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A1307 HAVERHILL TO CAMBRIDGE CORRIDOR

DRAFT ROAD INTERVENTION
TECHNICAL NOTE



CONFIDENTIAL

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DRAFT ROAD INTERVENTION TECHNICAL NOTE

Cambridgeshire County Council

**DRAFT
Confidential**

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WSP | Parsons Brinckerhoff

WSP House
70 Chancery Lane
London
WC2A 1AF

Tel: +44 (0) 20 7314 5817

Fax: +44 (0) 20 7314 5111

www.wspgroup.com

www.pbworld.com

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PRODUCTION TEAM

WSP GLOBAL INC. (WSP)

Associate Director Darren Pacey

Principal Engineer Andi Redhead

Principal Rail Planner Ating Liu

Graduate Engineer Shane Luck

TABLE OF CONTENTS

1	INTRODUCTION.....	1
1.1	BACKGROUND.....	1
1.2	MAJOR ROAD INTERVENTION SCENARIOS	1
1.3	FUTURE DEVELOPMENT DEMAND.....	2
1.4	TECHNICAL NOTE STRUCTURE	2
2	PROPOSED ROAD INTERVENTIONS	3
2.1	OVERVIEW.....	3
2.2	SCENARIO 1	3
2.3	SCENARIO 2	3
2.4	SCENARIO 3	5
2.5	BUSINESS CASE ASSESSMENT	5
2.6	CAPITAL AND OPERATING COSTS	7
3	FUTURE DEVELOPMENT DEMAND.....	8
3.1	OVERVIEW.....	8
3.2	DESIGN STANDARDS FOR A NEW DUAL CARRIAGEWAY ROAD	8
3.3	2014 AND 2031 BASELINE A1307 AADT FLOWS.....	9
3.4	RESIDENTIAL VEHICLE TRIP RATE PER DWELLING	9
3.5	PROPORTION OF RESIDENTIAL VEHICLE TRIPS ROUTING FROM HAVERHILL AND LINTON ALONG THE A1307 CORRIDOR.....	10
3.6	NUMBER OF ADDITIONAL RESIDENTIAL DWELLINGS TO ACHIEVE MID AND UPPER 2 LANE DUAL AADT FLOWS ON THE A1307 CORRIDOR	12
3.7	SENSITIVITY TEST	12
4	SUMMARY.....	14
4.1	PROPOSED ROAD INTERVENTIONS	14
4.2	FUTURE DEVELOPMENT DEMAND.....	14

4.3 LIMITATIONS15

TABLES

TABLE 2-1	KEY APPRAISAL PARAMETERS	6
TABLE 2-2	ROAD IMPROVEMENTS VIABILITY – SCENARIO 1	6
TABLE 2-3	ROAD IMPROVEMENTS VIABILITY – SCENARIO 2	6
TABLE 2-4	ROAD IMPROVEMENTS VIABILITY – SCENARIO 3	6
TABLE 3-1	2014 OBSERVED AND 2031 FUTURE BASELINE AADT LINK FLOWS	9
TABLE 3-2	DIFFERENCE BETWEEN A1307 2031 FUTURE BASELINE AADT & AND THE TA46/97 MID-POINT AND MAXIMUM 2 LANE DUAL AADT	9
TABLE 3-3	UPPER AND LOWER VEHICLE TRIP RATES (ALL DAY).....	10
TABLE 3-4	WORKPLACES WHERE JOURNEYS TO WORK HAVE BEEN ASSIGNED ALONG THE A1307 CORRIDOR.....	10
TABLE 3-5	WORKPLACES WHERE JOURNEYS TO WORK HAVE BEEN ASSIGNED ALONG THE A1307 CORRIDOR.....	11
TABLE 3-6	ASSUMED SPLIT OF PROPOSED DWELLINGS (BASED UPON EXISTING POPULATION).....	11
TABLE 3-7	DISTRIBUTION OF VEHICLE TRIPS (%) FROM A COMBINED DEVELOPMENT IN HAVERHILL AND LINTON	11
TABLE 3-8	ADDITIONAL NUMBER OF DWELLINGS TO MEET DMRB MAXIMUM AND MIDPOINT AADT FOR D2AP CARRIAGEWAY.....	12
TABLE 3-9	SENSITIVITY TEST: DISTRIBUTION OF VEHICLE TRIPS (%) FROM A COMBINED DEVELOPMENT IN HAVERHILL & LINTON .	13
TABLE 3-10	ADDITIONAL NUMBER OF DWELLINGS TO MEET DMRB MAXIMUM AND MIDPOINT AADT FOR D2AP CARRIAGEWAY WITH SENSITIVITY TEST	13

FIGURES

FIGURE 2-1	PROPOSED ROAD INTERVENTION SCENARIOS	4
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MAPS

NO TABLE OF FIGURES ENTRIES FOUND.

APPENDICES

A P P E N D I X	A	TRICS OUTPUT
A P P E N D I X	B	CALCULATIONS SUMMARY

1 INTRODUCTION

1.1 BACKGROUND

- 1.1.1 This technical note has been prepared by WSP | Parsons Brinckerhoff on behalf of Cambridgeshire County Council to support the work being undertaken on the A1307 Haverhill to Cambridge Corridor as part of the Greater Cambridge City Deal. The purpose of this note is:
1. To assess, at a very high level, the potential business case for a number of indicative road interventions on the corridor as identified in the Long List of Concepts; and
 2. To estimate, at a very high level, the number of residential dwellings potentially required in Haverhill and Linton to increase the forecast 2031 Annual Average Daily Traffic Flows (AADT) along the A1307 corridor to the recommended midpoint and upper limit flow range for a new rural dual 2 lane all-purpose (D2AP) carriageway.
- 1.1.2 The Draft Audit Report, available separately, prepared by WSP | Parsons Brinckerhoff contains information to support this technical note.

1.2 MAJOR ROAD INTERVENTION SCENARIOS

- 1.2.1 The Long List of Concepts for the A1307 Haverhill to Cambridge Corridor study identified a number of potential road interventions as whole route strategic concepts. These road interventions included:
- **Scenario 1** - Widening of the single carriageway sections of the A1307 between Haverhill & Cambridge where the carriageway is narrow (i.e. an S2 carriageway) to a Type WS2 carriageway (10m wide including 1m hardstrips);
 - **Scenario 2** – dualing of all the single lane / carriageway sections of the A1307 between Haverhill & Cambridge; and
 - **Scenario 3** – provision of a single carriageway bypass to the south of Linton extending from near the junction of Horseheath Road / A1307 to the east of Linton to junction of A1307 / Little Linton.
- 1.2.2 The A1307 is included in the associated SATURN highway model, but is located at the periphery of the network (the SATURN network does not extend beyond Linton) and therefore may not be well validated compared to observed traffic data. As a result, the CSR and SATURN modelling results presented in this report could be under predicting future flows along the corridor. Improvements to the CSR and SATURN models, which are outside the scope of this study, are recommended. The scenarios were tested in the 2031 future year SATURN model and compared against the 2011 base year.

1.3 FUTURE DEVELOPMENT DEMAND

- 1.3.1 WSP | Parsons Brinckerhoff were subsequently asked to estimate the number of dwellings required in Haverhill and Linton to increase the forecast 2031 Annual Average Daily Traffic Flows (AADT) along the A1307 corridor to the recommended midpoint and upper limit flow range for a new rural dual 2 lane all-purpose (D2AP) carriageway. This option was chosen as the most suitable major road intervention.
- 1.3.2 This high level analysis is based on guidance contained within Design Manual for Roads and Bridges (DMRB) TA 46/97 Traffic Flow Ranges for Use in the Assessment of New Rural Roads. TA 46/97 states that for a D2AP road the recommended flow range is from 11,000 to 39,000 AADT. Normally, we would consider an intervention to be considered at or beyond the AADT midpoint along with the further consideration of other transport options.
- 1.3.3 The number of dwellings required in Haverhill and Linton to generate the additional AADT flows along the A1307 corridor to achieve the mid and upper TA46/97 flow range has been calculated using the following methodology:
- **Step 1:** Obtained the forecast 2031 A1307 AADT corridor flows (based on increased observed traffic flows using an appropriate growth forecast);
 - **Step 2:** Calculated average residential dwelling vehicle trip rates;
 - **Step 3:** 2011 Census Journey to Work Origin Destination Data analysed to identify the proportion of vehicle trips that are likely to route along the A1307 corridor; and
 - **Step 4:** The average increase in AADT needed to reach the mid and upper flow ranges along the corridor has been divided by the number of residential generated corridor vehicle trips to calculate the number of dwellings.
- 1.3.4 This high level analysis is solely based on the estimated residential vehicle trip generation per dwelling, and an assumed distribution of residential development generated vehicle trips along the A1307 corridor based on journeys to work only. The assessment does not take into account the potential for additional non-residential generated trips along the corridor journeys or the potential for induced traffic into an improved corridor.
- 1.3.5 No consideration of traffic congestion has been considered due to the high level nature of this work, therefore there is no guarantee that additional housing would demonstrate a positive business case for a road intervention.
- 1.3.6 It should also be noted that this assessment does not consider the policy or political implications of a major road intervention and considers only a road based intervention. For example, various sustainable transport and/or major public transport interventions may be more appropriate, depending on the situation.

1.4 TECHNICAL NOTE STRUCTURE

- 1.4.1 The remainder of this note is structured as follows:
- Chapter 2 sets out the road interventions tested and the analysis undertaken to support the high level business case;
 - Chapter 3 sets out the potential future development to support a major road intervention including caveats for this high level assessment; and
 - Chapter 4 provides a summary of the work including limitations.

2 Proposed Road Interventions

2.1 OVERVIEW

2.1.1 A number of the long list of options considered various highway improvements to the A1307 corridor. These options are outlined in summary in the 'Draft Concepts Report' dated January 2016 and the three scenarios further considered included (as shown in Figure 1-1):

- **Scenario 1** – widening of the single carriageway sections of the A1307 between Haverhill & Cambridge where the carriageway is narrow (i.e. an S2 carriageway) to a Type WS2 carriageway (10m wide including 1m hardstrips);
- **Scenario 2** – dualing of all the single carriageway sections of the A1307 between Haverhill & Cambridge;
- **Scenario 3** – provision of a single carriageway bypass (for example, to the south) of Linton.

2.1.2 These three scenarios were developed with a high level assessment undertaken using the current SATURN model available for the Cambridge sub-region in the 2031 future year. A summary of the current and future traffic flows (AADT) is included in the Draft Audit Report and Draft Concepts Report.

2.1.3 No feasibility design work has been undertaken at this stage and the basis of the scenarios is detailed in the following paragraphs. The key assumptions have been listed where appropriate but are not exhaustive due to the complex nature of undertaking this type of work. The scenarios proposed are high level and indicative, which should be treated with caution.

2.1.4 No grade separation has been considered in any scenario. There are obvious journey time implications and safety implications in the provision of any grade separation / junctions and these would need to further considered if any design work was undertaken. Additionally, no consideration of environmental, heritage or social constraints has been considered.

2.2 SCENARIO 1

2.2.1 Scenario 1 comprises the widening of the single carriageway sections of the A1307 between Haverhill and Cambridge (from the junction of the A1307 / A1017 through to the roundabout on the A1307 at Addenbrooke's Hospital / Cambridge Biomedical Campus).

2.2.2 Currently, the single carriageway sections, through our initial assessment (without undertaking a feasibility design), are designated as an S2 carriageway (with a carriageway width of 7.3m). This includes 17 identified sections of single carriageway.

2.2.3 It is proposed in this scenario to widen the carriageway to 10 wide (including 1m hardstrips) to upgrade it to a Type WS2 carriageway. For this assessment, without the benefit of feasibility design, we have assumed that all junctions would remain as per the current arrangements.

2.3 SCENARIO 2

2.3.1 Scenario 2 comprises the dualing of the single carriageway sections of the A1307 between Haverhill and Cambridge (from the junction of the A1307 / A1017 through to Granham's Road on the A1307).

2.3.2 The sections considered for potential dualing include:

Figure 2-1 Proposed Road Intervention Scenarios



- Junction of A1307 / A1017 to existing dual carriageway west of Horseheath;
- From the existing dual carriageway east of the junction at Horseheath Road through Linton to the existing dual carriageway west of Linton near the college;
- From the existing dual carriageway west of Linton through to the Fourwentways junction at the A11;
- From west of the junction of the High Street at Babraham through to the Wandlebury Country Park area; and
- From the Wandlebury Country Park area through to Granham's Road.

2.3.3 It should be noted that the following has been further considered:

- At key junctions, particularly those at or near key towns & villages such as Horseheath, Linton, Great Abington and Babraham or at key intersecting roads, generic roundabout junction arrangements have been considered; and
- No new bypasses were considered and dualing would take place through Linton and Great Abington.

2.4 SCENARIO 3

2.4.1 Scenario 3 considers the potential provision of a bypass to the south of Linton through the provision of a single carriageway. The bypass in this scenario begins from east of the Bartlow Road junction with the A1307 and re-joins the A1307 west of Linton.

2.4.2 Providing a bypass to the south of Linton was chosen due to the topographical issues in the area and the majority of Linton being to the north.

2.4.3 The junctions with Bartlow Road, Hadstock Road and with the A1307 west of Linton would be at grade roundabouts within this scenario.

2.5 BUSINESS CASE ASSESSMENT

2.5.1 The economic appraisal methodologies are compliant with DfT WebTAG, the appraisal guidance for transport related schemes, as well as the Green Book. The appraisal has assessed three Base Case vs Do Something options, with a Benefit Cost Ratio (BCR) determined for each.

2.5.2 The key parameters, assumptions such as the Value of Time (VoT), discounting rate, optimism bias etc. are in line with the most up to date WebTAG values from November 2014. The key modelling parameters are shown in Table 2-3. An annualisation factor of 255 days has been used.

2.5.3 The WebTag value of time, and value of time growth was used. In addition, the following assumptions were made:

- Demand was assumed to be capped after 2031;
- Approximately 50% of journeys were assumed to be for work purposes with the remainder for non-work purposes; and
- No journey time savings were assumed in the off-peak conditions. The assumption was that in the off-peak, the interventions were in a free flow condition.

Table 2-1 Key Appraisal Parameters

CRITERION	ASSUMPTION	SOURCE
Discount Rate	3.5%	WebTAG
Opening Year	2025	General assumption for all scenarios
Base Year	2010	DfT Base Year
Appraisal Years	60 years	Based on asset life
Forecast Year	2084	60 years from the opening
Value of Time	Commuting: £6.81 / hr	WebTAG Nov 2014 update
Capital Cost	Scenario 1: £25m Scenario 2: £100m Scenario 3: £15m	Indicative costs only which include risk and contingency. Subject to change based upon feasibility design and further assessment
Capital Expenditure	100% in 2024	General assumption

2.5.4 The overall results of the modelling undertaken are contained within Table 2-4, 2-5 and 2-6.

Table 2-2 Road Improvements Viability – Scenario 1

Estimated Capital Cost	£25m
Existing Modelled Journey Time (2011)	25 minutes (AM Peak)
Modelled Journey Time (2011) - with Intervention	24 minutes (AM Peak)
Scenario 1 Journey Time (2031) – with Intervention	28 minutes (AM Peak)
BCR Assessment	0.30

Table 2-3 Road Improvements Viability – Scenario 2

Estimated Capital Cost	£100m
Existing Modelled Journey Time (2011)	25 minutes (AM Peak)
Modelled Journey Time (2011) - with Intervention	23 minutes (AM Peak)
Scenario 2 Journey Time (2031) – with Intervention	27 minutes (AM Peak)
BCR Assessment	0.26

Table 2-4 Road Improvements Viability – Scenario 3

Estimated Capital Cost	£15m
Existing Journey Time through Linton on the A1307 (2014)	6 minutes (AM Peak – car only)
Existing Modelled Journey Time (2011)	5.5 minutes (AM Peak)
Modelled Journey Time (2011) - with Intervention	4.2 minutes (AM Peak)
Scenario 3 Journey Time (2031) – with Intervention	4.5 minutes (AM Peak)
BCR Assessment	0.28

2.5.5 In providing any road scheme, the most direct benefit is that of congestion relief and the journey time savings made. Each option above was discounted in the assessment undertaken. The potential journey time improvements along with the expected traffic flows in relation to the road capacity improvements were not judged sufficient enough for a case to be made. Each option represented poor value for money with an average BCR of 0.30.

2.5.6 Scenario 1 and Scenario 2 are both unlikely to improve road safety and unlikely to significantly reduce journey times, as there will still be a need for a number of junctions (in the form of roundabouts or signalled junctions) to maintain access to/from local communities.

2.5.7 However, if significant further development occurs along the corridor outside the expected Local Plan through to 2031, then a case for road improvements could be revisited.

2.6 CAPITAL AND OPERATING COSTS

2.6.1 The capital costs have been estimated at high level (indicative costs only). The estimates shown in Table 2-4 to Table 2-6 are for construction costs only, with reasonable allowances, based upon experience, for ecological or land surveys, land purchase, design fees and consents.

3 Future Development Demand

3.1 OVERVIEW

3.1.1 In considering the potential number of dwellings that might necessitate a major road intervention, we have further considered the following:

- Current guidelines (DMRB TA 46/97) published by the DfT which state the potential flows required for new rural roads, including size & capacity;
- Available 2014 observed traffic flows on the corridor (AADT) and the predicted 2031 traffic flows (AADT) from the Cambridge SATURN model;
- Potential trip rates for residential dwellings;
- Proportion of vehicles using the A1307; and
- The number of dwellings (using the trip rates) required to achieve a major road intervention with a sensitivity analysis around lower and higher than expected trip rates.

3.1.2 We have assumed that a major road intervention would be classed as being a dual 2 lane all-purpose (D2AP) carriageway which would potentially require the upgrading of the current single carriageways to dual carriageway standard on the A1307 corridor between Haverhill and Cambridge to this standard. This is Scenario 2 as outlined in the previous chapter.

3.2 DESIGN STANDARDS FOR A NEW DUAL CARRIAGEWAY ROAD

3.2.1 The AADT flow ranges are provided in the Design Manual for Roads and Bridges (DMRB) Volume 5 Section 1 TA 46/97 'Traffic Flow Ranges For Use in The Assessment of New Rural Roads'. TA 46/97 provides an indication of the range of traffic flows for which different carriageway standards are likely to be economically justified. The following relevant road types are included in TA 46/97:

- Type S2 (all-purpose road) is a single carriageway road with a width of wither 6.0m or 7.2m width;
- Type WS2 (wide single carriageway) has a width of 10.0m including 1m hardstrips; and
- Type D2AP (dual 2 lane all purpose) dual carriageway with 1m hardstrips.

3.2.2 The typical AADT traffic flows for these three road types is summarised below:

- Type S2: Up to 13,000 AADT;
- Type WS2: 6,000-21,000 AADT; and
- Type D2AP: 11,000-39,000 AADT.

3.2.3 However, whilst considering the above, it would normally be at the midpoint AADT or towards the maximum AADT upon which an intervention to upgrade to the next carriageway type (or another intervention e.g. public transport) would be decided upon. Outside of these ranges it is recommended within DMRB that different carriageway standards are applied.

3.3 2014 AND 2031 BASELINE A1307 AADT FLOWS

- 3.3.1 In order to understand the existing and future baseline AADT flows on the A1307, 2014 observed flows were growthed to 2031 using the predicted change in flows from the Cambridge SATURN model. The 2031 baseline flows include trips generated from committed developments included within the Cambridge SATURN Model matrices. The Observed 2014 and 2031 Future Baseline AADT flows are summarised in Table 3-1 below.

Table 3-1 2014 Observed and 2031 Future Baseline AADT Link Flows

LINK	2014 OBSERVED AADT	FUTURE BASELINE (OBS + SATURN 2011 TO 2031) AADT
Haverhill (A1017 Junction - Horseheath)	14,969	18,532
Horseheath - Linton	13,670	17,233
Bartflow Road - High Street Linton	16,796	20,570
Linton - Great Abington	17,756	21,662
Great Abington - Granta Park Junction	18,459	22,365
Granta Park Junction - A11 Junction	20,112	24,292
A11 Junction - Babraham Research Campus	17,592	22,188
Babraham Research Park – Wandlebury Country Park Area	15,505	21,697
Wandlebury Country Park Area - Hinton Way Roundabout	16,910	23,300
Hinton Way Roundabout - Addenbrooke's Hospital / Cambridge Biomedical Campus	13,900	20,273

- 3.3.2 Table 3-1 shows the AADT on each link of the A1307 between Haverhill and Cambridge currently exceeds the minimum AADT for a dual 2 lane all-purpose road (11,000 AADT). Table 1 also shows that none of the A1307 links are forecast to exceed the upper flow range AADT set out in DMRB TA 46/97 (39,000 AADT) in the 2031 Future Baseline scenario.
- 3.3.3 The difference between the 2031 Future Baseline AADT and the midpoint (25,000 AADT) and maximum AADT (39,000) for a new a dual 2 lane all-purpose road is summarised in Table 3-2.

Table 3-2 Difference between A1307 2031 Future Baseline AADT & and the TA46/97 Mid-Point and Maximum 2 Lane Dual AADT

LINK	2031 DIFFERENCE FROM MIDPOINT BETWEEN MINIMUM AND MAXIMUM DMRB D2AP FLOW	2031 DIFFERENCE FROM MAXIMUM DMRB D2AP FLOW
Haverhill (A1017 Junction - Horseheath)	6,468	20,468
Horseheath - Linton	7,767	21,767
Bartflow Road - High Street Linton	4,430	18,430
Linton - Great Abingotn	3,338	17,338
Great Abingotn - Granta Park Junction	2,635	16,635
Granta Park Junction - A11 Junction	708	14,708
A11 Junction - Babraham Research Park	2,812	16,812
Babraham Research Park - Wandlebury	3,303	17,303
Wandlebury - Hinton Way Roundabout	1,700	15,700
Hinton Way Roundabout - Addenbrooke's	4,727	18,727

3.4 RESIDENTIAL VEHICLE TRIP RATE PER DWELLING

In order to understand how many additional dwellings in Haverhill and Linton would be required to reach the midpoint and maximum AADT for a dual 2 lane all-purpose road, an average daily vehicle trip rate per dwelling has been calculated. The average daily trip rate per dwelling has been obtained from the TRICS database, Version 7.2.4 using the parameters listed below:

→ Land Use: 03 – Residential;

- Category: A – Houses Privately Owned;
- All regions in England and Wales excluding London; and
- Only Suburban Areas were selected.

3.4.1 The full TRICS output is attached in Appendix A. For the purposes of this assessment, two daily vehicle trip rates have been assumed as follows:

- A combined AM (0700-0900 hours) and PM (1600-1800 hours) vehicle trip rate per dwelling; and
- A daily vehicle trip rate per dwelling.

3.4.2 Two residential trip rates have been considered as trips during the peak hours will predominately consist of commuter trips, of which a proportion will travel are more likely to route the A1307 corridor towards Cambridge. Trips outside of this period are more likely to be for a range of purposes including education, shopping, and leisure which may be contained more locally and not route along the A1307 corridor. The second residential vehicle trip rate covers the daily period and therefore covers all trips generated per day per dwelling. The upper and lower vehicle trip rates per dwelling are summarised in Table 3-3.

Table 3-3 Upper and Lower Vehicle Trip Rates (all day)

TRIP RATE	VEHICLE TRIP RATE PER DWELLING (2-WAY)
Lower (AM & PM Peak Only)	1.843
Upper (All Day)	4.663

3.5 PROPORTION OF RESIDENTIAL VEHICLE TRIPS ROUTING FROM HAVERHILL AND LINTON ALONG THE A1307 CORRIDOR

3.5.1 Of the vehicle trips generated by any additional residential development in Haverhill and Linton, only a proportion of trips are likely to use the A1307 corridor. The average proportion of vehicle trips from Haverhill and Linton using the A1307 has been estimated using the 2011 Census Journey to Work origin and destination data. A summary of the workplaces accessible from Haverhill and Linton via the A1307 corridor is summarised in Table 3-4.

Table 3-4 Workplaces where journeys to work have been assigned along the A1307 corridor

HAVERHILL		LINTON	
Workplace	% of Trips	Workplace	% of trips
Cambridgeshire	30.65%	Cambridgeshire excl. South Cambridgeshire	61.38%
Hertfordshire	2.96%	Hertfordshire	3.08%
Bedfordshire	0.33%	Bedfordshire	0.86%
Rutland	0.01%	Rutland	0.00%
Buckinghamshire	0.05%	Buckinghamshire	0.17%
Northamptonshire	0.05%	Northamptonshire	0.07%
Lincolnshire	0.07%	Lincolnshire	0.00%
London	1.75%	London	1.57%
Total	35.9%	Total	67.1%

3.5.2 Based on the analysis of 2011 Census data, 35.9% of journeys to work from Haverhill and 67.1% of journeys to work from Linton are assumed to route along the A1307 towards Cambridge. The percentage of vehicle trips from Haverhill and Linton using the A1307 corridor is given Table 3-5.

Table 3-5 Workplaces where journeys to work have been assigned along the A1307 corridor

A1307 BETWEEN HAVERHILL & LINTON		% OF TRIPS ON CORRIDOR
Haverhill Dwellings		35.9%
Linton Dwellings		0.0%

A1307 BETWEEN LINTON & CAMBRIDGE		% OF TRIPS ON CORRIDOR
Haverhill Dwellings		35.9%
Linton Dwellings		67.1%

3.5.3 It is important to note that the distribution above has not considered any journeys to work along the A1307 towards Haverhill from Linton. As such the percentage of vehicle trips from Linton that use the A1307 may be higher.

3.5.4 For the purpose of this assessment it is assumed that any development within Haverhill and Linton would be split proportionally based on their existing population. The existing population of these settlements and the assumed split of dwellings is summarised in Table 3-6 below.

Table 3-6 Assumed Split of Proposed Dwellings (based upon existing population)

SETTLEMENT	POPULATION	ASSUMED SPLIT OF PROPOSED DWELLINGS
Haverhill	27,040	86%
Linton	4,412	14%
Haverhill & Linton	31,452	100%

* Source – 2011 Census Data

3.5.5 Based on the proposed split of dwellings in Table 3-6 above and the proportion of vehicle trips from Haverhill and Linton using the A1307 corridor in Table 3-4, the percentage of all vehicle trips from a new combined development in Haverhill and Linton that will use the A1307 corridor has been calculated. This is summarised in Table 3-7 below.

Table 3-7 Distribution of Vehicle Trips (%) from a combined development in Haverhill and Linton

SETTLEMENT	% OF VEHICLE TRIPS ON A1307 CORRIDOR	% OF TOTAL NEW DWELLINGS	% OF ALL DWELLING VEHICLE TRIPS ON A1307 CORRIDOR
A1307 between Haverhill & Linton			
Haverhill Dwellings	35.9%	86.0%	31.0%
Linton Dwellings	0.0%	14.0%	0.0%
Section Total		100.0%	31.0%
A1307 between Linton & Cambridge			
Haverhill Dwellings	35.9%	86.0%	31.0%
Linton Dwellings	67.1%	14.0%	9.0%
Section Total		100.0%	40.0%

3.5.6 Table 3-7 above shows that for any combined development in Haverhill and Linton 31% of all vehicle trips would travel on the A1307 corridor between Haverhill and Linton and 40% of all vehicle trips would travel on the A1307 corridor between Linton and Cambridge. This is achieved by assuming that of the total new dwellings needed to reach the upper AADT limit, 86% will be in Haverhill and 14% in Linton. These respective numbers are then multiplied by the percentage of work journeys which use the corridor in each location.

3.6 NUMBER OF ADDITIONAL RESIDENTIAL DWELLINGS TO ACHIEVE MID AND UPPER 2 LANE DUAL AADT FLOWS ON THE A1307 CORRIDOR

- 3.6.1 The number of dwellings required in Haverhill and Linton has been calculated by identifying the difference between the DMRB midpoint and maximum AADT for a new dual 2 lane all-purpose road, divided by the product of the average vehicle trip rate per dwelling and percentage of vehicle trips that will use the A1307 corridor. This can be summarised as follows:

$$\frac{\text{Difference between the DMRB AADT Flow and 2031 Future Baseline on A1307}}{\text{Assumed Trip Rate per Dwelling} \times \text{Percentage of all dwelling trips on A1307}}$$

- 3.6.2 Table 3-8 below summarises the number of additional dwellings required in Haverhill and Linton to reach the midpoint and maximum AADT for a dual 2 lane all-purpose carriageway.

Table 3-8 Additional number of dwellings to meet DMRB Maximum and Midpoint AADT for D2AP Carriageway

SETTLEMENT	ADDITIONAL DWELLINGS TO REACH MIDPOINT BETWEEN MINIMUM & MAXIMUM DMRB AADT FOR D2AP CARRIAGEWAY (25,000)	ADDITIONAL DWELLINGS TO REACH MAXIMUM DMRB AADT FOR DMRB AADT FOR D2AP CARRIAGEWAY (39,000)
Lower Forecast (Combined peak vehicle trip rate)		
Haverhill	14,189	51,582
Linton	1,990	8,416
Total	16,505	59,999
Upper Forecast (higher vehicle trip rate)		
Haverhill	5,608	20,387
Linton	787	2,860
Total	6,523	23,714

- 3.6.3 Table 3-8 suggests in the lower forecast scenario an additional 16,505 dwelling will be required to reach the TA 46/97 AADT midpoint (25,000) AADT for a dual 2 lane single carriageway road. With the higher vehicle trip generation forecast the number of dwellings is reduced to 6,523. To achieve the maximum TA 46/97 AADT (39,000) an additional 59,999 dwellings could be required in the lower scenario and 23,714 in the high corridor trip generation scenario.
- 3.6.4 As noted earlier these figures should be treated with extreme caution as no detailed modelling of induced traffic, additional outbound trips from Cambridge or non-residential generated trips has been undertaken.

3.7 SENSITIVITY TEST

- 3.7.1 In order to assess the potential impact of an increased proportion of trips being attracted to the A1307 corridor from Haverhill and Linton a further sensitivity test has been conducted. In this sensitivity test it has been assumed that there is a 10% increase in the percentage of trips on the A1307 from each area. This will result in 45.9% of trips from Haverhill and 77.1% of trips from Linton using the corridor.
- 3.7.2 The revised distribution of vehicle trips can be seen in Table 3-9.

Table 3-9 Sensitivity Test: Distribution of Vehicle Trips (%) from a Combined Development in Haverhill & Linton

SETTLEMENT	% OF VEHICLE TRIPS ON A1307 CORRIDOR	% OF TOTAL NEW DWELLINGS	% OF ALL DWELLING VEHICLE TRIPS ON A1307 CORRIDOR
A1307 between Haverhill & Linton			
Haverhill Dwellings	45.9%	86.0%	39.0%
Linton Dwellings	0.0%	14.0%	0.0%
Section Total		100.0%	39.0%
A1307 between Linton & Cambridge			
Haverhill Dwellings	45.9%	86.0%	31.0%
Linton Dwellings	77.1%	14.0%	11.0%
Section Total		100.0%	50.0%

3.7.3

The additional dwellings calculation is carried out using the same methodology as described in Section 6, the results of which are in Table 3-10 below.

Table 3-10 Additional number of dwellings to meet DMRB Maximum and Midpoint AADT for D2AP Carriageway with sensitivity test

SETTLEMENT	ADDITIONAL DWELLINGS TO REACH MIDPOINT BETWEEN MINIMUM & MAXIMUM DMRB AADT FOR D2AP CARRIAGEWAY (25,000)	ADDITIONAL DWELLINGS TO REACH MAXIMUM DMRB AADT FOR DMRB AADT FOR D2AP CARRIAGEWAY (39,000)
Lower Forecast (Combined peak vehicle trip rate)		
Haverhill	11,162	40,713
Linton	1,566	6,643
Total	12,983	47,355
Upper Forecast (higher vehicle trip rate)		
Haverhill	4,412	16,091
Linton	619	2,257
Total	5,131	18,717

3.7.4

As can be seen in the case of an increase of 10% trip assignment along the A1307, the number of dwellings required to reach the AADT thresholds drops by approximately 21%.

4 SUMMARY

4.1 PROPOSED ROAD INTERVENTIONS

4.1.1 Three potential road intervention scenarios were considered as part of the Long List of Concepts:

- Scenario 1 – widening of the single carriageway sections of the A1307 between Haverhill & Cambridge where the carriageway is narrow (i.e. an S2 carriageway) to a Type WS2 carriageway (10m wide including 1m hardstrips);
- Scenario 2 – dualing of all the single carriageway sections of the A1307 between Haverhill & Cambridge;
- Scenario 3 – provision of a single carriageway bypass (for example, to the south) of Linton.

4.1.2 In providing any road scheme, the most direct benefit is that of congestion relief and the journey time savings made. The potential journey time improvements along with the expected traffic flows in relation to the road capacity improvements were not judged sufficient enough for a case to be made. Each option represented poor value for money with an average BCR of 0.30.

4.1.3 Scenario 1 and Scenario 2 are both unlikely to improve road safety and unlikely to significantly reduce journey times, as there will still be a need for a number of junctions (in the form of roundabouts or signalled junctions) to maintain access to/from local communities.

4.1.4 However, if significant further development occurs along the corridor outside the expected Local Plan through to 2031, then a case for road improvements could be revisited.

4.1.5 As a result of the assessment undertaken, with the concepts ranging from low to very poor value for money, these concepts are recommended to be discounted in the context of the current City Deal. While the findings show that there is not a viable business case for such major schemes up to 2031, there may be a case for such schemes outside of the current period.

4.2 FUTURE DEVELOPMENT DEMAND

4.2.1 This high level analysis indicates that between 23,714 and 59,999 residential dwellings could be required in Haverhill and Linton beyond what is accounted for in the existing SATURN model of the corridor to generate A1307 corridor flows to reach the upper flow range of AADT for a new dual 2 lane all-purpose road.

4.2.2 To achieve the DMRB's midpoint AADT for a for a new dual 2 lane all-purpose road a combined development of 6,523 to 16,505 dwellings could be needed in Haverhill and Linton to justify the dualing of the A1307.

It is important to note:

- That the AADT on the A1307 already exceeds the minimum AADT flow stated in DMRB TA 46/97 for a new dual carriageway;
- The analysis has provided a high level assessment of the number of dwelling that might be required to increase the AADT flows to 25,000 and 39,000 along the A1307 corridor; and
- The assessment does not consider non-residential trip generation, induced traffic or the costs and benefits of upgrading the route to a dual carriageway; and
- The assessment makes no consideration of policy nor master planning including the use of sustainable transport measures.

4.2.3 The predicted number of dwellings should be treated with caution due to a number of vehicle trip generation and distribution assumptions underpinning this assessment.

4.3 LIMITATIONS

4.3.1 There are a significant number of limitations given the very indicative and high level nature of this technical note. These include, but are not limited to, the following:

→ Proposed Road Interventions

- The major road interventions proposed are indicative only and if further detailed assessment was required, a feasibility design would need to be undertaken along with a detailed assessment of the environmental, social, and economic impacts;
- In considering the intervention, further detailed modelling would be required. The comments made regarding the current model in the 'Draft Concepts Report' need to be noted; and
- The capital costs provided are also indicative and are based upon standard industry figures for this type of road construction.

→ Future Development Demand

- The assessment undertaken within this technical is an indicative high level assessment only and is no substitute for a major masterplanning and transport assessment which would be required to properly determine any future housing requirements within or adjacent to the A1307 Corridor;
- No consideration of traffic congestion has been considered due to the high level nature of this work, therefore there is no guarantee that additional housing would demonstrate a positive business case for a road intervention;
- We have only considered the number of residential dwellings potentially required to necessitate a major road intervention and not any economic, social or environmental impacts or economic growth;
- We have not considered any policy or strategy implications in this assessment nor public transport interventions. It is highly likely, that an increase in the number of residential dwellings of this size, would require a significant sustainable transport intervention (e.g. public transport, cycling and the like) for it to be viable;
- We have not considered the strategic traffic flows along the A1307 corridor and any impact that this may or may not have in terms of additional traffic; and
- It should be noted that we are working within the limitations of the current SATURN and CSR models with the limitations of these as noted within the 'Draft Concepts Report'.

Appendix A

TRICS OUTPUT

WSP GROUP STREET NAME TOWN/CITY

Licence No: 100314

Calculation Reference: AUDIT-100314-160114-0103

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 03 - RESIDENTIAL
 Category : A - HOUSES PRIVATELY OWNED
 VEHICLES

Selected regions and areas:

02	SOUTH EAST	
	HC HAMPSHIRE	1 days
03	SOUTH WEST	
	CW CORNWALL	1 days
	DC DORSET	1 days
04	EAST ANGLIA	
	CA CAMBRIDGESHIRE	1 days
	NF NORFOLK	2 days
	SF SUFFOLK	2 days
05	EAST MIDLANDS	
	LN LINCOLNSHIRE	2 days
06	WEST MIDLANDS	
	SH SHROPSHIRE	1 days
	ST STAFFORDSHIRE	1 days
	WK WARWICKSHIRE	1 days
07	YORKSHIRE & NORTH LINCOLNSHIRE	
	NY NORTH YORKSHIRE	3 days
	SY SOUTH YORKSHIRE	1 days
08	NORTH WEST	
	CH CHESHIRE	2 days
	MS MERSEYSIDE	1 days
09	NORTH	
	TW TYNE & WEAR	1 days
10	WALES	
	CF CARDIFF	1 days
	PS POWYS	1 days

This section displays the number of survey days per TRICS® sub-region in the selected set

Filtering Stage 2 selection:

This data displays the chosen trip rate parameter and its selected range. Only sites that fall within the parameter range are included in the trip rate calculation.

Parameter: Number of dwellings
 Actual Range: 6 to 186 (units:)
 Range Selected by User: 6 to 4334 (units:)

Public Transport Provision:

Selection by: Include all surveys

Date Range: 01/01/07 to 12/11/15

This data displays the range of survey dates selected. Only surveys that were conducted within this date range are included in the trip rate calculation.

Selected survey days:

Monday	7 days
Tuesday	7 days
Wednesday	4 days
Thursday	2 days
Friday	3 days

This data displays the number of selected surveys by day of the week.

Selected survey types:

Manual count	23 days
Directional ATC Count	0 days

This data displays the number of manual classified surveys and the number of unclassified ATC surveys, the total adding up to the overall number of surveys in the selected set. Manual surveys are undertaken using staff, whilst ATC surveys are undertaken using machines.

Selected Locations:

Suburban Area (PPS6 Out of Centre)	23
------------------------------------	----

This data displays the number of surveys per main location category within the selected set. The main location categories consist of Free Standing, Edge of Town, Suburban Area, Neighbourhood Centre, Edge of Town Centre, Town Centre and Not Known.

Selected Location Sub Categories:

Residential Zone	21
No Sub Category	2

This data displays the number of surveys per location sub-category within the selected set. The location sub-categories consist of Commercial Zone, Industrial Zone, Development Zone, Residential Zone, Retail Zone, Built-Up Zone, Village, Out of Town, High Street and No Sub Category.

Filtering Stage 3 selection:

Use Class:

C3	22 days
----	---------

This data displays the number of surveys per Use Class classification within the selected set. The Use Classes Order 2005 has been used for this purpose, which can be found within the Library module of TRICS®.

Population within 1 mile:

1,001 to 5,000	3 days
5,001 to 10,000	6 days
10,001 to 15,000	2 days
15,001 to 20,000	5 days
20,001 to 25,000	3 days
25,001 to 50,000	4 days

This data displays the number of selected surveys within stated 1-mile radii of population.

WSP GROUP STREET NAME TOWN/CITY

Licence No: 100314

Filtering Stage 3 selection (Cont.):

Population within 5 miles:

5,001 to 25,000	2 days
25,001 to 50,000	2 days
50,001 to 75,000	1 days
75,001 to 100,000	4 days
100,001 to 125,000	3 days
125,001 to 250,000	5 days
250,001 to 500,000	6 days

This data displays the number of selected surveys within stated 5-mile radii of population.

Car ownership within 5 miles:

0.6 to 1.0	9 days
1.1 to 1.5	14 days

This data displays the number of selected surveys within stated ranges of average cars owned per residential dwelling, within a radius of 5-miles of selected survey sites.

Travel Plan:

No	23 days
----	---------

This data displays the number of surveys within the selected set that were undertaken at sites with Travel Plans in place, and the number of surveys that were undertaken at sites without Travel Plans.

WSP GROUP STREET NAME TOWN/CITY

Licence No: 100314

TRIP RATE for Land Use 03 - RESIDENTIAL/A - HOUSES PRIVATELY OWNED
VEHICLES

Calculation factor: 1 DWELLS

BOLD print indicates peak (busiest) period

Time Range	ARRIVALS			DEPARTURES			TOTALS		
	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	23	51	0.068	23	51	0.258	23	51	0.326
08:00 - 09:00	23	51	0.144	23	51	0.376	23	51	0.520
09:00 - 10:00	23	51	0.149	23	51	0.198	23	51	0.347
10:00 - 11:00	23	51	0.148	23	51	0.150	23	51	0.298
11:00 - 12:00	23	51	0.161	23	51	0.167	23	51	0.328
12:00 - 13:00	23	51	0.199	23	51	0.170	23	51	0.369
13:00 - 14:00	23	51	0.165	23	51	0.162	23	51	0.327
14:00 - 15:00	23	51	0.154	23	51	0.182	23	51	0.336
15:00 - 16:00	23	51	0.236	23	51	0.175	23	51	0.411
16:00 - 17:00	23	51	0.285	23	51	0.168	23	51	0.453
17:00 - 18:00	23	51	0.337	23	51	0.207	23	51	0.544
18:00 - 19:00	23	51	0.226	23	51	0.178	23	51	0.404
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			2.272			2.391			4.663

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: $COUNT/TRP*FACT$. Trip rates are then rounded to 3 decimal places.

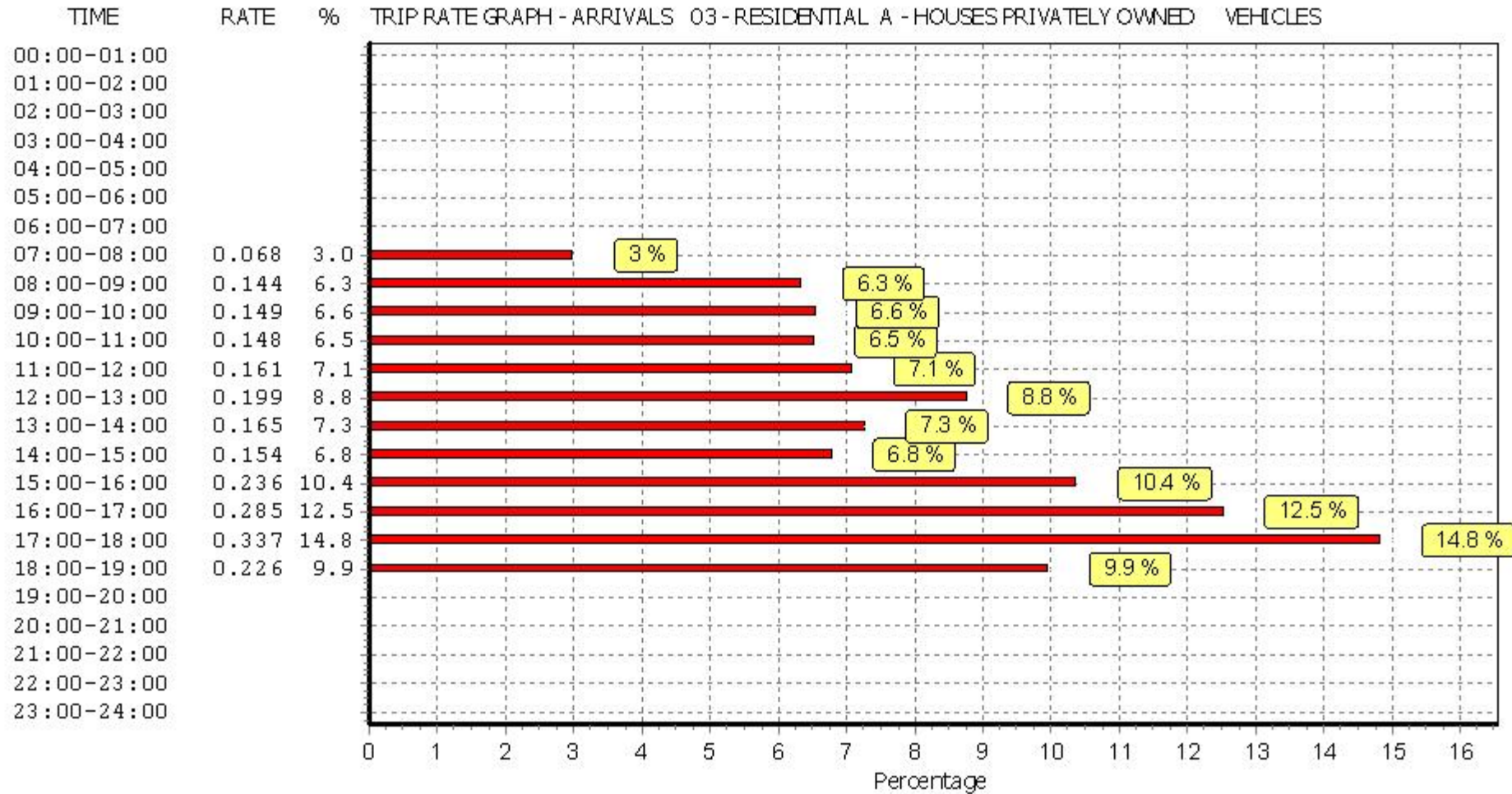
Parameter summary

Trip rate parameter range selected: 6 - 186 (units:)
 Survey date date range: 01/01/07 - 12/11/15
 Number of weekdays (Monday-Friday): 23
 Number of Saturdays: 0
 Number of Sundays: 0
 Surveys manually removed from selection: 1

This section displays a quick summary of some of the data filtering selections made by the TRICS® user. The trip rate calculation parameter range of all selected surveys is displayed first, followed by the range of minimum and maximum survey dates selected by the user. Then, the total number of selected weekdays and weekend days in the selected set of surveys are shown. Finally, the number of survey days that have been manually removed from the selected set outside of the standard filtering procedure are displayed.

WSP GROUP STREET NAME TOWN/CITY

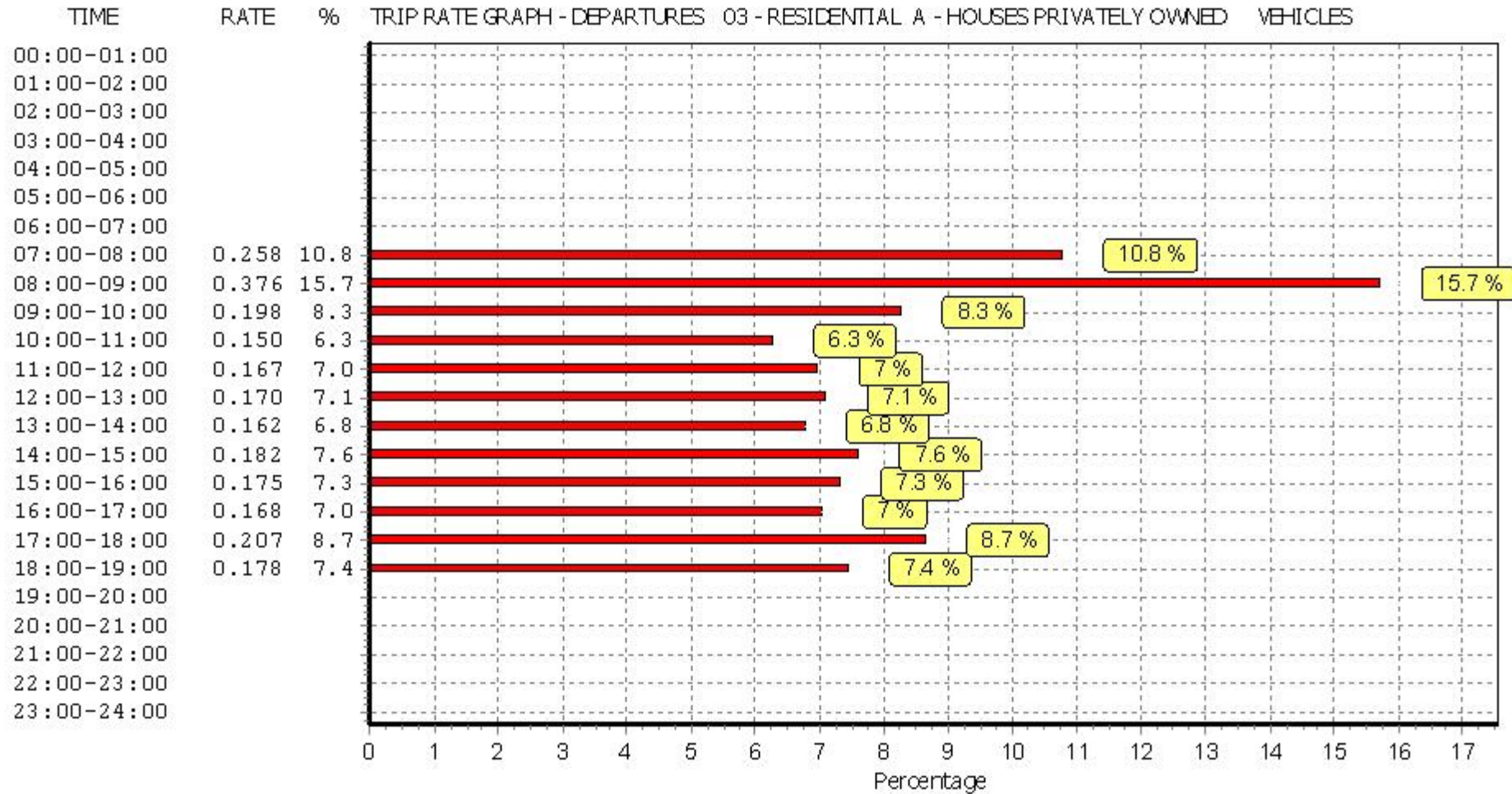
Licence No: 100314



This graph is a visual representation of the trip rate calculation results screen. The same time periods and trip rates are displayed, but in addition there is an additional column showing the percentage of the total trip rate by individual time period, allowing peak periods to be easily identified through observation. Note that the type of count and the selected direction is shown at the top of the graph.

WSP GROUP STREET NAME TOWN/CITY

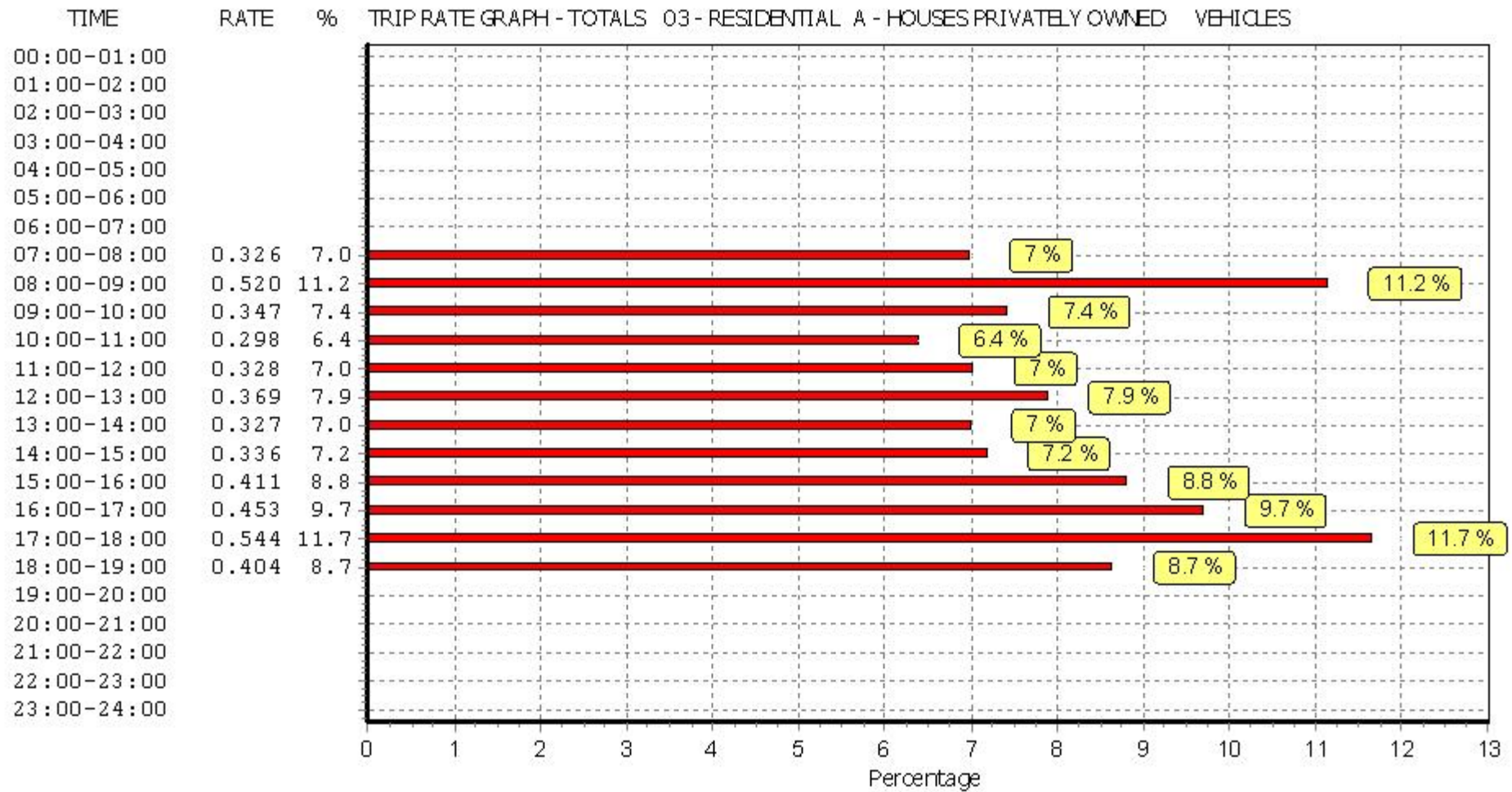
Licence No: 100314



This graph is a visual representation of the trip rate calculation results screen. The same time periods and trip rates are displayed, but in addition there is an additional column showing the percentage of the total trip rate by individual time period, allowing peak periods to be easily identified through observation. Note that the type of count and the selected direction is shown at the top of the graph.

WSP GROUP STREET NAME TOWN/CITY

Licence No: 100314



This graph is a visual representation of the trip rate calculation results screen. The same time periods and trip rates are displayed, but in addition there is an additional column showing the percentage of the total trip rate by individual time period, allowing peak periods to be easily identified through observation. Note that the type of count and the selected direction is shown at the top of the graph.

Appendix B

CALCULATIONS SUMMARY

Percentage of vehicle trips using A1307 corridor towards Cambridge (inbound)

Haverhill	35.9%
Linton	67.1%

Population split of Haverhill and Linton

Haverhill pop.	27040	0.86
Linton pop.	4412	0.14

Difference between 2031 Future Baseline and Maximum AADT Flow for D2AP Road

A1307 Link	Difference between 2031 Future Baseline and Maximum AADT Flow for D2AP Road	Difference between 2031 Future Baseline and Midpoint AADT Flow for D2AP Road
Haverhill (A1017 Junction - Horseheath)	20468	6468
Horseheath - Linton	21767	7767
Bartflow Road - High Street Linton	18430	4430
Linton - Great Abingotn	17338	3338
Great Abingotn - Granta Park Junction	16635	2635
Granta Park Junction - A11 Junction	14708	708
A11 Junction - Babraham Research Park	16812	2812
Babraham Research Park - Wandlebury	17303	3303
Wandlebury - Hinton Way Roundabout	15700	1700
Hinton Way Roundabout - Addenbrooke's	18727	4727
Average	17789	3789

Vehicle Trip Rate (per dwelling)

Scenario	Vehicle Trip Rate	Description
Low	1.843	Trip rate is for AM and PM peaks only, assuming these will primarily be work trips (2-way)
High	4.663	Trip rates for entire day (2-way)

AADTs

	Upper Av AADT Shortfall	Mid. Av AADT shortfall
A1307 Between Haverhill and Linton	2118	7118
A1307 Between Linton and Cambridge	16957	2957

Assumed Split of proposed Dwellings (based on existing population)

Haverhill	86%
Linton	14%

Distribution / Assignment of vehicle trips (%)

A1307 Between Haverhill and Linton	% of trips on corridor	Proportional Split	% of all dwellings trips on corridor
Haverhill Dwellings	35.9%	86%	31%
Linton Dwellings	0.0%	14%	0%
TOTAL			31%
A1307 Between Linton and Cambridge	% of trips on corridor	Proportional Split	% of all dwellings trips on corridor
Haverhill Dwellings	35.9%	86%	31%
Linton Dwellings	67.1%	14%	9%
TOTAL			40%

Low Forecast (trips to work - AM & PM Peaks)

	A1307 Between Haverhill and Linton	A1307 Between Linton and Cambridge	
Dwellings	37147	22851	59999
Haverhill	31936	19646	51582
Linton	5211	3206	8416

Upper Forecast (all trips)

	A1307 Between Haverhill and Linton	A1307 Between Linton and Cambridge	
Dwellings	14682	9032	23714
Haverhill	12623	7765	20387
Linton	1771	1089	2860

Low Forecast - Mid

	A1307 Between Haverhill and Linton	A1307 Between Linton and Cambridge	
Dwellings	12520	3984	16505
Haverhill	10764	3426	14189
Linton	1510	481	1990

Upper Forecast - Mid

	A1307 Between Haverhill and Linton	A1307 Between Linton and Cambridge	
Dwellings	4949	1575	6523
Haverhill	4254	1354	5608
Linton	597	190	787

