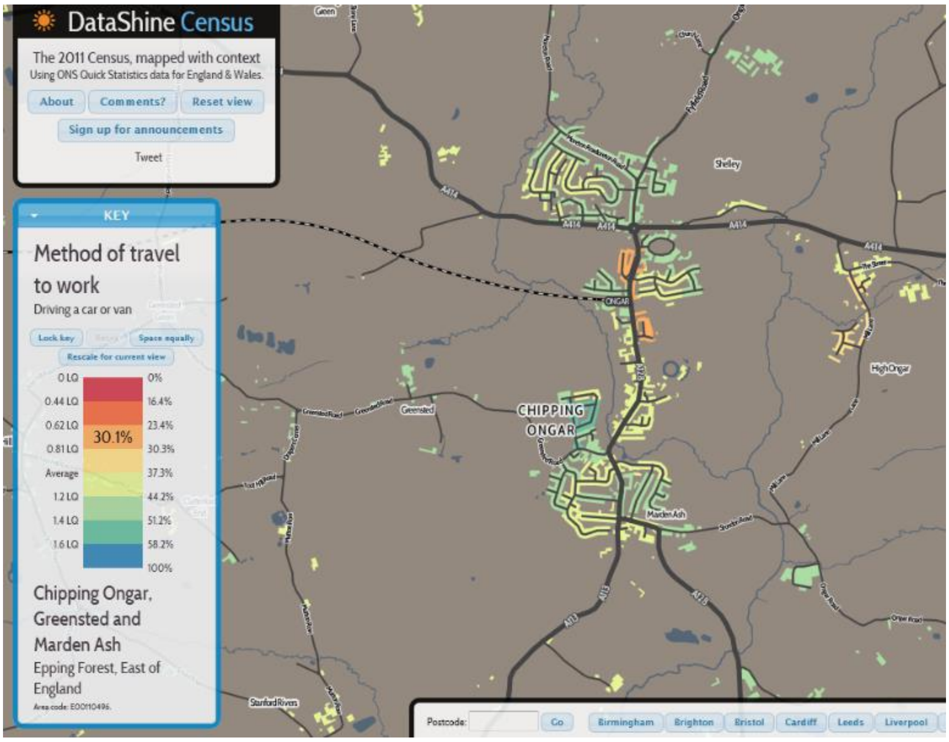

Figure A3 – Method of travel to work in Chipping Ongar - % driving a car or van

(As illustrated: Lowest = 30.1% in Census Output Area Code: E00110496)

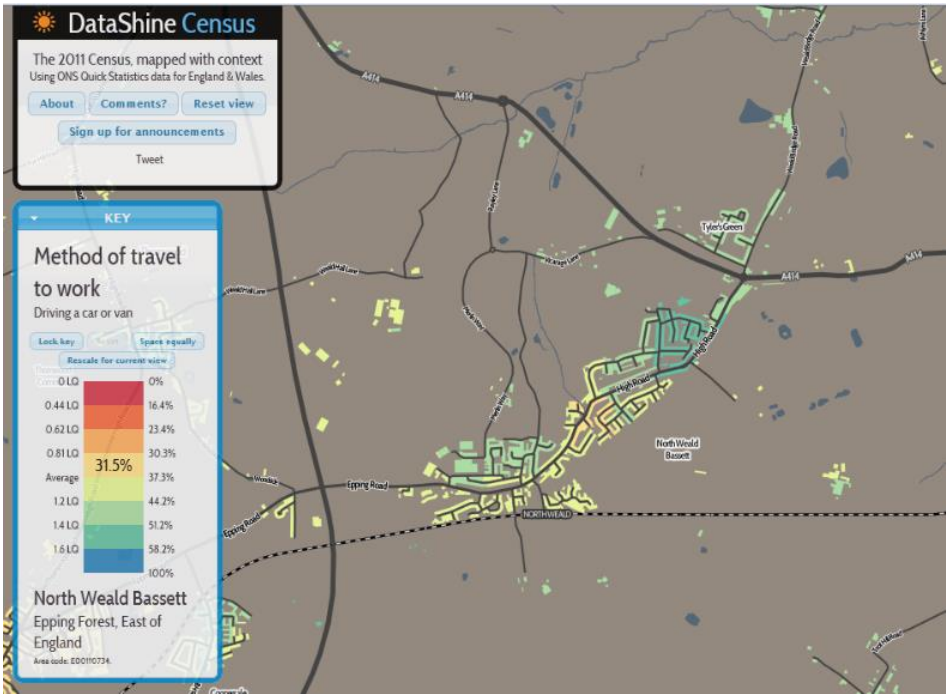

Figure A4 – Method of travel to work in North Weald Bassett - % driving a car or van

(As illustrated: Lowest = 31.5% in Census Output Area Code: E00110734)

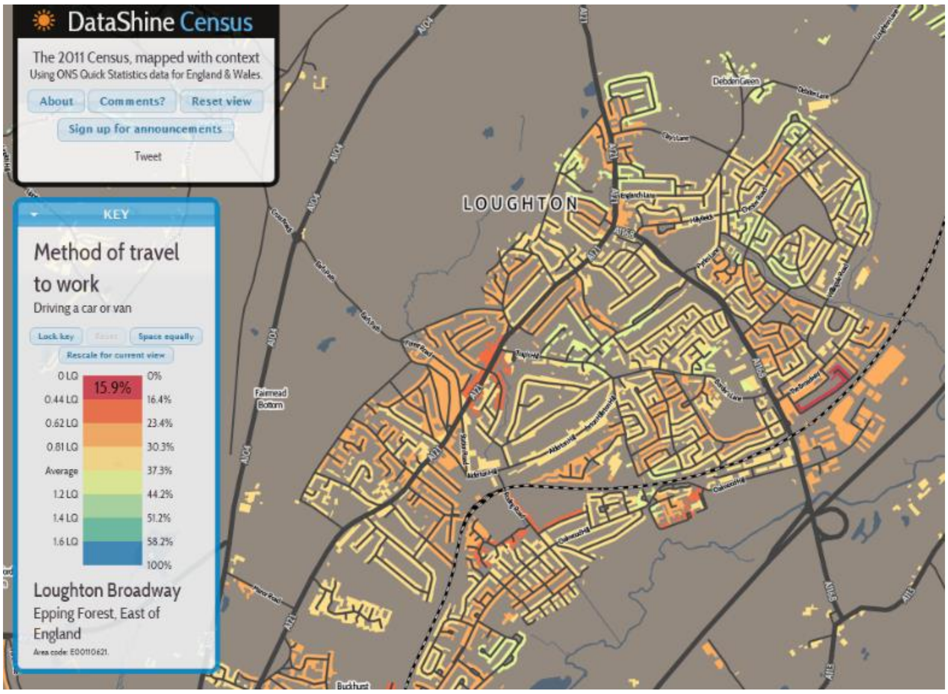

Figure A5 – Method of travel to work in Loughton - % driving a car or van

(As illustrated: Lowest = 15.9% in Census Output Area Code: E00110621)

Appendix B: 2011 Census Car ownership data

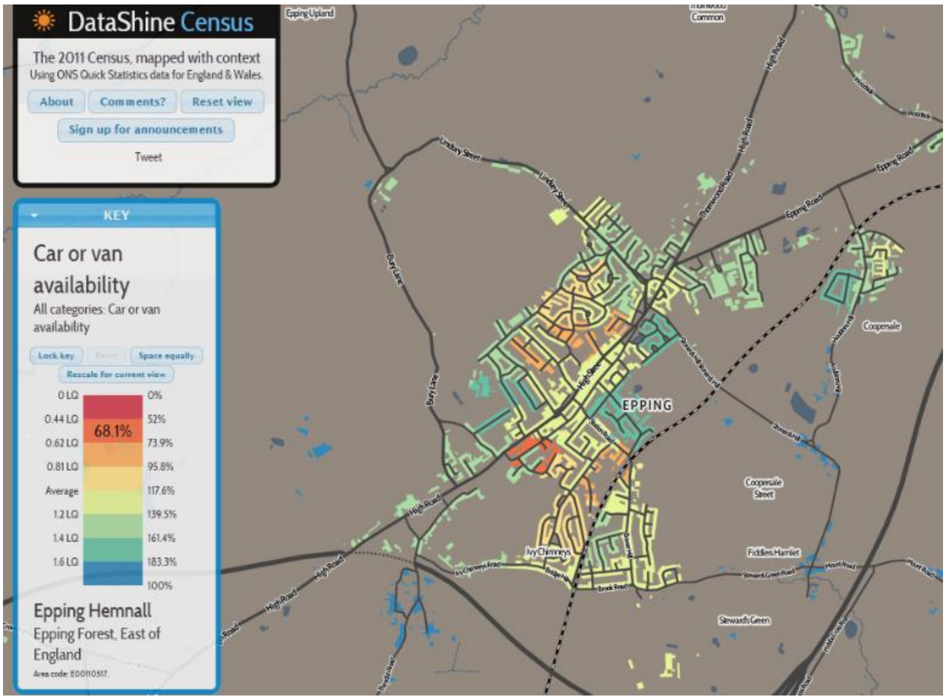

Figure A6 – Car or van availability in Epping – 100% = 1 car per household on average

(As illustrated: Lowest = 68.1% in Census Output Area Code: E00110517)

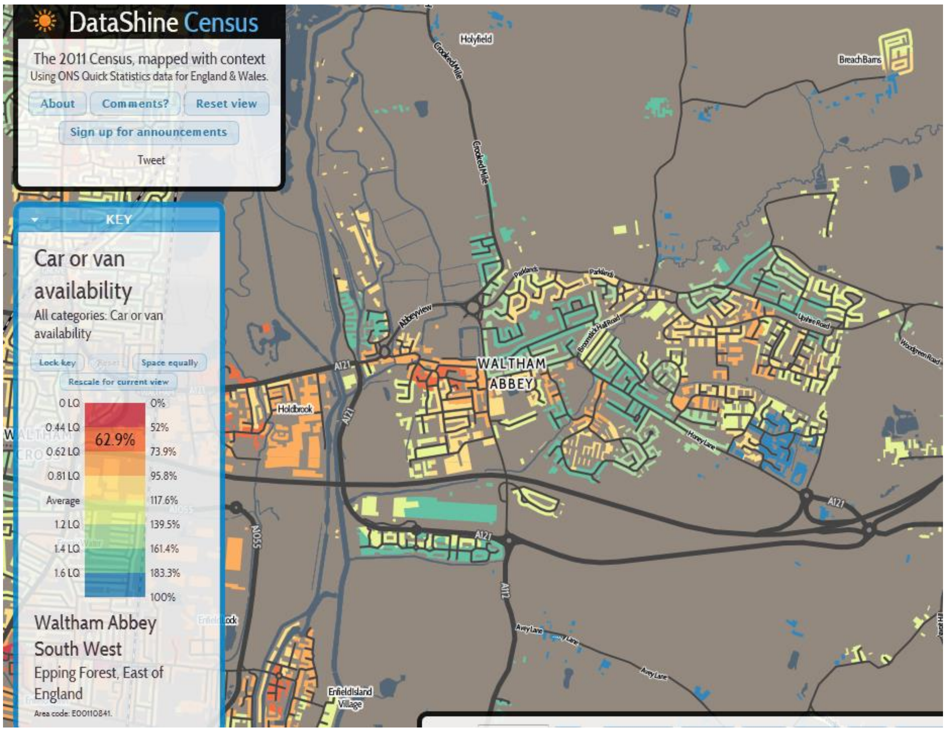

Figure A6 – Car or van availability in Waltham Abbey – 100% = 1 car per household on average

(As illustrated: Lowest = 62.9% in Census Output Area Code: E00110838)

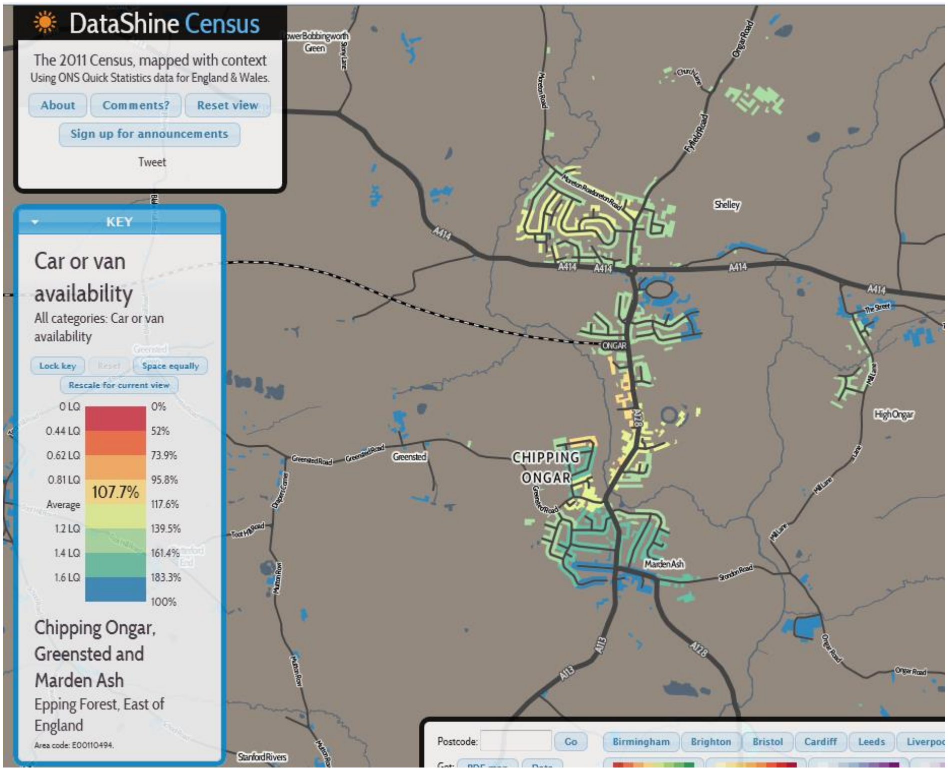

Figure A7 – Car or van availability in Chipping Ongar – 100% = 1 car per household on average

(As illustrated: Lowest = 107.7% in Census Output Area Code: E00110494)

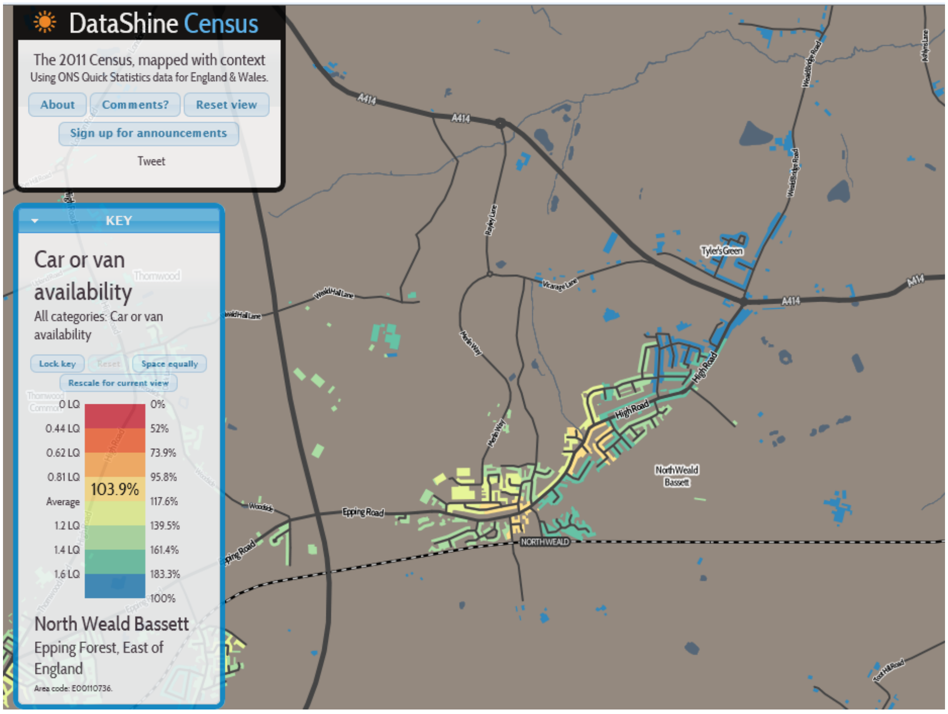

Figure A7 – Car or van availability in North Weald Bassett – 100% = 1 car per household on average

(As illustrated: Lowest = 103.9% in Census Output Area Code: E00110738)

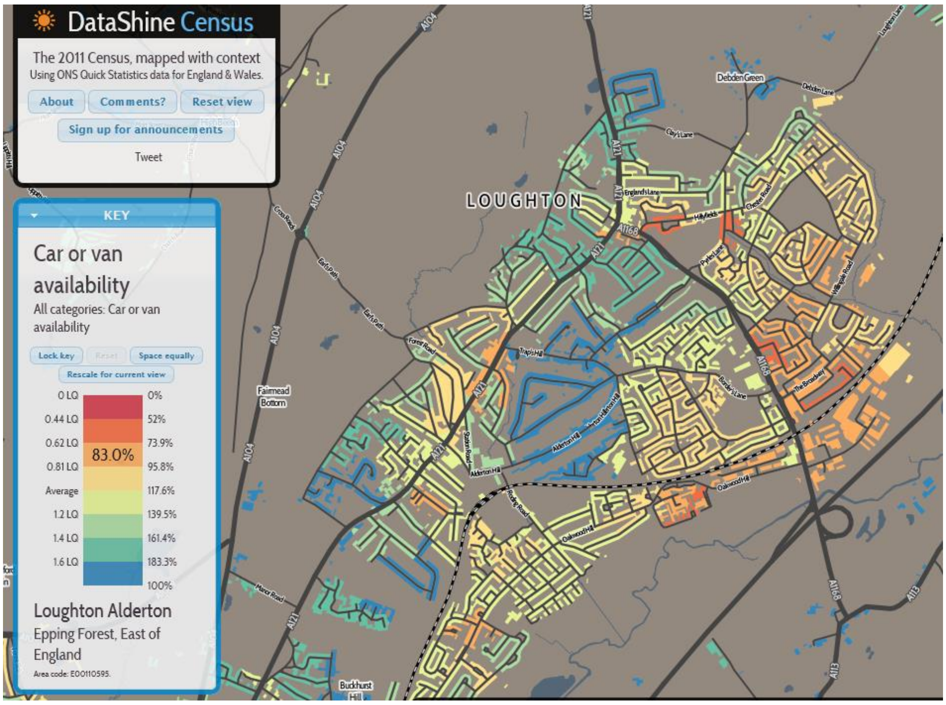

Figure A7 – Car or van availability in Loughton – 100% = 1 car per household on average

(As illustrated: Lowest = 83% in Census Output Area Code: E00110595)