BDC/034

# Braintree Local Plan – Interim Assessment

## Highways/Transport Planning

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RINGWAY JACOBS
integrated expertise

Essex County Council

# Document Control Sheet

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# Executive Summary

Essex Highways Transport Planning team have been asked by Essex County Council (ECC) and Braintree District Council (BDC) to investigate potential transport mitigation measures for the upcoming public consultation of Local Plan proposals in July 2016.

At the time of undertaking this stage of work, a complete Preferred Option had not been defined by BDC and so all testing of mitigation and trip distribution analysis was based on Scenario 1 from the previous stage of work, as this was the closest option to what BDC believed would be their Preferred Option on starting this stage of work.

This stage of work has involved identifying likely levels of reduction at the key junctions forecast to be over capacity required to bring them within capacity, identifying infrastructure mitigation measures at those key junctions, investigating the assumed trip distribution in order to identify the likely public transport and sustainable transport required, investigating under what circumstances trip rates can be reduced, and providing an overview of ongoing studies and projects that will help to alleviate a number of current transport issues within the District.

Mitigation was identified as being potentially possible at 9 of the 11 junctions forecast to be over capacity in 2033, with Highways England investigating options at one of those. Of the remaining 8, modelling suggests that two could be successfully mitigated and drawings were produced for three.

The initial modelling work suggests that many of the current and future trips are being made between settlements with rail links and therefore a focus on improving those rail links is recommended. Similarly it is recommended that access to the key rail stations by sustainable modes ought to be improved and encouraged.

Through the analysis of the trip rates, it was identified that if there are increased levels of public transport provision, then car trip generation is likely to be reduced. This in turn could influence the results of the junction sensitivity testing which found that the majority of the key junctions required a reduction, on average, of around 35% in 2033 forecast flows to enable them to operate ‘within capacity’.

Similarly it was found that current traffic flows are largely concentrated into one peak hour. It is therefore likely that, given the existing congestion, the impact of the growth in future years will not all be realised in the peak hour, but rather it would be spread over longer peak periods.

Overall it was found that a number of aspects can be considered to reduce the transport impact of the Local Plan and that the current forecast is likely to be a “worst case” scenario. Alongside this, a number of ongoing studies, including strategic infrastructure projects such as the A120 between Braintree and the A12, are seeking to alleviate a number of key transport issues within the District.

# 1. Introduction

1. "Braintree Local Plan – Options Assessment" was produced in February 2016 to describe the likely impact on the local transport network of six development options for the Braintree Local Plan. Braintree District Council (BDC) and Essex County Council (ECC) requested that Essex Highways Transport Planning undertake further work considering the likely impact on the transport network and the demands it will place on the transport system, in the form of an interim assessment, to feed into the scheduled public consultation on a Preferred Option. This work looks at the scenario from the previous work that is believed to be closest to the Preferred Option. Included in the assessment is an overview of the likely impact on road junctions of some initially designed potential improvements that at this preliminary stage are considered feasible and affordable, and an overview of other current plans for infrastructure improvements that will help to mitigate the impact. Also incorporated is an indication of the potential for changing trip patterns and mode choice to support additional trips on the transport network and the likely extent of that required to still have a workable transport system.

2. The previous work has indicated that irrespective of the option chosen, it will not be possible to mitigate the Local Plan's long term impact through the provision of highway infrastructure measures alone. It is clear that travel choices need to be examined in more detail, giving consideration to how trips will distribute in the network, whether the time that trips take place will change and how the provision of public transport and sustainable mode travel will have the potential to mitigate additional demand. Consideration should also be given to other ongoing plans and initiatives to improve the transport system and which will add capacity or affect levels of demand.

3. As a Preferred Option had yet to be agreed by BDC, this work has been based on Scenario 1, developed in the previous stage of work[1]. The results at this time reflect our best understanding of the makeup of the development sites and their likely trip generation and distribution. Further work will be undertaken after the consultation period, July 2016, to further refine the likely transport implications of a Preferred Option.

4. The junctions that are most affected by development traffic under Scenario 1, as previously reported, have been tested with mitigating measures that could be implemented to alleviate expected future congestion. Measures included have been restricted to those that might be feasible, could be affordable within reason and have been shown to have a positive impact. This is discussed in Chapter 2. In the case of some junctions, it has not been possible to identify options that can provide the required mitigation whilst being feasible and affordable at the same time.

5. One effect of high traffic demand exceeding capacity is that traffic spreads out more over the peak hours and within the peak periods. Chapter 3 offers a view firstly, on how much current flows might be able to increase, before each peak hour is operating as the peak 15-minute period is at the moment and secondly, on the growth of traffic that might be accommodated if the peak periods extend to three hours in both the AM and PM. While long periods of high flows may not be satisfactory, it does illustrate a possible effect of increased demand and the need to lower car use through use of alternative modes

6. Chapter 4 provides a summary of an investigation into the number of car trips generated by developments considering how these are affected by the provision of public transport and the location of developments in relation to existing town centres and urban areas.

7. There are a number of other ongoing studies and initiatives in the Braintree District area that if implemented, are expected to have a significant positive impact on the transport network, support growth and reduce the forecast impact of additional trips on the network. These are summarised in Chapter 5 together with their current status, although their impacts cannot be fully quantified at this stage, as they are the subject of ongoing studies.

8. Chapter 6 investigates the current travel patterns within the District through analysis of 2011 Census journey to work data.

9. Chapter 7 covers an overview of the likely public transport measures required and the need to encourage cycling and walking as modes of transport alternative to private car travel.

[1] Braintree Local Plan: Options Assessment Appendix E, page 102 of 127.

10. BDC and ECC have also requested a comparison of the current assumptions for the cross border trips generated by the Braintree Local Plan and those generated by the Local Plans of the surrounding Districts. This is detailed in Chapter 8.

# 2. Junction Assessment & Mitigation

11. During the previous stage of work:

- 16 key junctions were identified as being likely to be most impacted by the development proposals considered in the 6 scenarios;
- junction models were created for each of the key junctions to assess the likely impact of each scenario;
- these were tested using the estimated development flows from the six scenarios developed;
- a number of junctions were identified as being forecast to be over capacity in 2033; and so
- at this stage some potential mitigation options were identified and tested, where possible.

12. In some instances, it was identified that there was no potential highway mitigation that that would be feasible or cost effective due to the physical constraints of the area surrounding the junction. For these junctions the subjects of the other chapters of this assessment will be more important.

13. Of the 16 key junctions outlined, potential mitigation was identified for 9 junctions. Mitigating measures were not tested for the following 7 junctions for the reasons outlined below:

- A131 – London Road: Junction has not been forecast to be over capacity in 2033;
- A131 – Head Street (Halstead): No mitigation has been identified due to the physical constraints of the surrounding area preventing layout changes, whilst flows at the junction are too high for signals.
- A120 – Colne Road: It is anticipated that a new A120 route would alleviate this junction and short term mitigation is unlikely to be cost effective. Highways England (HE) have prepared sketch drawings for improvements to this junction and BDC and ECC propose to liaise with them on this scheme.
- Cuckoo Way: Junction has not been forecast to be over capacity in 2033.
- Gershwin Boulevard: Junction is being upgraded as part of the Lodge Farm Development, as per the suggested mitigation in the 2010 Core Strategy.
- Rickstones Road: Junction is being upgraded as part of the Forest Road development, as per the suggested mitigation in the 2010 Core Strategy.
- Maldon Road – The Street (Hatfield Peverel): It was agreed by all parties at the Maldon Local Plan examination that issues at this junction related largely to long term concerns about the impact of growth across the region, and not specifically the Maldon Local Plan. Upgrades to the A12, identified in the Road Building Strategy (2014) regarding potential widening to 3 lanes of the A12, would improve its reliability and ensure a limited level of queuing at the junction. In addition a combination of the public transport improvements proposed to support the MDC Local Plan through its site allocations would provide some short term relief. More significant mitigation options are limited given minimal land availability between development and roadway; the character of the locality, and proximity to the A12 slip lanes reducing the opportunity for increased signal timings. The work undertaken for Braintree Local Plan supports the findings from the MDC Local Plan work.

14. Following discussion with ECC and BDC it was decided that as HE have produced sketch drawings for proposals at Marks Farm, no potential mitigation should be developed by Essex Highways. ECC and BDC propose to work with HE to progress the implementation of their proposed scheme. It is also acknowledged that a new A120 route is likely to have a positive impact on this junction.

15. The remaining junctions have had mitigation measures tested. These are outlined below and the detail results can be found in **Appendices A - H**:

- Aetheric Road: Currently a signalised junction. Signal optimisation has been considered. However it has been found that by slightly altering the junction layout and banning the east to north right turn out of Rayne Road East, some mitigation might be provided. A right turn ban out of Aetheric Road has also been tested.

- Broad Road: Currently a roundabout. A left turn slip from A131N to A131S, with widened approaches from Broad Road and A131S has been tested for two options, one within the highway boundary, which requires the existing roundabout to be moved and one with land take from outside the highway boundary, which will not require the relocation of the existing roundabout. A signalised option has also been tested.
- Chipping Hill – The Avenue: Currently a mini-roundabout. A standard roundabout and signalised option have been tested.
- Church Lane – Broad Road: Currently a double mini-roundabout. Due to the physical constraints created by the surrounding buildings, only a signalised junction has been tested.
- Newland Street: Currently a signalised staggered crossroads. Optimisation of the signal timings has been tested as has banning all movements from Maldon Road making it "exit only".
- Panners Interchange: Currently consists of two roundabouts. Testing has included widening of the A120 west slip road to 2 lanes including a short third lane off the A120 and widening of Pods Brook Road southbound to 2 lanes.
- Springwood Drive: Currently a roundabout. A range of mitigation options have been tested including: the options proposed by the developer of the Brook Green land and land west of Panfield Lane, a combination of the two developers' proposals, land take from outside the highway boundary to allow left turn slips and a signalised option.
- Rye Mill Lane: Currently a staggered crossroads. Due to the physical constraints created by the surrounding buildings only signalising the junction has been considered.

## 2.1 Results of Mitigation Tests

16. BDC is producing an evidence base to identify its preferred spatial strategy. Prior to the confirmation of this strategy, Scenario 1 has been used to test the effectiveness of any proposed mitigation, as this distribution of growth is most aligned to the emerging spatial strategy indicated by BDC.

17. Sketch drawings have been provided for proposed mitigation where it has been shown to have a positive impact on capacity.

### 2.1.1 Aetheric Road Mitigation, Braintree

18. The sketch drawings of the proposed mitigation are shown in **Appendix A1**, while the results of the modelling of this can be found in **Appendix A2**. The modelling results and sketch do not include the right turn ban out of Aetheric Road as it is likely that the majority of the traffic that would be banned would reroute to Springwood Drive and this would not be desirable.

19. The modelling of the proposed mitigation suggests that the junction will be operating at capacity in 2033. It should be noted that this assumes that the Panfield Link is built as part of the proposed development just north of Springwood Drive. Without this link the mitigation is unlikely to be as effective and thus the junction is likely to be operating over capacity in 2033.

### 2.1.2 Broad Road Mitigation, Braintree

20. Of the various mitigation options tested at Broad Road (see paragraph 15, 2nd bullet point), moving the existing roundabout in order to keep the proposed junction within the highway boundary, incorporating the left turn slip from A131N to A131S, has been modelled to be the most effective in terms of mitigating the 2033 forecast flows. An outline drawing of the proposed mitigation and the results of the modelling can be found in **Appendices B1** and **B2** respectively.

21. The modelling of the proposed mitigation indicates that the junction is likely to be able to operate under capacity in 2033.

### 2.1.3 Chipping Hill Mitigation, Witham

22. Two options for mitigation have been tested at Chipping Hill, signalisation and the implementation of a standard roundabout. The modelling suggests that a standard roundabout would provide the most effective level of mitigation, however, the option requires significant land take from outside the

highway boundary and there are level differences between the junction and adjacent land, which may prove infeasible or costly. Modelling this still indicated that it would not be sufficient to meet the 2033 forecast demand and so no proposed layout has been produced. Similarly, modelling of a signalised junction indicated that this would likely reduce the amount of capacity available at the junction from that with the current layout.

23. The modelling results can be found in **Appendix C**.

### 2.1.4 Church Lane Mitigation, Braintree

24. A signalised option has been tested at this junction, however, the modelling suggested that it would not provide sufficient relief to the junction to be considered as appropriate mitigation. The modelling results can be found in **Appendix D**. A new A120 route may provide some relief to the junction as the current reasons for not using the bypass are congestion issues at Galleys Corner and Marks Farm. However trips heading north / south through Braintree will only be encouraged to reroute to the bypass if journey times are quicker than those through this junction.

### 2.1.5 Newland Street Mitigation, Witham

25. This junction has been tested to assess whether the signal timings could be optimised. It was found that the junction might currently benefit from signal optimisation, which may provide some additional short term capacity, but is unlikely to accommodate the growth forecast by 2033.

26. A further option of banning all movements from Maldon Road, making it “exit only”, has been tested. The modelling indicates that with this option the junction would operate under capacity in 2033, but the mitigation would result in traffic re-routing onto roads of lower classification in the road hierarchy, which is contrary to ECC Policy as outlined in Section 3.4, paragraph 3.4.7 of The Essex Traffic Management Strategy (2005). The results of the signal optimisation tests with and without the ban on movements from Maldon Road can be found in **Appendix E**.

### 2.1.6 Panners Interchange Mitigation, Braintree

27. It was identified that the Pods Brook southbound and A120 eastbound off-slip arms were the most in need of mitigation at Panners Interchange and so improvements to these approaches have been tested. However these improvements did not alleviate either approach sufficiently and additionally they worsened the A120 westbound off-slip approach as more traffic was able to get through the junction, due to the improved approach from Pods Brook Road. The modelling results can be found in **Appendix F.**

### 2.1.7 Springwood Drive Junction Mitigation, Braintree

28. A range of mitigation measures were tested at the Springwood Drive junction, as identified in paragraph 15, 7th bullet point. Signalising the existing roundabout is not feasible, since the existing roundabout it not large enough.

29. Through extensive testing it was found that a combination of the proposals by the developers of the Brook Green and west of Panfield Lane sites for improvements at the junction are likely to be the most effective. However the modelling suggests that the combined option still will not provide sufficient capacity for the future demand at the junction. The results of the modelling can be found in **Appendix G.**

### 2.1.8 Rye Mill Lane Mitigation, Kelvedon

30. Signalisation of the junction was the only option tested, because of the physical constraints surrounding the junction. However modelling of this indicates that it would not provide sufficient relief. The modelling results can be found in **Appendix H**. There is currently a proposal by the developer of a site situated between Inworth Road, the A12 and London Road, which considers a road between Inworth Road and junction 24 on the A12. Further detail is available in paragraph 77.

## 2.2 Analysis of Excess Demand

31. The junction models for each of the key junctions forecast to be over capacity in 2033 were tested in order to establish the percentage reduction in forecast total car trips likely to be required for the junctions to operate within capacity thus leaving congestion at levels which are deemed to be likely to be acceptable. As shown in the previous stage of work, the forecast growth includes background growth, development and existing trips. This was undertaken for both the unchanged junctions and for the mitigation tested. The results are shown in Table 2.1 below. N/A is shown where mitigation could not be identified or was not tested.

**Table 2.1: Percentage reduction in traffic flows likely to be required to bring junction within capacity**

| | | Base model 2033 | | Mitigation model 2033 | |
|---|---|---|---|---|---|
| Key Junction | Junction Type (Mitigation modelled) | AM | PM | AM | PM |
| A131 - Head St – Halstead | Double Mini Roundabout | 25% | 35% | N/A | N/A |
| A120 - Colne Road - Coggeshall | Priority | 20% | 15% | N/A | N/A |
| Rye Mill Lane – Kelvedon | Priority (Signalised) | 55% | 45% | 55% | 50% |
| Chipping Hill - Witham | Mini Roundabout (Signalised) | 45% | 30% | 40% | 20% |
| Newland Street - Witham* | Signalised (Signal optimisation) | 20% | 25% | 20% | 25% |
| Maldon Road - The Street – Hatfield Peverel | Mini Roundabout | 35% | 30% | N/A | N/A |
| Panners Interchange – Great Notley/Braintree | Dumbbell Roundabout (Widening of Pods Brook & A120 EB Off Slip approaches) | 60% | 45% | 45% | 40% |
| Springwood Drive - Braintree | Roundabout (Geometry adjustments) | 45% | 35% | 30% | 25% |
| Aetheric Road - Braintree | Signalised (Adjustment to junction layout) | 30% | 25% | 20% | 15% |
| Church Lane - Braintree | Double Mini Roundabout (Signalised) | 50% | 40% | 45% | 65% |
| Broad Road - Braintree | Roundabout (left turn from A131 N to A131 S) | 10% | 10% | 0% | 0% |
| Marks Farm - Braintree | Roundabout | 20% | 30% | N/A | N/A |

* Mitigation modelled at this junction is an adjustment to the signal timings.

32. The results of the sensitivity testing demonstrate that between 20 – 50% of the forecast 2033 peak hour demand flows need to be accommodated by another modes, outside the peak hours or elsewhere in the network in order for the key junctions to operate within capacity and congestion to be at a level that is likely to be deemed acceptable.

# 3. Peak Spreading

33. One effect of traffic demand exceeding capacity is that traffic spreads within the peak hours and the peak periods. This section firstly indicates the level of increase in current flows likely to be possible before peak hours are operating at the level that the peak 15-minute period is at the moment and secondly, how much traffic growth might be able to be accommodated if peak hours extend to three hours in both the AM and PM, e.g. from 0600 to 0900 and 1600 to 1900. This analysis has been based on survey data. While long periods of high traffic flows are not seen as a desirable outcome, this has been used to illustrate the potential for traffic to switch to a different travel time.

34. Table 3.1, below, provides an indication as to how many additional vehicles each arm is likely to be able to accommodate in the peak hour, before each of the four 15 minute periods within the peak hour has the same number of vehicles as the current busiest 15 minute period. Similarly the values in the peak period column reflect the number of vehicles each arm can accommodate until all the 15 minute periods over a 3 hour period, are as busy as the current busiest 15 minute period. For this analysis, the District peak hours (8 – 9am & 5 – 6pm) have been used for the peak hour calculation along with an hour either side of those to calculate the peak period.

**Table 3.1: Peak spreading capacity (vehicles)**

| Junction Name | Junction Arm | AM Peak Hour | AM Peak Period | PM Peak Hour | PM Peak Period |
|---|---|---|---|---|---|
| A131 – Head Street, Halstead | A131 Head Street | 65 | 313 | 31 | 353 |
| | A1124 Colchester Road | 61 | 371 | 59 | 432 |
| | Parsonage Street | 19 | 93 | 14 | 59 |
| | A131 High Street | 64 | 415 | 61 | 300 |
| | A1124 Hedingham Road | 53 | 394 | 64 | 246 |
| A120 – Colne Road, Coggeshall | B1024 Colne Road | 67 | 323 | 35 | 277 |
| | CR A120 E | 130 | 881 | 53 | 559 |
| | Colne Road | 69 | 271 | 62 | 228 |
| | CR A120 W | 124 | 710 | 55 | 325 |
| Rye Mill Lane, Kelvedon | Rye Mill Lane | 13 | 54 | 9 | 52 |
| | B1024 London Road | 89 | 580 | 67 | 389 |
| | B1023 | 50 | 353 | 48 | 391 |
| | B1024 | 46 | 364 | 100 | 403 |
| Rickstones Road, Witham | RN Rickstones Road | 71 | 373 | 56 | 256 |
| | RN Cressing Road | 43 | 403 | 130 | 484 |
| | RS Cypress Road | 41 | 231 | 15 | 99 |
| | RS B1018 | 128 | 707 | 134 | 603 |
| Chipping Hill, Witham | Chipping Hill | 47 | 550 | 61 | 311 |
| | CH The Avenue | 57 | 271 | 66 | 372 |
| | CH Collingwood Road | 26 | 150 | 87 | 355 |
| Newland Street, Witham | B1389 NE | 17 | 308 | 14 | 188 |
| | Maldon Road | 29 | 508 | 14 | 295 |
| | B1839 SW | 17 | 308 | 14 | 188 |
| | HS Collingwood Road | 32 | 345 | 28 | 202 |
| Gershwin Boulevard, Witham | B1839 Hatfield Road | 48 | 564 | 35 | 291 |
| | Gershwin Blvd | 29 | 418 | 62 | 305 |
| | B1389 SW | 15 | 416 | 141 | 821 |

| Junction Name | Junction Arm | AM Peak Hour | AM Peak Period | PM Peak Hour | PM Peak Period |
|---|---|---|---|---|---|
| Maldon Road - The Street, Hatfield Peverel | The Street E | 27 | 357 | 69 | 292 |
| | B1019 Maldon Road | 118 | 572 | 23 | 533 |
| | The Street W | 61 | 487 | 127 | 416 |
| A131 – London Road, Great Notley | GN A131 N | 83 | 422 | 49 | 414 |
| | GN London Road N | 121 | 720 | 35 | 260 |
| | GN London Road S | 23 | 138 | 59 | 227 |
| | GN A131 S | 51 | 553 | 63 | 777 |
| Cuckoo Way, Great Notley | CW A131 N | 79 | 626 | 56 | 457 |
| | Cuckoo Way | 37 | 287 | 47 | 212 |
| | CW A131 S | 122 | 740 | 77 | 444 |
| Springwood Drive, Braintree | Springwood Drive | 31 | 348 | 75 | 1021 |
| | SW B1256 Rayne Road | 98 | 802 | 48 | 238 |
| | SW Pods Brook Road | 117 | 643 | 60 | 474 |
| | SW Rayne Road | 60 | 361 | 36 | 146 |
| Aetheric Road, Braintree | PW Aetheric Road | 117 | 603 | 108 | 325 |
| | PW B1256 E | 10 | 112 | 61 | 261 |
| | PW B1256 Pierrefitte Way | 222 | 1010 | 12 | 391 |
| | PW B1256 Rayne Road | 69 | 665 | 24 | 152 |
| Church Lane, Braintree | B1053 Church Street | 61 | 476 | 61 | 292 |
| | Convent Hill | 136 | 701 | 76 | 373 |
| | Bradford Street | 149 | 668 | 65 | 551 |
| Broad Road, Braintree | BR A131 N | 51 | 646 | 127 | 531 |
| | BR A131 S | 114 | 683 | 108 | 476 |
| | Broad Road | 74 | 348 | 59 | 398 |

35. This shows that there is (limited) available capacity in the peak hour and more available capacity in the peak period, suggesting potential for peak spreading. Given the limited availability of peak hour capacity, it is considered that future traffic flows are more likely to spread across the three hour peak period, than be realised in the current peak hour. This indicates that where demand is forecast to be over the capacity that the network can provide, if behaviour is not changed to reduce demand, congestion is likely to occur over longer periods.

# 4. Variance of Trip Generation Characteristic

## 4.1 Introduction

36. The TRICS database, which contains survey data on the number of trips that enter and leave developments, has been explored to see which conditions result in higher or lower vehicle trip generation and public transport use characteristics.

37. The analysis has used multi-modal surveys and has excluded Ireland, Northern Ireland & Inner London Boroughs and weekend surveys. The analysis has combined the following sub land uses:

**Table 4.1: Land Uses for TRICS data**

| Residential Type | Land Use (03-Residential) |
|---|---|
| Houses | A – Houses Privately Owned |
| | B – Affordable / Local Authority Houses |
| Flats | C – Flats Privately Owned |
| | D – Affordable / Local Authority Flats |

38. The TRICS database has been used to generate trip rates for the following modes:

- Vehicles
- Public Transport Users (Bus/Tram Passengers, Coach Passengers & Total Rail Passengers – includes London Underground)
- Pedestrians
- Cyclists

39. Wherever the trip rates have been compared in a multi-modal fashion, only sites with surveys for all of the modes have been used.

40. The trip-rates have been calculated for all locations and also with the following location definitions:

- Town Centre
- Edge of Town Centre
- Suburban Area
- Edge of Town
- Neighbourhood Centre

41. The TRICS database has been analysed to examine the effect of:

- Location Type
- Public Transport Provision (Mon-Fri (0700-1900) frequency)
- Variance in trip rate over the peak period

42. In this analysis, it should be noted that correlation does not imply causation.

## 4.2 Location Type

43. This section examines how the TRICS defined location varies with the vehicular and public transport trip rates for houses and flats.

**Table 4.2: Vehicle Trip Rate per Household by Location Type**

| | Houses | | Flats | |
|---|---|---|---|---|
| Location Type | AM Departures (0800-0900) | PM Arrivals (1700-1800) | AM Departures (0800-0900) | PM Arrivals (1700-1800) |
| Overall | 0.36 | 0.31 | 0.15 | 0.15 |
| Town Centre | | | 0.06 | 0.07 |
| Edge of Town Centre | 0.32 | 0.27 | 0.16 | 0.17 |
| Suburban Area | 0.34 | 0.29 | 0.16 | 0.17 |
| Edge of Town | 0.39 | 0.33 | 0.21 | 0.25 |
| Neighbourhood Centre | | | 0.23 | 0.10 |

**Table 4.3: Passenger Transport Trip Rate per Household by Location Type**

| | Houses | | Flats | |
|---|---|---|---|---|
| Location Type | AM Departures (0800-0900) | PM Arrivals (1700-1800) | AM Departures (0800-0900) | PM Arrivals (1700-1800) |
| Overall | 0.03 | 0.03 | 0.11 | 0.07 |
| Town Centre | | | 0.13 | 0.18 |
| Edge of Town Centre | 0.11 | 0.12 | 0.07 | 0.04 |
| Suburban Area | 0.04 | 0.03 | 0.12 | 0.06 |
| Edge of Town | 0.01 | 0.00 | 0.03 | 0.01 |
| Neighbourhood Centre | | | 0.29 | 0.15 |

44. From the available evidence it appears:

- Vehicle Trip Rates for house do not vary much by location. There are obviously no or very few houses surveyed located in Town Centres and Neighbourhood Centres.
- Public Transport use from houses is higher from Edge of Town Centres, than suburban or edge of town locations.
- For flats, town centre locations have low vehicle trip generation rates, with edge of town location higher, although still clearly lower for flats compared to houses.

- For flats, the use of public transport is less clear, partly due to low sample sizes in some cases, but it appears that town centres and neighbourhood centres have higher passenger transport uptake.

## 4.3 Public Transport Provision

45. This section examines the effect of public transport provision on vehicle and public transport trip rates.

46. Table 4.4 shows how the trip rate for surveyed houses varies with public transport provision. The column "Monday-Friday (0700-1900) minimum frequency" refers to the number of public transport services available during that 12 hour period (e.g. bus or rail services).

**Table 4.4: Vehicle Trip Rates per Household by Public Transport Provision**

| | Houses | | Flats | |
|---|---|---|---|---|
| Monday-Friday (0700-1900) minimum frequency | AM Departures (0800-0900) | PM Arrivals (1700-1800) | AM Departures (0800-0900) | PM Arrivals (1700-1800) |
| 0 | 0.36 | 0.31 | 0.15 | 0.15 |
| 100 | 0.35 | 0.29 | 0.14 | 0.14 |
| 200 | 0.33 | 0.27 | 0.13 | 0.13 |
| 300 | 0.29 | 0.22 | 0.13 | 0.11 |

47. For the surveyed houses there is a clear trend towards decreased vehicle trip rates with increased public transport provision, but the trend is much less clear for surveyed flats.

48. Table 4.5 shows public transport uptake by public transport provision for the surveyed households.

**Table 4.5: Public Transport Trip Rates per Household by Level of Provision**

| | Houses | | Flats | |
|---|---|---|---|---|
| Monday-Friday (0700-1900) minimum frequency | AM Departures (0800-0900) | PM Arrivals (1700-1800) | AM Departures (0800-0900) | PM Arrivals (1700-1800) |
| 0 | 0.03 | 0.03 | 0.11 | 0.07 |
| 100 | 0.06 | 0.06 | 0.12 | 0.08 |
| 200 | 0.06 | 0.06 | 0.13 | 0.08 |
| 300 | 0.06 | 0.06 | 0.15 | 0.07 |

49. Although the public transport rates per household for surveyed houses is quite low, there is an increase in rates for houses with higher frequency public transport. The rate of public transport use is much higher for surveyed flats and increases when provision increases.

50. Overall the analysis shows a correlation between public transport provision and a reduction in vehicle trip rates regardless of surveyed location type.

51. Analysis of vehicle trip rates and passenger transport uptake did not show any clear trend if the population density is considered.

52. Correlation between the public transport provision for the sites used from the TRICS database and 2011 Census journey to work data was also investigated and it was found that there is a positive correlation between trips to work by public transport and public transport provision, although not necessarily strong; 0.81 (strong) for houses and 0.59 (modest) for flats. Similarly there is a negative correlation between car use and public transport provision; 0.39 (weak) for houses and -0.52 (modest) for flats.

## 4.4 Peak period analysis

53. This section examines how trip rates vary across the AM (0700-1000) and PM (1600-1900) peak periods.

54. Table 4.6 shows how the trip rate changes across the AM and PM peak periods for houses and flats.

**Table 4.6: Peak Period Vehicle Trip Rates for Houses and Flats**

| Vehicle Trip Rates | AM Departures | | | PM Arrivals | | |
|---|---|---|---|---|---|---|
| | 0700-0800 | 0800-0900 | 0900-1000 | 1600-1700 | 1700-1800 | 1800-1900 |
| House | 0.25 | 0.36 | 0.06 | 0.28 | 0.31 | 0.07 |
| Flats | 0.10 | 0.15 | 0.07 | 0.11 | 0.15 | 0.11 |

55. For houses Table 4.6 shows that trip rates are higher in the AM (0800-0900) and PM (1700-1800) peak hours. In the AM peak period, the peak hour (0800-0900) total trip rate is over 1.5 times higher than the preceding hour (0700-0800) and 4 times higher than the following hour (0900-1000). In the PM peak period, the peak hour (1700-1800) total trip rate is less than 10% higher than the preceding hour (1600-1700) and 4 times higher than the following hour (1800-1900).

56. For flats, the trip rates are higher in the AM (0800-0900) and PM (1700-1800) peak hours. In the AM peak period, the peak hour (0800-0900) total trip rate is 60% higher than the preceding hour (0700-0800) and following hour (0900-1000). In the PM peak period, the peak hour (1700-1800) total trip rate is 25% higher than the preceding hour (1600-1700) and 20% higher than the following hour (1800-1900).

57. This indicates that peak period vehicle trip generation at source is very concentrated in specific peak hours, rather than spread over a number of hours. This indicates that the trip generation rates used in the initial assessment obtained from TRICS will follow the same pattern and that, if read with Section 3, indicates room for some spreading over peak periods.

# 5. Ongoing Studies and Projects

58. There are a number of studies that are currently ongoing, which all have the aim of improving the transport network and transport provision in Braintree District. While these are acknowledged, we have not been able to incorporate them fully into our work to date either due to their current status or the stage which they are at. It is important to note that some of these studies, in particular those relating to strategic routes such as the A12, A120 and the Braintree Branch Rail line, would be likely to have a significant positive effect on trip distribution within the District in the plan period. Therefore, the results shown in this report are likely to reflect a "worst case" scenario in which there are no significant transport infrastructure changes during the plan period.

## 5.1 A120 Braintree to Marks Tey Junction Improvements

59. HE are currently investigating the potential for junction improvements on the A120 between Braintree and Marks Tey. Initial options for the Marks Farm roundabout and A120 – Colne Road junction have been produced. It is understood that the purpose of the proposals at Marks Farm is to increase capacity and ease congestion.

## 5.2 A120 Braintree to A12 Route Options

60. Highways England has asked the County Council to lead on the feasibility work to determine options for a new A120 route between Braintree and the A12 by Summer 2017. A range of options have been sifted down to a few possible routes and further assessment of these is due to begin soon. Public consultation is likely to take place in the winter 2016/17. Moving forward, ECC/HE will recommend its preferred route to the Government for inclusion in the next Government Road Investment Strategy (RIS), which will run from 2020 to 2025. Increasing the capacity of the A120 has the potential to reduce traffic on local roads within Braintree.

## 5.3 A12 Widening between M25 and A12 J25.

61. HE are currently investigating widening the A12 to 3 lanes in each direction between the M25 and junction 25 on the A12 at Marks Tey. The section between Chelmsford and Marks Tey has been identified in the RIS 1 document to be delivered first, with construction outlined to start by the end of 2019/20. The widening of the remainder of the route is to be included in "Road Period 2".

## 5.4 Millennium Way Slip(s)

62. An option to alleviate some of the resulting congestion from the Galleys Corner junction on the A120 is to implement either one or two slip roads onto Millennium Way. This is considered to be a partial solution in the short term and is being developed by HE with the support of BDC and ECC. Modelling work, jointly commissioned by HE, ECC and BDC has indicated that in the short term these slips would provide significant relief to the Galleys Corner junction, in particular in the PM peak heading eastbound. A single slip, from the A120 EB to Millennium Way, was also shown to be likely to provide some relief to Galleys Corner. However it was noted that by 2031 with the slips, both Galleys Corner and Marks Farm would be at capacity.

## 5.5 Braintree Branch Line

63. Capacity improvements on the Braintree Branch line by the construction of a passing loop, were identified as an infrastructure requirement in the adopted Braintree Core Strategy (2011) to support growth in the whole district. Work is being undertaken to develop options for improving the Braintree branch line. It is expected, if improvements that facilitate a higher frequency of trains can be made, that this will help encourage more trips by train, rather than car, which is of significance given the high number of car trips in to and out of Braintree. This would likely alleviate the junctions on routes in from the south of Braintree in particular due to the number of people travelling between Braintree and Witham / Chelmsford. Therefore the junctions on Pods Brood Road (Springwood Drive), Pierrefitte Way (London Road – Clare Road, Aetheric Road – Pierrefitte Way), Notley Road (Notley Road – South Street) and the A120 (Panners Interchange, Galleys Corner) may see reduced flows. The timescale for completion of this work is unknown.

## 5.6 Braintree Integrated Transport Package

64. A study was recently undertaken to establish a range of transport measures in Braintree town to be progressed through workshops, option identification, prioritisation and business case development. The key requirement of this integrated, all mode study was to ensure that a comprehensive evidence base was assembled to provide an understanding of the transport issues and opportunities in Braintree town in line with the District's Core Strategy.

65. One of the key elements of the study was to identify suitable schemes to prioritise for implementation in the short to medium term. It is the intention that those schemes that are taken forward will be funded either through the ECC, Local Highways Panels (LHP) or South East Local Enterprise Partnership (SE LEP).

66. A range of options, including new cycle routes, junction improvements and access improvements to the two rail stations, have been prioritised from this study and form part of a potential ECC round 3 SELEP bid. The likely impact of these options will be assessed as part of the bid.

## 5.7 Braintree Cycling Action Plan

67. In line with the Essex Cycling Strategy, District Cycling Action Plans are being produced which will ultimately provide BDC with a strategy that includes a range of cycling proposals. It expected that a final Action Plan will be complete in Autumn 2016. This can then be used to incorporate into planning agreements, provide the LHP with cycling schemes and provide schemes for future funding bids.

68. The aims of the Cycling Action Plan are to:

- Identify the current level of cycle demand within the district and how cycling levels can be increased;
- Identify any cycle safety issues within the district;
- Identify gaps in existing cycle provision, particularly relating to key routes;
- Identify ways of closing the gaps in cycle provision and proposed cycle enhancements;
- Create better cycle connectivity to Flitch Way, key employment areas, development zones and schools; and
- Investigate ways of marketing existing and proposed cycle routes.

69. The provision of complete cycle routes or even a coherent cycle network will encourage people to make short trips by bicycle rather than by car. Potential Local Plan developments can then add to the cycle network, thus providing an even wider cycle network, encouraging both existing and future short trips to be made by bicycle.

## 5.8 A131 Route Based Strategies

70. Essex County Council (ECC) commissioned Essex Highways, in 2015, to create a number of Route Based Strategies. This included the A131 Braintree to Sudbury and A130 / A131 Chelmsford to Braintree Route Based Strategies.

71. The key objectives of a Route Based Strategy is to identify options that will result in economic growth and regeneration through the introduction of initiatives focused on improving safety, reducing congestion, improving journey time reliability and increasing sustainable travel patterns. The options proposed in these Route Based Strategies are, as of May 2016, under consideration.

72. The A131 Braintree to Sudbury Route Based Strategy proposes a number of options. These include: improved signing and road surface at collision clusters along the route, improved bus provision and better crossing facilities within Halstead.

73. The A130 / A131 Chelmsford to Braintree Route Based Strategy also proposes a number of options. These include: improved signing and road lining across the route, improving the bus provision along the route including an express bus service between Chelmsford and Braintree. Highway improvements aimed at reducing congestion include addressing the capacity problem at Sheepcotes roundabout.

74. The proposed options along these routes will help to alleviate current congestion and provide an opportunity for growth, whilst also providing suitable alternatives to car travel through implementation of services such as an express bus service between Braintree and Chelmsford.

## 5.9 Developer Schemes

75. The County and District will work closely with developers to put in place schemes that can both mitigate impact and contribute to improving the overall road network.

76. Several developments that have recently submitted planning applications have included new roads as part of their mitigation. These are likely not only to mitigate against the impacts of the development but will also provide relief to the existing road network through use as an alternative route by existing trips in the immediate vicinity.

77. It is noted that a development site in Kelvedon, between Inworth Road, the A12 and the B1024, has proposed a new link road between Inworth Road and the A12, in order to mitigate against the impacts of their development. At this point in time, however, modelling suggests that the large proportion of traffic flows in / out of the development would be to / from the south and so the link road may not support these. The link itself has not yet been formally modelled, however, the VISUM development assignment model has been used to understand the forecast trip distribution in the area. It is noted that if the A12 junction 24 were improved to facilitate all movements, this would be likely to mitigate some of the impact, if it provided shorter journey times for journeys through Kelvedon to access the A12 at junction 23.

# 6. Census Journey to Work Characteristics

78. Analysis of the 2011 Census journey to work data has been undertaken in order to establish the existing commuting travel patterns within the District. Full details on the analysis undertaken can be found in **Appendix I.**

79. The analysis found that over half of Braintree District residents currently commute outside of the District for work, with the majority (around 90%), commuting by car. Likewise trips to work within the District itself are largely made by car (around 75%), while the majority of trips from outside the District to the District are also made by car, around 90%, with the exception of those from London, which is nearer 65%.

80. This provides clear evidence that car travel is by far the most popular method of travel to / from and within Braintree District for commuting. It could reasonably be inferred that this is also the case for all trips to be considered together regardless of purpose. This suggests that there is significant potential to encourage a modal shift given that other methods of travel are currently not well used and indicates that if more sustainable travel options are improved people may switch modes.

# 7. Role of Public Transport and Sustainable Modes

81. Using the modelling work undertaken for the February report, the assumed trip distribution of the developments has been analysed to identify the key potential sustainable transport corridors that might be required to facilitate these developments. Alongside this the origins of traffic entering some of the key junctions where infrastructure mitigation may not be possible has also been investigated to understand how to further develop a strategic sustainable transport network.

82. The assumed trip distribution was based on existing 2011 Census journey to work data. Greater detail can be found in the "Braintree Local Plan: Options Assessment" Report, however it has been assumed that the travel patterns for new developments would mirror existing patterns in those areas.

## 7.1 Public Transport

### 7.1.1 Existing Situation

83. The existing bus services in the Braintree District are somewhat fragmented, with no one single operator serving the District. Overall, there are seven bus operators who run services in Braintree District. Days of operation and service frequency vary greatly between these services. Moreover, bus infrastructure varies in design and quality which is a result of management by different parties, with no single authority responsible for all bus infrastructure in the District. (Various parties include Clearchannel, Braintree District Council, Freeport and Essex County Council.).

84. Around 85% of bus services in Essex are commercially operated, however this is lower in Braintree District with Essex County Council paying for the majority of evening and weekend services. Most recently many of the rural services have been replaced by Demand Responsive Services with the aim of increasing the number of passengers using public transport, by giving residents more transport opportunities, which in turn will allow older rural residents to remain in their homes for longer and more employment and education opportunities for all.

85. Through liaison with ECC passenger transport team, existing issues have been identified as: decreasing passenger numbers, a lack of service frequency reducing the potential to create a modal shift, increasing levels of congestion impacting on the running and reliability of bus services, the cost of running the services, and a lack of an integrated public transport service.

86. The two main improvements that the ECC passenger transport team would like to see are: a better use of resources to integrate all services into one in order to reduce the costs of running / supporting the existing services; and reduced congestion in order to improve the reliability of bus services.

87. In order to encourage a modal shift away from car, thereby reducing the number of car trips, there need to be suitable alternative methods of travel. To achieve a reduction in congestion / modal shift, emphasis needs to be placed on improving sustainable travel modes, i.e. making viable public transport routes that operate smoothly, potentially having priority over private car travel, thus making public transport / sustainable travel a more appealing method of travel.

### 7.1.2 Impact of site location

88. The likely potential for each of the sites included in the previous stage of work to facilitate public transport services, walking and cycling was assessed in the "Braintree Local Plan: Note on Sustainable Transport Accessibility Assessment".

89. This demonstrated that sites in Witham and Braintree would have a high potential for encouraging use of sustainable transport, while larger Garden Settlements would have a high future potential for encouraging use of sustainable transport, but in the existing situation their potential would be very low. With regard to the Garden Settlements, careful consideration will need to be given as to how sustainable transport can be encouraged in the early stages of their development. Sites around the smaller villages, Silver End, Rayne, Kelvedon and/ Halstead, would have a low existing and low future potential for sustainable transport provision, unless the development is substantial enough to support a bus service – see Paragraph 90 below.

90. It is expected that larger development sites (+1000 homes) should be served by bus services, particularly in areas that are extensions of existing urban areas, to reduce the number of car trips generated. ECC will seek to collaborate with developers and bus operators to ensure new or

enhanced services are incorporated into any discussions for new infrastructure and developer contributions on larger development sites are agreed at the planning application stage.

### 7.1.3 Strategic routes

91. Through analysis of the assumed trip distribution it is clear that there will be increased pressure on many of the existing strategic roads (A131, A120 and A12). It was also evident that there are a number of short car trips being made to / from developments that could be reduced through encouragement of cycling and walking along with improved infrastructure for both modes.

92. Many of the trips from Braintree were found to be heading towards the M11 / Stansted, Witham, Chelmsford and Colchester. As Witham and Chelmsford are both on the existing rail line, emphasis should be placed on improving the rail link and access to / from the rail stations. The area will benefit from improved bus services to the rail stations. In particular there appears a need for increased number of routes in the north-west and north-east of Braintree and Great Notley.

93. There are currently regular bus services between both Stansted and Colchester, but it will benefit from increased frequency of these services and alternative services between Braintree, Stansted and Colchester. In particular if the Garden Settlements West of Colchester (Marks Tey) and West of Braintree are to be included in the Local Plan, then bus routes ought to be provided that link these settlements to Braintree, Witham, Colchester (West of Colchester), and Stansted (West of Braintree).

94. In the west of Braintree it was found that there are expected to be a large proportion of trips heading towards Braintree Freeport and also a number of short trips. Therefore consideration ought to be given to providing a regular bus service linking the east and west of Braintree.

95. Developments around Great Notley would also be expected to generate a number of short trips around the developments and into Braintree. There is currently a good level of cycle infrastructure provision and there are regular bus services to and from Great Notley. Further infrastructure and services would support the developments and encourage sustainable travel in the area.

96. Current modelling work suggests development trips from Witham are largely expected to head towards Braintree and Chelmsford, with a smaller amount heading towards Maldon. This would therefore indicate that emphasis be placed on rail services and access to Witham station from the developments. There are currently no or limited bus routes serving the areas of committed development (Maltings Lane, Forest Road, Lodge Road) or the eastern side of Witham and, therefore, routes will be required in these areas. Increased frequency of bus services between Witham and Maldon with the relevant infrastructure to support these services will be beneficial

97. Likewise in Hatfield Peverel, the assumed trip distribution suggests that the majority of trips will head to Braintree and Chelmsford, both initially via the A12. Widening of the A12 will help support these trips, however links to the rail station should be explored. Options to improve accessibility to the rail station have been assessed in the “Hatfield Peverel Station Access” report (March 2016) which found that utilising bus services to the station is currently not an attractive option due to the distance from the nearest bus stop to the station. It is noted that the potential closure of the Arla Foods factory, currently proposed to be July 2016, may provide an opportunity to expand the station car park. This could free up space in the existing car park to allow buses to serve the station from the south. Although services from the north would likely be hindered by the railway bridge, this is less of an issue as there are few settlements or proposed developments north of Hatfield Peverel that would require bus access via this route.

98. The modelling suggests that trips from Halstead will likely be distributed towards Braintree and Colchester. There are no rail services and there are congestion issues along the routes to both towns. The route between Braintree and Halstead is being assessed as part of the A131 Braintree to Sudbury Route Based Strategy. Bus services between these locations will help provide an alternative for existing car trips and also reduce the potential for increased congestion from the development trips. However the Route Based Strategy, although under review, has found limited options for improvement without significant cost attached.

99. The majority of trips to / from Halstead are likely to be generated as a result of the industrial estate in the east and any extension of this. It was found that there would likely be some trips from this area to Witham via Coggeshall and the A120 / Colne Road junction. The limited capacity at this junction

of the minor arms would probably not make it a feasible bus route due to the likely delay and so if demand develops for such a route, consideration will need to be given to improvements at the A120 / Colne Road junction to facilitate bus services or an alternative route between the two settlements.

100. Modelling indicates that trips to / from Kelvedon have a wide trip distribution with many heading towards Braintree, the A12 south (Witham, Chelmsford), and some on the A12 north (Marks Tey / Colchester). The majority of these destinations are on the rail line and so access to the rail station can be improved with the introduction of a local circular bus service in order to encourage sustainable travel to the station. It is known that there are issues with station users parking on the High Street – in order to mitigate this, parking restrictions could be considered and enforced and alternative measures, such as a bus service provided. Expanding the car park at the station would likely further worsen congestion problems in the area, by attracting more car trips and reduce the likelihood of a bus service being well used.

### 7.1.4 Impact of improved bus services

101. There are few studies that have looked at the impact of improving bus services. However, the University of Leeds conducted a study in conjunction with the Institute for Transport Studies, which looked at the link between Buses and Economic Growth. The study estimated that 360,000 people are in a better, more productive job than they could otherwise access, and 30,000 people would not be in the UK labour market without bus services.

102. The study identified that bus services provide access to education and training, especially for deprived areas and supports the vitality of urban centres by providing access to retail and leisure facilities.

103. 20% of those interviewed as part of the study stated that they had not applied for or had turned down a job due to the lack of a suitable bus service between their origin and the job.

104. However the study did note that fares and journey times were key factors in the decision making process as to whether or not one ought to utilise the bus as a method of travel.

105. It can therefore be concluded from the few studies that have been undertaken that improving the bus services will likely reduce the number of car trips and bring economic benefits, however this will be dependent on journey times, journey time reliability and fares.

## 7.2 Cycling

### 7.2.1 Existing Situation

106. Both Braintree and Witham have some existing cycle infrastructure, however it is largely sporadic with few clearly defined routes. Therefore the existing situation does not encourage or support short local trips by bicycle, while cycle access to the rail stations within the District is limited with only Braintree having a clearly defined route from the west along Flitch Way.

107. However none of the other main settlements within the District have any cycling infrastructure, and at this point in time, the Draft District Cycling Action Plan only includes proposals for Halstead, not Hatfield Peverel or Kelvedon. Given that it has been noted that access to the rail stations by sustainable means ought to be improved, consideration should be given to providing cycle links to these stations.

108. Cycling levels in the District are around the mid-point for Essex, and the propensity to cycle within the District is reasonable, thus suggesting that it is possible that improved cycling facilities and encouragement of cycling will lead to a great uptake in the number of people cycling.

### 7.2.2 Impact of site location

109. As with the potential for bus services within the development sites, a number of the sites lend themselves to connecting with existing cycle infrastructure / proposed cycle infrastructure in order to develop a coherent and consistent cycle network within the towns and the District. All development sites would be expected to include cycle infrastructure, whilst larger development sites would likely have a number of internal short trips that can be made by bicycle.

### 7.2.3 Impact of improved cycle facilities

110. A number of studies have been undertaken in order to assess the impact of improving cycling levels through the provision of infrastructure, promotion / marketing of cycling and cycle training. The majority of these studies have taken place between 2004 and 2009, with the two most prominent being; "The Effects of Smarter Choice Programmes in the Sustainable Travel Towns: Summary Report" by the DfT and; "Cycling Demonstration Towns Monitoring Project Report 2006 to 2009" by Cycling England. These studies took place in 8 different towns / cities in a variety of locations within the UK.

111. The studies found that cycling levels increased by between 3% and 55%, with an average increase of around 23% in each location over a 4 – 5 year period, whilst the percentage decrease in vehicle trips was around -2.5% over the same period. Relative to the number of existing car trips to the number of existing cycle trips, -2.5% over the 4-5 years equates to a fairly significant number of vehicles.

112. The clear suggestion from these studies is that a targeted and integrated approach to improving levels of cycling leads to a positive result and modal shift. The Essex Cycle Strategy and the subsequent District Cycling Action Plans aim to provide this kind of approach which will help to boost cycling levels in the District.

113. As noted above, modelling suggests that many of the development trips are between locations with existing rail links and therefore improving access to / from the stations for sustainable transport modes could help to reduce the number of car trips. As a result, cycle access to all stations within the District should be improved.

## 7.3 Rail

114. There is currently an ongoing study looking at options for improving the Braintree branch line. What has become clear from the previous stage modelling work, is that many car trips could potentially be made by rail.

115. However due to the current nature of the Braintree branch line (single track from Witham to Braintree), rail is not the most popular or feasible method of travel within the District due to the infrequency of the trains. With the exception of Witham, this is a problem at all the stations within the District. Halstead has no rail links.

116. Furthermore any proposed Garden Settlements are unlikely to have rail links, due to the expense and land take associated with building new rail infrastructure, despite a probable need for them. Therefore it will very important that there are good bus services and cycle facilities to / from these settlements and those that live there to work there are encouraged to use them. However, it is acknowledged that the West of Colchester Garden Settlement may have the potential to relocate the Marks Tey rail station in order to provide a rail connection.

117. The provision of an improved rail service from Braintree would also likely reduce the number of car trips to Witham rail station and potentially Beaulieu Park station. However it should be noted that any expansion in the car park at Witham or a car park of significant size at the proposed Beaulieu Park station near Chelmsford will only encourage car trips and will likely detract from the provision of bus services or cycle infrastructure.

## 7.4 Travel Planning

118. Working with developers to produce travel plans should be undertaken to ensure measures are in place early in the development of new locations. Projects should also be undertaken with existing employers, schools and residents to influence travel behaviour and encourage the use of more sustainable travel.

119. The following measures should be considered when producing a travel plan covering a large development site/location:

- Implementation of car sharing schemes;
- Inclusion of public transport vouchers or discounts schemes for residents of new developments (in conjunction with any new bus services/routes); and
- Shuttle bus services for employment travel.

# 8. Cross-Boundary Traffic Forecasts

120. This section provides a comparison of the current assumptions for the cross boundary trips forecast by the Braintree Local Plan and the surrounding Districts.

121. In this section, both Scenarios 1 and 2 from the previous stage of work were used, as Scenario 2 contains the Garden Settlements, which have also been considered in the scenarios modelled in the Colchester work and are also likely to have a significant impact on the A12 and A120.

122. Where transport modelling work has been undertaken for the Districts surrounding Braintree, in this case Colchester Borough, the flows have been compared at key entry / exit points to the District in Table 8.1 and Table 8.2 below.

**Table 8.1: Cross-boundary total flows comparison AM (vehicles)**

| | Colchester LP 2032 S0 | Colchester LP 2032 S1 | Colchester LP 2032 S2 | Colchester LP 2032 S3 | Colchester LP 2032 S4 | Braintree LP 2033 S1 | Braintree LP 2033 S2 |
|---|---|---|---|---|---|---|---|
| A1124 EB | 600 | 584 | 585 | 594 | 544 | 586 | 569 |
| A1124 WB | 522 | 535 | 529 | 533 | 422 | 470 | 509 |
| A120 EB | 1590 | 1636 | 1644 | 1598 | 1576 | 999 | 1925 |
| A120 WB | 2101 | 2109 | 2108 | 2101 | 2075 | 1443 | 2279 |
| A12 NEB | 2891 | 3063 | 2984 | 3067 | 3358 | 3086 | 3246 |
| A12 SWB | 3462 | 3706 | 3575 | 3667 | 3462 | 3383 | 3233 |

**Table 8.2: Cross-boundary total flows comparison PM (vehicles)**

| | Colchester LP 2032 S0 | Colchester LP 2032 S1 | Colchester LP 2032 S2 | Colchester LP 2032 S3 | Colchester LP 2032 S4 | Braintree LP 2033 S1 | Braintree LP 2033 S2 |
|---|---|---|---|---|---|---|---|
| A1124 EB | 442 | 447 | 441 | 448 | 388 | 638 | 509 |
| A1124 WB | 539 | 532 | 529 | 536 | 515 | 556 | 544 |
| A120 EB | 1919 | 1926 | 1928 | 1922 | 1910 | 1159 | 2643 |
| A120 WB | 1738 | 1751 | 1753 | 1742 | 1742 | 1184 | 2205 |
| A12 NEB | 4589 | 4755 | 4653 | 4826 | 4642 | 4558 | 4635 |
| A12 SWB | 2305 | 2519 | 2379 | 2546 | 2749 | 3069 | 3173 |

123. It can be seen from the tables above, that the modelling work to date indicates a reasonable level of consistency between the Colchester work and Braintree, with the exception of the A120, possibly due to different assumptions about the West of Colchester Garden Settlement. Whilst confirmation of a preferred scenario in both Districts will likely change the results, it is encouraging to note the early consistencies with the two pieces of work.

124. It should be noted that Chelmsford City, Babergh District and Uttlesford District Councils are in the early stages of developing their Local Plans and as yet have not finalised their transport modelling. Whilst Colchester Borough are in a similar position to Braintree District in testing several scenarios prior to assessing the Preferred Option.

125. It is understood that Maldon intend to progress with their Local Plan inspection and so the flows reported previously have been compared in Table 8.3 and Table 8.4 below.

**Table 8.3: Cross-border total flows comparison AM**

| | Maldon LDP 2026 | Braintree LP 2033 S1 | Braintree LP 2033 S2 |
|---|---|---|---|
| Maldon Rd NB | 873 | 1028 | 861 |
| Maldon Rd SB | 615 | 897 | 628 |

**Table 8.4: Cross-border total flows comparison PM**

| | Maldon LDP 2026 | Braintree LP 2033 S1 | Braintree LP 2033 S2 |
|---|---|---|---|
| Maldon Rd NB | 749 | 1084 | 800 |
| Maldon Rd SB | 749 | 894 | 730 |

126. From the tables above, it can be seen that there is reasonable consistency between the Maldon LDP work and the Braintree work. Once a preferred scenario has been chosen for Braintree the results may change, but at this point in time it is encouraging to see that there are similarities between the two pieces of work.

# 9. Conclusions

127. This stage of work was undertaken to provide an assessment of where mitigation will be required at junctions, what mitigation will be possible at those junctions, where public transport improvements will be required, under what circumstances could trip rates for the developments be reduced and an overview of the ongoing studies or projects that are working to alleviate the current transport issues within Braintree District.

128. Modelling in the previous stage of work indicated that 11 of the 16 key junctions would likely be over capacity in 2033, and therefore would ideally need mitigation. Of these, mitigation options were identified for 9 of the junctions, although Highways England are developing mitigation for the Marks Farm junction, and only 8 were tested further. A summary is shown in Table 9.1 below.

**Table 9.1: Summary of junction mitigation options**

| Junction | Forecast over capacity in 2033? (Y/N) | Are mitigation proposals required? (Y/N) | What mitigation has been considered? | Suggested Mitigation |
|---|---|---|---|---|
| A120 – Colne Road, Coggeshall | Y | Y | Highways England are working on options for this junction. It will also be affected by any new A120 route. | N/A |
| A131 – Head Street, Halstead | Y | Y | No possible infrastructure mitigation could be identified at this junction. A bypass or modal shift measures are required. | Modal Shift Measures |
| A131 – London Road, Great Notley | N | N | N/A | N/A |
| Aetheric Road, Braintree | Y | Y | Option 1: Adjustment of junction layout including a right turn ban out of Rayne Road E.<br>Option 2: Right turn ban out of Aetheric Road. | Option 1 |
| Broad Road, Braintree | Y | Y | Option 1: Free flow left slip from A131N outside of highway boundary.<br>Option 2: Free flow left slip from A131N inside highway boundary and relocation of roundabout.<br>Option 3: Signalisation of junction with free flow left slip from A131N. | Option 2 |
| Chipping Hill, Witham | Y | Y | Option 1: Signalisation of the junction.<br>Option 2: Creation of a standard roundabout. | Modal Shift Measures as mitigation considered is unlikely to provide sufficient relief. |

| Junction | Forecast over capacity in 2033? (Y/N) | Are mitigation proposals required? (Y/N) | What mitigation has been considered? | Suggested Mitigation |
|---|---|---|---|---|
| Church Lane, Braintree | Y | Y | Option 1: Signalisation of the junction. | Modal Shift Measures as mitigation considered is unlikely to provide sufficient relief. |
| Cuckoo Way, Great Notley | N | N | N/A | N/A |
| Gershwin Boulevard, Witham | Y | N | Mitigation is being provided as part of a planning application in south Witham. | N/A |
| Maldon Road – The Street, Hatfield Peverel | Y | Y | Limited infrastructure mitigation could be identified at this junction. A bypass or modal shift measures are required. | Modal Shift Measures – improved passenger transport links. A12 improvements. |
| Marks Farm, Braintree | Y | Y | Highways England are working on options for this junction. It will also be affected by any new A120 route. | N/A |
| Newland Street, Witham | Y | Y | Option 1: Optimisation of signal timings.<br>Option 2: Ban of all movements from Maldon Road. | Option 1 in the short term (next 5-7 years); Modal Shift Measures in the long term (+7 years). |
| Panners Interchange, Braintree / Great Notley | Y | Y | Option 1: Widening of Pods Brook Road and A120 eastbound off slip to 2 lanes. | Modal Shift Measures as mitigation considered is unlikely to provide sufficient relief. |
| Rickstones Road, Witham | Y | N | Mitigation is being provided as part of a planning application in north Witham. | N/A |
| Rye Mill Lane, Kelvedon | Y | Y | Option 1: Signalisation of the junction. | Modal Shift Measures as mitigation considered is unlikely to provide sufficient relief. |

| Junction | Forecast over capacity in 2033? (Y/N) | Are mitigation proposals required? (Y/N) | What mitigation has been considered? | Suggested Mitigation |
|---|---|---|---|---|
| Springwood Drive, Braintree | Y | Y | Option 1: Minor Geometry adjustments to roundabout<br>Option 2: Left turn slips from Springwood Drive and Rayne Road East<br>Option 3: Signalised Crossroads<br>Option 4: Enlarged Signalised Crossroads with land take | Modal Shift Measures as mitigation considered is unlikely to provide sufficient relief. |

129. Of the 8 junction mitigation options tested, only three were drawn up as the others were signalised options which the modelling indicated would not alleviate the junction in 2033. Of the three drawn up, modelling suggested that at only two of these signals would alleviate the junctions in question in 2033.

130. However, it was found that there is significant potential to encourage a modal shift as the majority of journey to work trips to / from / within the District are currently made by car. It is important to note that in order to alleviate the forecast impact on the transport network in 2033, a significant number of car trips will need to be catered for by another mode.

131. The initial modelling work suggests that many of the trips are being made between settlements with rail links and therefore those rail links should be improved. Similarly access to the rail stations by sustainable modes ought to be improved and encouraged.

132. In depth analysis of trip rates suggests that there is potential to lower the currently assumed rates under certain circumstances such as improved public transport provision. It is also likely that some trips will spread into the hours either side of the peak hour.

133. There are currently a number of ongoing studies and projects, all of which are investigating options for improving the existing transport network and alleviating current issues, many within the plan period. These will likely have a significant positive effect should the options developed come to fruition.

# Appendices

Proposed marking
to diag. no. 1038

Proposed markings
to diag. no. 1038

Proposed markings
to diag. no. 1004

Proposed markings
to diag. no. 1038

Proposed markings
to diag. no. 1001

RAYNE ROAD

PIERREFITTE WAY

Multi Car Pk

70.0m

69.9m

1 to 3

70 to 74b

68

74

78

73

67

98

82

76

70

64

56

6

CHP

TOWN HOUSES

PARK

CHP

ALL

Notes

1. Do not scale.

Key

- Modified Island
- Proposed carriageway extension
- Existing highway assets
- Proposed road markings
- Existing road markings
- Proposed kerbing

| Rev. | Date | Description of revision | Drawn | Checked | Review'd | Approv'd |
|---|---|---|---|---|---|---|
| | | | | | | |
| B | MAY 16 | Addition of an extra lane northbound | JT | MJ | ML | ML |
| A | MAY 16 | Change of Drawing Title | JT | MJ | MPA | MPA |

DRAWING STATUS

**FOR INFORMATION**

RINGWAY JACOBS
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Tel: 0345 6037631



SCHEME TITLE

**BRAINTREE LOCAL PLAN SCHEMES**

DRAWING TITLE

**APPENDIX A1
AETHERIC ROAD**

| DESIGNED | DRAWN | CHECKED | REVIEWED | APPROVED |
|---|---|---|---|---|
| JT | JLE | MJ | ML | ML |
| DATE | DATE | DATE | DATE | DATE |
| APR 16 | APR 16 | APR 16 | APR 16 | APR 16 |

DRAWING UNITS U.N.O.
DIMENSIONS IN METRES
LEVELS IN METRES

SCALE AT A3 (420x297mm)
1:500

DRAWING No.
**43TP005-06-001**

REV.
**B**



File Location \\eheche2fp000\Common$\9 Trans Impr\TP\Projects\43TP005 Braintree Local Plan Support 2016-17\005 - Working Documents\06 - Design Team\03_CAD\06_Aetheric Road\43TP005-06-001 B.dwg Last saved by Jay.Thanki on 25 May 2016 Printed By Jay Thanki on 25 May 2016

# Appendix A2 – Aetheric Road Junction Results

The results of the junction modelling, for signalised junctions, are shown as Percentage Degree of Saturation and Delay (in seconds) per Passenger Car Unit (PCU).

A Degree of Saturation below 75% is shown in green and indicates that movement is operating within capacity. A Degree of Saturation between 75 – 85% is shown in orange and indicates the movement is nearing capacity. Finally if the Degree of Saturation is over 85% then that movement is at or over capacity.

With regards to Delay per PCU, over 40 seconds is shown in red and is considered to be a frustration for drivers.

A – Aetheric Road
B – Rayne Road E
C – Pierrefitte Way
D – Rayne Road W

## Existing Layout

| | | Turning Movement | | | | |
|---|---|---|---|---|---|---|
| | | A - BCD | B – ACD | C - AD | C - B | D - ABC |
| Base Year AM | Deg. Of Sat | 104.2% | 8.6% | 99.6% | 74% | 104% |
| | Delay/PCU | 173.2 | 42 | 133.8 | 75.3 | 173.2 |
| Base Year PM | Deg. Of Sat | 95.3 | 48.9 | 94.2 | 46.6 | 94 |
| | Delay/PCU | 94.1 | 53.5 | 89.1 | 51.6 | 62 |
| Scenario 1 AM | Deg. Of Sat | 118.9 | 8.9 | 121.1 | 74.2 | 121 |
| | Delay/PCU | 357.5 | 40.2 | 415.9 | 71.6 | 408.1 |
| Scenario 1 PM | Deg. Of Sat | 114.6 | 52.8 | 114.2 | 39.9 | 111.0 |
| | Delay/PCU | 89.8 | 66.2 | 314.3 | 42.3 | 280.1 |

## Mitigation Layout

| | | | | Turning Movement | | | | |
|---|---|---|---|---|---|---|---|---|
| | | A - BC | A - CD | B – CD | C - A | C - B | C - D | D - ABC |
| Base Year AM | Deg. Of Sat | 101.1 | 101.1 | 8.1 | 84.9 | 78.0 | 99.6 | 102.5 |
| | Delay/PCU | 97.2 | 97.2 | 33.4 | 78.1 | 68.7 | 78.1 | 140.4 |
| Base Year PM | Deg. Of Sat | 86.4 | 90.4 | 9.8 | 92.5 | 53.0 | 92.5 | 93.3 |
| | Delay/PCU | 63.6 | 63.6 | 20.9 | 72.2 | 44.8 | 72.2 | 51.4 |
| Scenario 1 AM | Deg. Of Sat | 108.5 | 108.5 | 7.2 | 109.0 | 72.1 | 109.0 | 109.5 |
| | Delay/PCU | 209.0 | 209.0 | 36.7 | 243.7 | 68.0 | 243.7 | 56.3 |
| Scenario 1 PM | Deg. Of Sat | 102.2 | 102.2 | 20.5 | 101.7 | 37.5 | 101.7 | 100.0 |
| | Delay/PCU | 127.3 | 127.3 | 44.9 | 125.6 | 37.8 | 125.6 | 127.8 |


Notes

1. Do not scale.
2. Earthworks not shown but some will fall outside of Highway Boundary.

Key

- Proposed kerb
- Proposed carriageway extension
- Proposed / Modified island
- Proposed nose taper road markings
- Proposed road markings
- Existing highway boundary

| Rev. | Date | Description of revision | Drawn | Checked | Review'd | Approv'd |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| A | MAY 16 | Change of Drawing Title | JT | MJ | MPA | MPA |

DRAWING STATUS

**FOR INFORMATION**

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SCHEME TITLE

**BRAINTREE LOCAL PLAN SCHEMES**

DRAWING TITLE

**APPENDIX B1.1**
**A131 / BROAD ROAD ROUNDABOUT**

| DESIGNED | DRAWN | CHECKED | REVIEWED | APPROVED |
|---|---|---|---|---|
| JT | JT | MJ | ML | ML |
| DATE | DATE | DATE | DATE | DATE |
| APR 16 | APR 16 | APR 16 | APR 16 | APR 16 |

DRAWING UNITS U.N.O.: DIMENSIONS IN METRES, LEVELS IN METRES
SCALE AT A3 (420x297mm): 1:1000

DRAWING No.: **43TP005-02-01-001**
REV.: **A**



File Location \\ehche2fp000\Common$\9 Trans Impr\TP\Projects\43TP005 Braintree Local Plan Support 2016-17\005 - Working Documents\06 - Design Team\03_CAD\02_Broad Road\45TP005-02-01-001 A.dwg Last saved by Jay.Thanki on 24 May 2016 Printed By Jay Thanki on 24 May 2016


Notes

1. Do not scale.
2. Earthworks not shown but assumed will lie within the Highway Boundary.

Key

- Proposed kerb
- Proposed carriageway extension
- Proposed carriageway reduction
- Proposed / Modified island
- Proposed nose taper road markings
- Proposed road markings
- Existing highway boundary

| Rev. | Date | Description of revision | Drawn | Checked | Review'd | Approv'd |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |

DRAWING STATUS

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SCHEME TITLE

**BRAINTREE LOCAL PLAN SCHEMES**

DRAWING TITLE

**APPENDIX B1.2**
**A131 / BROAD ROAD ROUNDABOUT**

| DESIGNED | DRAWN | CHECKED | REVIEWED | APPROVED |
|---|---|---|---|---|
| JT | JT | MJ | MPA | MPA |
| DATE | DATE | DATE | DATE | DATE |
| APR 16 | APR 16 | MAY 16 | MAY 16 | MAY 16 |

DRAWING UNITS U.N.O.: DIMENSIONS IN METRES, LEVELS IN METRES

SCALE AT A3 (420x297mm): 1:1000

DRAWING No.: **43TP005-02-01-002**

REV.: -



File Location \\ehche2fp000\Common$\9 Trans Impr\TP\Projects\43TP005 Braintree Local Plan Support 2016-17\005 - Working Documents\06 - Design Team\03_CAD\02_Broad Road\45TP005-02-01-002.dwg Last saved by Jay.Thanki on 24 May 2016 Printed By Jay Thanki on 24 May 2016

# Appendix B2 – Broad Road Junction Results

The results of the junction modelling, for priority junctions and roundabout, are shown as Ratio of Flow to Capacity (RFC) and Delay (in seconds) per vehicle

A RFC below 0.75 is shown in green and indicates that the arm / movement is operating within capacity. A RFC between 75 – 85% is shown in orange and indicates the arm / movement is nearing capacity. Finally if the RFC is over 85% then that arm / movement is at or over capacity.

With regards to Delay per vehicles, over 40 seconds is shown in red and is considered to be a frustration for drivers.

## Existing Layout

| | | Junction Arm | | |
|---|---|---|---|---|
| | | A131 N | A131 S | Broad Rd |
| Base Year AM | RFC | 0.74 | 0.51 | 0.38 |
| | Delay (s) | 8.58 | 4.85 | 5.61 |
| Base Year PM | RFC | 0.54 | 0.51 | 0.61 |
| | Delay (s) | 5.22 | 4.15 | 9.85 |
| Scenario 1 AM | RFC | 0.83 | 0.96 | 0.39 |
| | Delay (s) | 14.72 | 41.60 | 6.50 |
| Scenario 1 PM | RFC | 0.95 | 0.72 | 0.85 |
| | Delay (s) | 43.81 | 7.68 | 25.88 |

## Mitigation Layout – with land take (Appendix B1.1)

| | | Junction Arm | | |
|---|---|---|---|---|
| | | A131 N | A131 S | Broad Rd |
| Base Year AM | RFC | 0.41 | 0.51 | 0.38 |
| | Delay (s) | 3.67 | 4.85 | 5.61 |
| Base Year PM | RFC | 0.21 | 0.51 | 0.61 |
| | Delay (s) | 2.91 | 4.14 | 9.85 |
| Scenario 1 AM | RFC | 0.45 | 0.96 | 0.39 |
| | Delay (s) | 4.11 | 41.91 | 6.50 |
| Scenario 1 PM | RFC | 0.30 | 0.72 | 0.85 |
| | Delay (s) | 3.59 | 7.71 | 25.88 |

## Mitigation Layout – within highway boundary (Appendix B1.2)

| | | Junction Arm | | |
|---|---|---|---|---|
| | | A131 N | A131 S | Broad Rd |
| Base Year AM | RFC | 0.41 | 0.42 | 0.32 |
| | Delay (s) | 3.75 | 3.38 | 4.41 |
| Base Year PM | RFC | 0.21 | 0.42 | 0.52 |
| | Delay (s) | 2.96 | 2.84 | 6.83 |
| Scenario 1 AM | RFC | 0.45 | 0.77 | 0.33 |
| | Delay (s) | 4.21 | 9.33 | 5.09 |
| Scenario 1 PM | RFC | 0.31 | 0.58 | 0.73 |
| | Delay (s) | 3.66 | 4.23 | 12.35 |

## Mitigation Layout – Signalised

A – A131N

B – A131S

C – Broad Road

| | | Junction Movement | | | |
|---|---|---|---|---|---|
| | | A – B | A – C | B – AC | C – AB |
| Base Year AM | Degree of saturation (%) | 31.2 | 82.1 | 82.7 | 64.4 |
| | Delay / pcu (s) | 1.4 | 46.9 | 31.6 | 34.3 |
| Base Year PM | Degree of saturation (%) | 24.9 | 68.3 | 80.6 | 79.5 |
| | Delay / pcu (s) | 1.3 | 43.8 | 24.8 | 36.7 |
| Scenario 1 AM | Degree of saturation (%) | 36.2 | 133.0 | 131.1 | 102.9 |
| | Delay / pcu (s) | 1.6 | 531.7 | 497.9 | 142.3 |
| Scenario 1 PM | Degree of saturation (%) | 47.2 | 126.0 | 125.0 | 126.7 |
| | Delay / pcu (s) | 1.9 | 448.2 | 411.8 | 435.6 |

# Appendix C – Chipping Hill Results

## Existing Layout

| | | Junction Arm | | |
|---|---|---|---|---|
| | | Chipping Hill | The Avenue | Collingwood Rd |
| Base Year AM | RFC | 0.99 | 0.82 | 0.54 |
| | Delay (s) | 74.10 | 30.93 | 9.79 |
| Base Year PM | RFC | 0.80 | 0.96 | 0.67 |
| | Delay (s) | 14.71 | 64.40 | 13.92 |
| Scenario 1 AM | RFC | OC | 1.16 | 0.77 |
| | Delay (s) | OC | 479.9 | 20.7 |
| Scenario 1 PM | RFC | 1.09 | OC | 0.80 |
| | Delay (s) | 325.6 | OC | 21.5 |

## Mitigation Layout – Signalised

A – Chipping Hill

B – The Avenue

C – Collingwood Road

| | | Junction Movement | | |
|---|---|---|---|---|
| | | A – BC | B – AC | C – AB |
| Base Year AM | Degree of saturation (%) | 99.7 | 99.1 | 83.8 |
| | Delay / pcu (s) | 65.6 | 108.5 | 34.2 |
| Base Year PM | Degree of saturation (%) | 94.7 | 93.5 | 39.7 |
| | Delay / pcu (s) | 45.5 | 62.3 | 16.2 |
| Scenario 1 AM | Degree of saturation (%) | 146.7 | 147.3 | 92.7 |
| | Delay / pcu (s) | 642.4 | 681.0 | 43.7 |
| Scenario 1 PM | Degree of saturation (%) | 126.2 | 126.5 | 46.7 |
| | Delay / pcu (s) | 443.6 | 483.4 | 17.7 |

## Mitigation Layout – Standard Roundabout

| | | Junction Arm | | |
|---|---|---|---|---|
| | | Chipping Hill | The Avenue | Collingwood Rd |
| Base Year AM | RFC | 0.97 | 0.50 | 0.32 |
| | Delay (s) | 54.19 | 7.22 | 4.04 |
| Base Year PM | RFC | 0.78 | 0.59 | 0.38 |
| | Delay (s) | 13.23 | 7.88 | 4.51 |
| Scenario 1 AM | RFC | OC | 0.64 | 0.47 |
| | Delay (s) | 1563 | 11.92 | 5.62 |
| Scenario 1 PM | RFC | 1.07 | 0.76 | 0.52 |
| | Delay (s) | 252.6 | 16.67 | 6.25 |

# Appendix D – Church Lane Results

## Existing Layout

| | | Junction Arm | | |
|---|---|---|---|---|
| | | Church Lane | Convent Hill | Bradford St |
| Base Year AM | RFC | 0.80 | 1.00 | 0.62 |
| | Delay (s) | 23.90 | 69.86 | 8.72 |
| Base Year PM | RFC | 0.99 | 0.56 | 0.93 |
| | Delay (s) | 78.21 | 8.82 | 32.58 |
| Scenario 1 AM | RFC | 0.88 | OC | 0.59 |
| | Delay (s) | 36.58 | OC | 9.61 |
| Scenario 1 PM | RFC | OC | 0.75 | 1.27 |
| | Delay (s) | OC | 15.31 | 728.29 |

## Mitigation Layout – Signalised

A – Church Lane

B – Convent Hill

C – Bradford Street

| | | Junction Movement | | |
|---|---|---|---|---|
| | | A – BC | B – AC | C – AB |
| Base Year AM | Degree of saturation (%) | 96.6 | 99.3 | 55.1 |
| | Delay / pcu (s) | 79.4 | 87.3 | 16.3 |
| Base Year PM | Degree of saturation (%) | 127.0 | 121.6 | 76.8 |
| | Delay / pcu (s) | 473.0 | 389.8 | 15.4 |
| Scenario 1 AM | Degree of saturation (%) | 214.5 | 208.2 | 60.0 |
| | Delay / pcu (s) | 1082.8 | 1040.9 | 10.0 |
| Scenario 1 PM | Degree of saturation (%) | 123.8 | 203.4 | 172.7 |
| | Delay / pcu (s) | 378.0 | 958.4 | 791.8 |

# Appendix E – Newland Street Results

## Existing Layout

A – Newland St NE
B – Maldon Road
C – Newland St SW
D – Collingwood Road

| | | Turning Movement | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | C – A | C – B | Link SW - BC | B - CA | Link NE – DA | A - CD | D - AC |
| Base Year AM | Deg. Of Sat % | 40.6 | 26.2 | 33.9 | 73.2 | 43.4 | 36.6 | 58.3 |
| | Delay/PCU (s) | 36.3 | 38.1 | 4.0 | 55.2 | 6.1 | 38.7 | 47.3 |
| Base Year PM | Deg. Of Sat % | 47.2 | 76.9 | 61.6 | 80.2 | 43.5 | 82.3 | 102.3 |
| | Delay/PCU (s) | 36.5 | 91.4 | 6.8 | 64.8 | 6.8 | 55 | 159.5 |
| Scenario 1 AM | Deg. Of Sat % | 35.3 | 76.8 | 80.9 | 109.7 | 44.0 | 108.0 | 110.5 |
| | Delay/PCU (s) | 32.4 | 115.8 | 11.6 | 268.7 | 7.4 | 217.1 | 290.2 |
| Scenario 1 PM | Deg. Of Sat % | 43.7 | 120.0 | 75.6 | 116.2 | 44.6 | 110.6 | 117.0 |
| | Delay/PCU (s) | 37.9 | 460.0 | 8.8 | 366.0 | 8.3 | 260.8 | 365.3 |

## Mitigation Layout – Signal timings optimised

| | | Turning Movement | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | C – A | C – B | Link SW - BC | B - CA | Link NE – DA | A – CD | D - AC |
| Base Year AM | Deg. Of Sat % | 51.6 | 38.1 | 37.2 | 52.6 | 41.0 | 51.8 | 54.4 |
| | Delay/PCU (s) | 47.4 | 52.3 | 4.6 | 40.4 | 5.2 | 49.8 | 47.5 |
| Base Year PM | Deg. Of Sat % | 47.6 | 62.4 | 57.5 | 82.7 | 44.1 | 81.9 | 83.1 |
| | Delay/PCU (s) | 39.7 | 61.2 | 5.6 | 73.4 | 7.2 | 57.9 | 60.4 |
| Scenario 1 AM | Deg. Of Sat % | 35.3 | 76.8 | 80.9 | 109.7 | 44.0 | 108.0 | 110.5 |
| | Delay/PCU (s) | 32.4 | 115.8 | 11.6 | 268.7 | 7.4 | 217.1 | 290.2 |
| Scenario 1 PM | Deg. Of Sat % | 43.7 | 120.0 | 75.6 | 116.2 | 44.6 | 110.6 | 117.0 |
| | Delay/PCU (s) | 37.9 | 460.0 | 8.8 | 366.0 | 8.3 | 260.8 | 365.3 |

## Mitigation Layout – Maldon Road exit only

| | | Turning Movement | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | C – A | C – B | Link SW - BC | B - CA | Link NE – DA | A – CD | D - AC |
| Base Year AM | Deg. Of Sat % | 39.7 | 25.3 | 28.4 | 0.0 | 31.1 | 38.9 | 40.4 |
| | Delay/PCU (s) | 35.0 | 36.6 | 3.1 | 0.0 | 5.8 | 36.7 | 33.5 |
| Base Year PM | Deg. Of Sat % | 45.1 | 55.3 | 53.3 | 0.0 | 35.5 | 78.2 | 75.6 |
| | Delay/PCU (s) | 35.1 | 50.0 | 4.7 | 0.0 | 5.9 | 49.1 | 46.7 |
| Scenario 1 AM | Deg. Of Sat % | 25.3 | 32.9 | 63.1 | 0.0 | 26.2 | 77.6 | 76.2 |
| | Delay/PCU (s) | 19.8 | 33.7 | 3.8 | 0.0 | 4.8 | 34.0 | 59.4 |
| Scenario 1 PM | Deg. Of Sat % | 33.9 | 77.2 | 66.0 | 0.0 | 34.9 | 86.3 | 87.8 |
| | Delay/PCU (s) | 28.0 | 79.7 | 3.9 | 0.0 | 6.3 | 49.7 | 60.4 |

# Appendix F – Panners Interchange Results

## Existing Layout

| | | Junction Arm | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Northern Rdbt | | | Southern Rdbt | | | |
| | | Pods Brook | A131 Link | A120 W | A131 Link | A120 E | B1256 | A131 |
| Base Year AM | RFC | 0.53 | 0.40 | 0.30 | 0.36 | 0.31 | 0.40 | 0.29 |
| | Delay (s) | 5.91 | 2.63 | 4.79 | 2.45 | 6.05 | 10.88 | 2.32 |
| Base Year PM | RFC | 0.64 | 0.34 | 0.55 | 0.52 | 0.39 | 0.40 | 0.21 |
| | Delay (s) | 10.30 | 2.41 | 5.57 | 3.20 | 8.57 | 10.95 | 2.00 |
| Scenario 1 AM | RFC | OC | 0.88 | 1.35 | 0.47 | 1.36 | 0.37 | 0.55 |
| | Delay (s) | OC | 13.9 | 881.7 | 3.2 | 1083 | 59.2 | 4.7 |
| Scenario 1 PM | RFC | OC | 0.81 | OC | 0.54 | 0.95 | 0.13 | 0.57 |
| | Delay (s) | OC | 8.0 | OC | 3.6 | 73.5 | 15.2 | 3.8 |

## Mitigation Layout – Widened approaches

| | | Junction Arm | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Northern Rdbt | | | Southern Rdbt | | | |
| | | Pods Brook | A131 Link | A120 W | A131 Link | A120 E | B1256 | A131 |
| Base Year AM | RFC | 0.32 | 0.40 | 0.28 | 0.36 | 0.31 | 0.40 | 0.29 |
| | Delay (s) | 2.59 | 2.63 | 4.26 | 2.45 | 6.06 | 10.90 | 2.33 |
| Base Year PM | RFC | 0.37 | 0.34 | 0.51 | 0.53 | 0.39 | 0.40 | 0.21 |
| | Delay (s) | 3.38 | 2.41 | 4.69 | 3.21 | 8.59 | 10.97 | 2.0 |
| Scenario 1 AM | RFC | OC | 0.77 | 0.88 | 0.72 | OC | 0.50 | 0.53 |
| | Delay (s) | OC | 7.65 | 38.03 | 5.79 | OC | 95.51 | 4.32 |
| Scenario 1 PM | RFC | 0.97 | 0.73 | OC | 0.79 | OC | 0.14 | 0.54 |
| | Delay (s) | 42.78 | 5.83 | OC | 7.8 | OC | 16.04 | 3.39 |

# Appendix G – Springwood Drive Results

## Existing Layout

| | | Junction Arm | | | |
|---|---|---|---|---|---|
| | | Springwood Drive | Rayne Rd E | Pods Brook Rd | Rayne Rd W |
| Base Year AM | RFC | 0.34 | 0.69 | 0.68 | 0.46 |
| | Delay (s) | 6.73 | 7.88 | 8.39 | 7.31 |
| Base Year PM | RFC | 0.70 | 0.42 | 0.52 | 0.26 |
| | Delay (s) | 11.45 | 4.89 | 5.00 | 4.52 |
| Scenario 1 AM | RFC | OC | OC | OC | 1.30 |
| | Delay (s) | OC | OC | OC | 774.0 |
| Scenario 1 PM | RFC | 1.29 | 0.87 | 1.20 | OC |
| | Delay (s) | 761.9 | 27.5 | 626.0 | OC |

## Mitigation Layout – Combined Developer Mitigation (widening of approaches)

| | | Junction Arm | | | |
|---|---|---|---|---|---|
| | | Springwood Drive | Rayne Rd E | Pods Brook Rd | Rayne Rd W |
| Base Year AM | RFC | 0.28 | 0.56 | 0.49 | 0.35 |
| | Delay (s) | 5.07 | 4.62 | 3.80 | 4.56 |
| Base Year PM | RFC | 0.58 | 0.33 | 0.37 | 0.20 |
| | Delay (s) | 7.04 | 3.43 | 2.79 | 3.28 |
| Scenario 1 AM | RFC | OC | 1.26 | 1.14 | 1.19 |
| | Delay (s) | OC | 560.38 | 408.03 | 452.91 |
| Scenario 1 PM | RFC | 1.27 | 0.73 | 0.85 | 1.25 |
| | Delay (s) | 554.8 | 11.76 | 13.86 | 680.54 |

## Mitigation Layout – Combined Developer Mitigation (widening of approaches) with left turn slips from Springwood Drive & Rayne Road East

| | | Junction Arm | | | |
|---|---|---|---|---|---|
| | | Springwood Drive | Rayne Rd E | Pods Brook Rd | Rayne Rd W |
| Base Year AM | RFC | 0.19 | 0.24 | 0.49 | 0.35 |
| | Delay (s) | 4.90 | 2.75 | 3.80 | 4.56 |
| Base Year PM | RFC | 0.38 | 0.16 | 0.37 | 0.20 |
| | Delay (s) | 4.86 | 2.69 | 2.79 | 3.28 |
| Scenario 1 AM | RFC | 1.34 | 0.69 | 1.19 | 1.19 |
| | Delay (s) | 956.19 | 12.95 | 566.25 | 436.68 |
| Scenario 1 PM | RFC | 0.89 | 0.41 | 0.58 | 1.25 |
| | Delay (s) | 34.39 | 5.73 | 14.12 | 680.25 |

## Mitigation Layout – Signalised Crossroads (land take required)

A – Springwood Drive
B – Rayne Road E
C – Pods Brook Road
D – Rayne Road W

| | | Junction Movement | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | A – BC | A – D | B – ACD | C – AB | C – D | D – AB | D - C |
| Base Year AM | Degree of Saturation % | 91.4 | 17.3 | 109.4 | 111.2 | 13.0 | 109.7 | 42.2 |
| | Delay / PCU (s) | 117.6 | 70.9 | 234.3 | 262.9 | 35.5 | 281.4 | 60.5 |
| Base Year PM | Degree of Saturation % | 106.1 | 5.9 | 102.5 | 101.9 | 15.6 | 97.4 | 19.2 |
| | Delay / PCU (s) | 181.2 | 31.3 | 144.6 | 130.9 | 29.9 | 142.5 | 47.3 |
| Scenario 1 AM | Degree of Saturation % | 220.6 | 63.7 | 215.1 | 190.2 | 207.7 | 141.4 | 212.4 |
| | Delay / PCU (s) | 1115.6 | 52.9 | 1100.2 | 959.0 | 1048.9 | 615.3 | 1083.4 |
| Scenario 1 PM | Degree of Saturation % | 175.0 | 25.1 | 182.2 | 181.2 | 80.5 | 122.7 | 175.6 |
| | Delay / PCU (s) | 885.4 | 43.3 | 936.6 | 907.7 | 10.5 | 68.0 | 193.8 |

# Appendix H – Rye Mill Lane Results

## Existing Layout

A – London Road
B – Inworth Road
C – Feering Hill
D – Rye Mill Lane

| | | Turning Movement | | | | | |
|---|---|---|---|---|---|---|---|
| | | D - A | D - BC | A - D | B - C | B - AD | C - B |
| Base Year AM | RFC | 0.07 | 0.05 | 0.03 | 1.07 | 1.05 | 0.41 |
| | Delay (s) | 8.01 | 14.89 | 7.23 | 238.29 | 210.76 | 13.40 |
| Base Year PM | RFC | 0.04 | 0.04 | 0.06 | 0.99 | 1.02 | 0.40 |
| | Delay (s) | 6.79 | 14.79 | 7.27 | 170.3 | 146.16 | 11.43 |
| Scenario 1 AM | RFC | OC | OC | 0.04 | OC | OC | 1.03 |
| | Delay (s) | OC | OC | 16.91 | OC | OC | 144.64 |
| Scenario 1 PM | RFC | OC | OC | 0.09 | OC | OC | 1.15 |
| | Delay (s) | OC | OC | 15.55 | OC | OC | 431.88 |

## Mitigation Layout – Signalised Junction

| | | Turning Movement | | | |
|---|---|---|---|---|---|
| | | A – BCD | B – ACD | C – ABD | D – ABC |
| Base Year AM | RFC | 98.0 | 96.8 | 99.2 | 8.7 |
| | Delay (s) | 92.2 | 103.5 | 119.5 | 36.8 |
| Base Year PM | RFC | 91.7 | 91.1 | 92.9 | 4.4 |
| | Delay (s) | 68.3 | 73.1 | 85.6 | 34.5 |
| Scenario 1 AM | RFC | 183.0 | 180.0 | 182.8 | 9.9 |
| | Delay (s) | 953.1 | 954.5 | 962.2 | 29.6 |
| Scenario 1 PM | RFC | 172.8 | 174.7 | 174.5 | 5.3 |
| | Delay (s) | 879.7 | 910.2 | 893.5 | 31.5 |

# Appendix I – Census Characteristics

This chapter examines travel patterns using Census 2011 Journey to Work data to understand the containment and attraction, production and mode of trips for Braintree District.

## 1.1 Trip Destinations

Figure 1.1 below shows the trip destinations and containment of Braintree residents for journey to work trips as recorded in the 2011 Census.

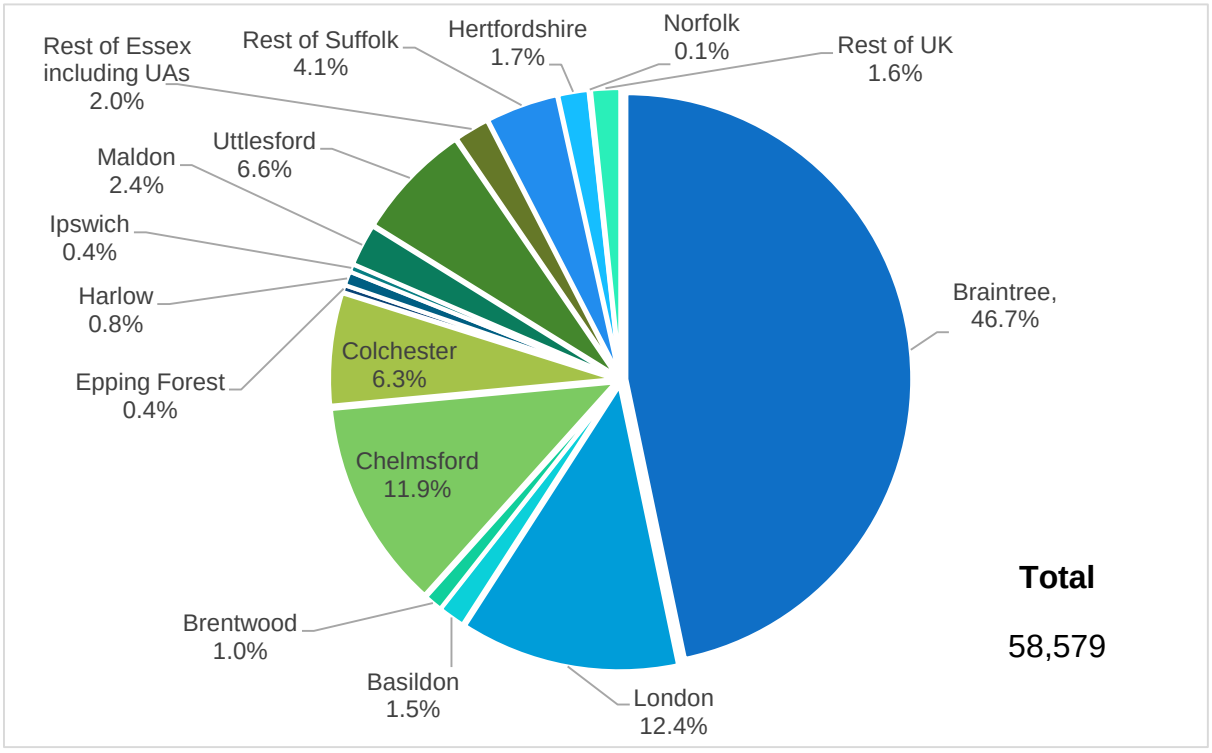


*Figure 1.1: Trips Destinations for Braintree Residents (2011 Census JTW)*

Figure 1.1 shows that 47% (26,964) of Braintree residents do not travel outside of Braintree for work. This means that over half (31,615) of Braintree residents travel outside of the District for work. The main locations for commuters are London (12%), Chelmsford (12%), Uttlesford (7%) and Colchester (6%).

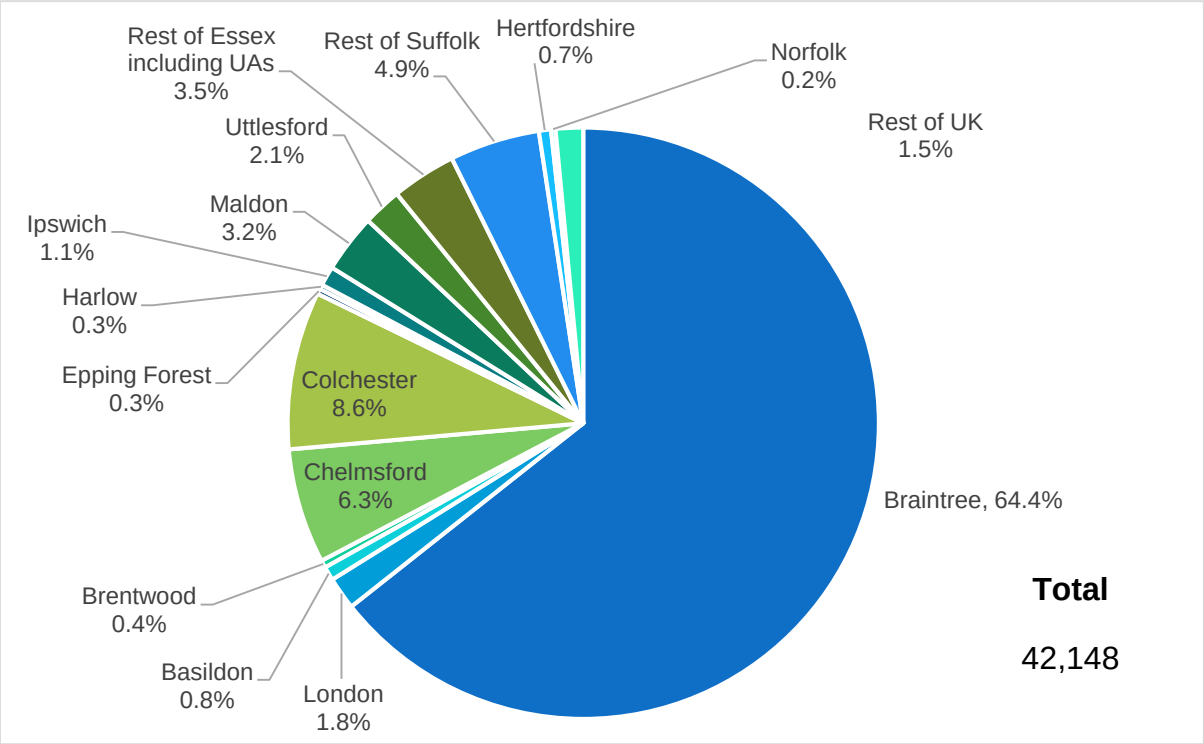


*Figure 1.2: Trips Origins for People Working in Braintree (2011 Census JTW)*

Figure 1.2 above shows the trip origins for people who work in Braintree. The highest proportion of those employed in Braintree also live in Braintree (26,964, 64%). 2011 Census journey to work statistics shows that 15,184 people commute into Braintree to work. The highest proportion of these are residents of Colchester (9%), Chelmsford (6%) and Suffolk (6% including Ipswich).

## 1.2 Mode Choice

The 2011 Census documents respondents' usual residence, the address of their workplace and the main method of travel, referred to as journey to work (JTW) trips. This, therefore, ascertains the modes and number of commuting trips between the two defined areas

Figure 1.3 below shows the modal split for residents of Braintree who travel to work.

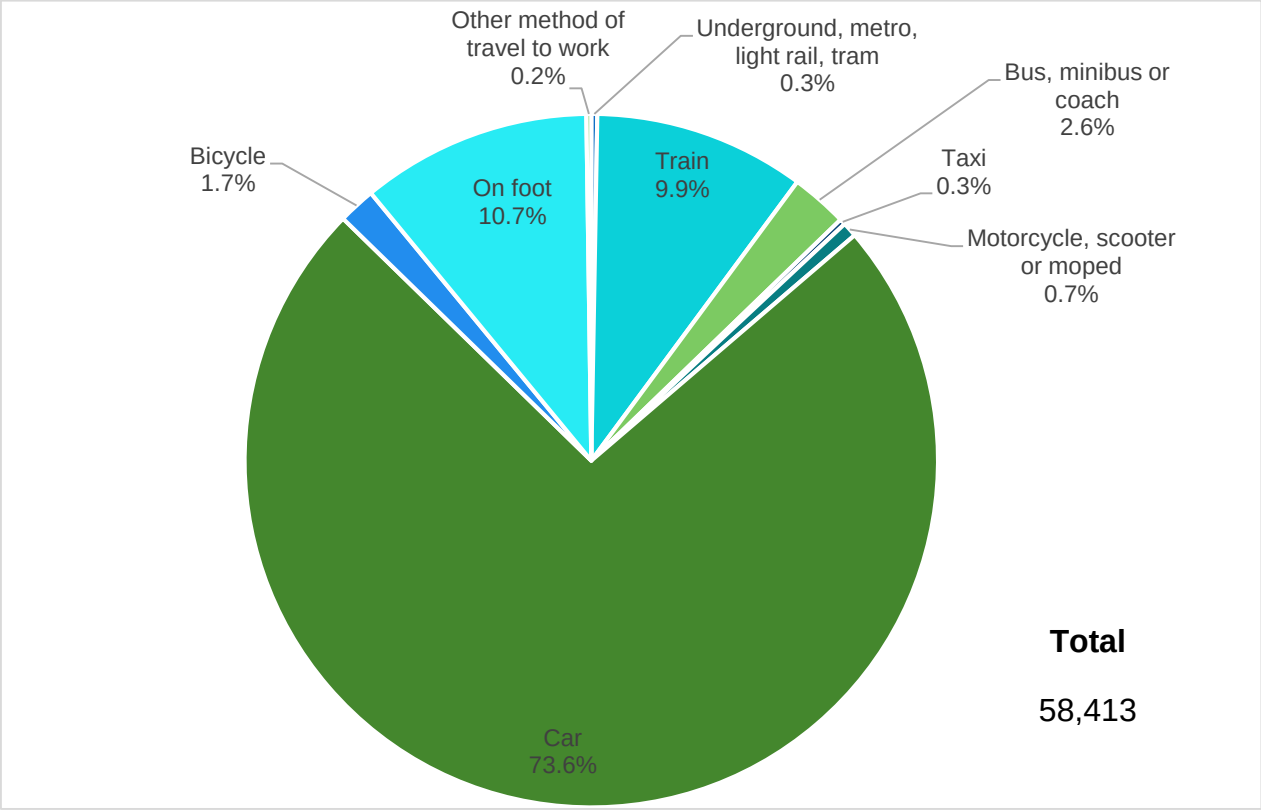


*Figure 1.3: Braintree Mode Split for People Living in Braintree (2011 Census JTW)*

Figure 1.3 shows that the majority of Braintree residents travel to work by car (77%) followed by train (17%), bus (2%) and on foot (2%).

Figure 1.4 shows the modal split of people who work in Braintree and travel to work.

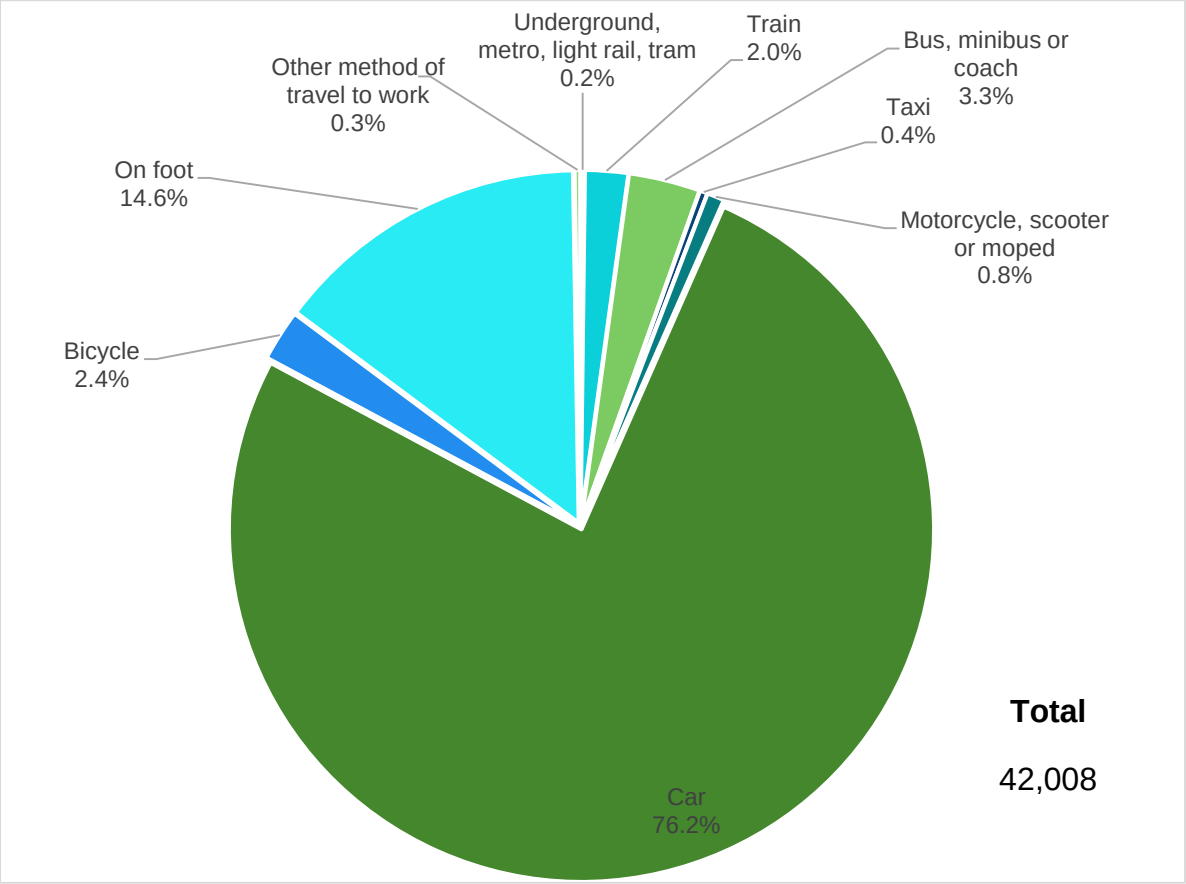


*Figure 1.4: Braintree Mode Split for People Working in Braintree (2011 Census JTW)*

Figure 1.4 shows that the majority of people who work in Braintree travel to work by car (76%), followed by on foot (15%), bus (3%), train (2%) and bicycle (2%).

## 1.3 Mode Choice by Destination

This section examines the mode choice for trips to work that are contained within Braintree and to Chelmsford, Colchester and London.

### 1.3.1 Braintree

Figure 1.5 shows the modal split for journey to work trips within Braintree.

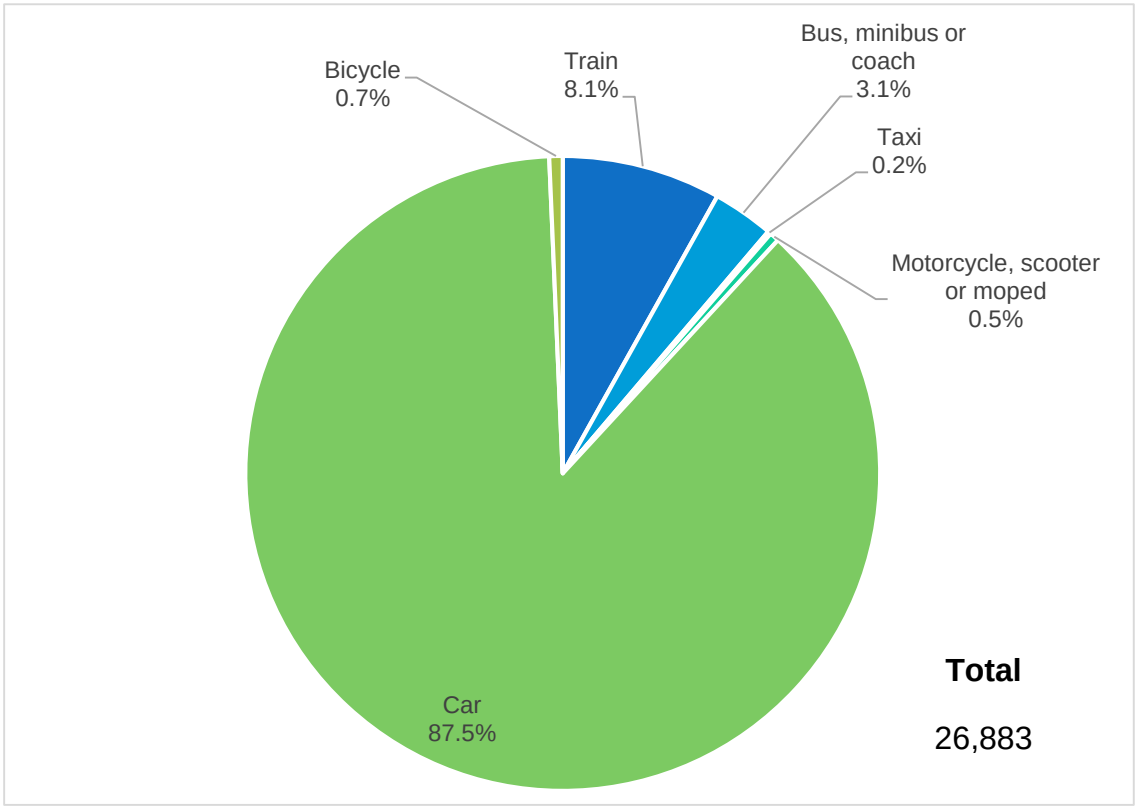


*Figure 1.5: Mode Split for Trips Contained Within Braintree (2011 Census JTW)*

Figure 1.5 shows that the majority of people who live and work in Braintree travel to work by car (69%), followed by on foot (22%), bicycle (3%) and bus (3%).

### 1.3.2 Chelmsford

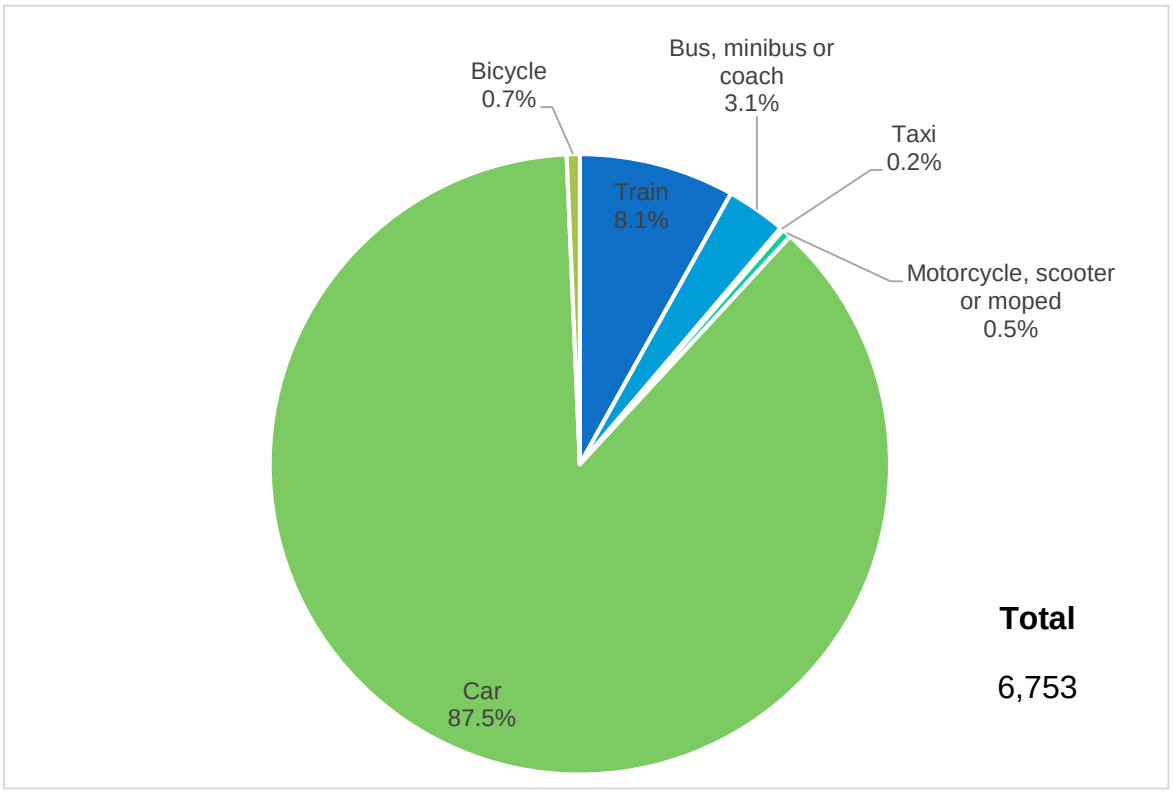


*Figure 1.6: Modal Split for Residents of Braintree Working in Chelmsford (2011 Census JTW)*

Figure 1.6 shows that 88% of people who live in Braintree and work in Chelmsford travel by car, 8% by train and 3% by bus.

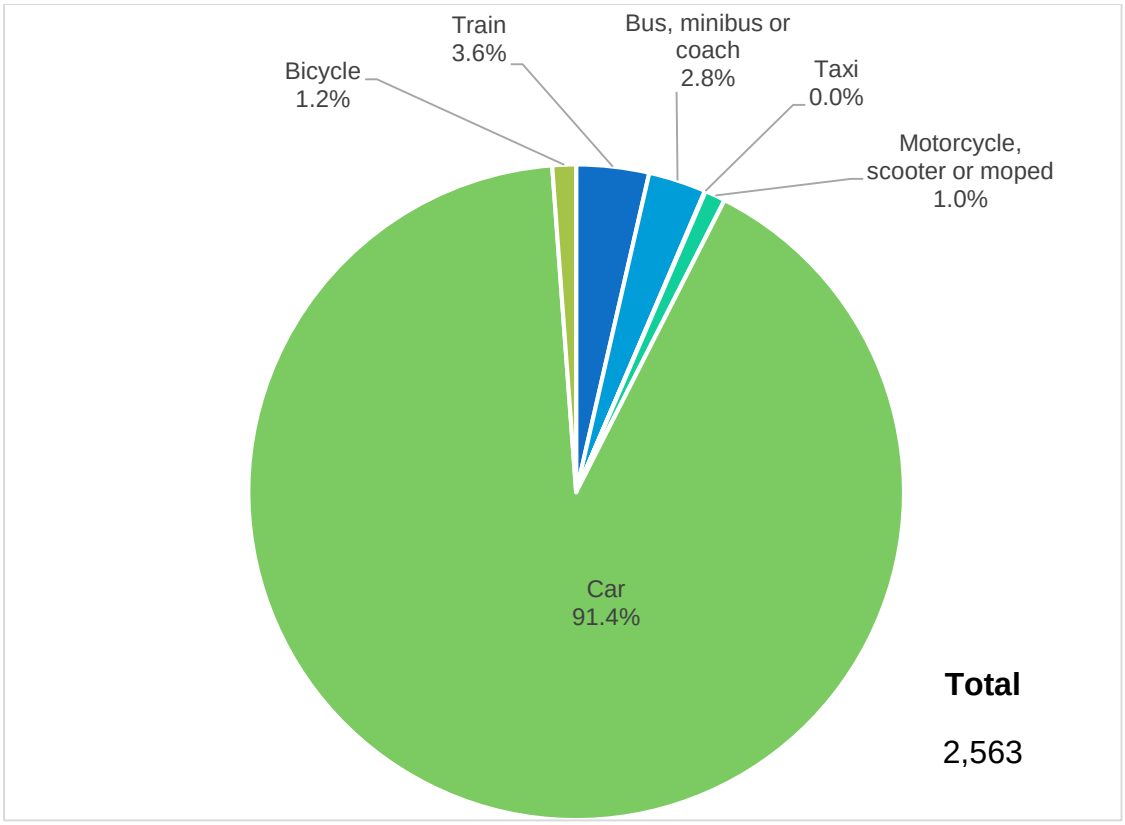


*Figure 1.7: Modal Split for Residents of Chelmsford Working in Braintree (2011 Census JTW)*

Figure 1.7 shows that 91% of people who live in Chelmsford and work in Braintree travel by car, 4% by train and 3% by bus.

### 1.3.3 Colchester

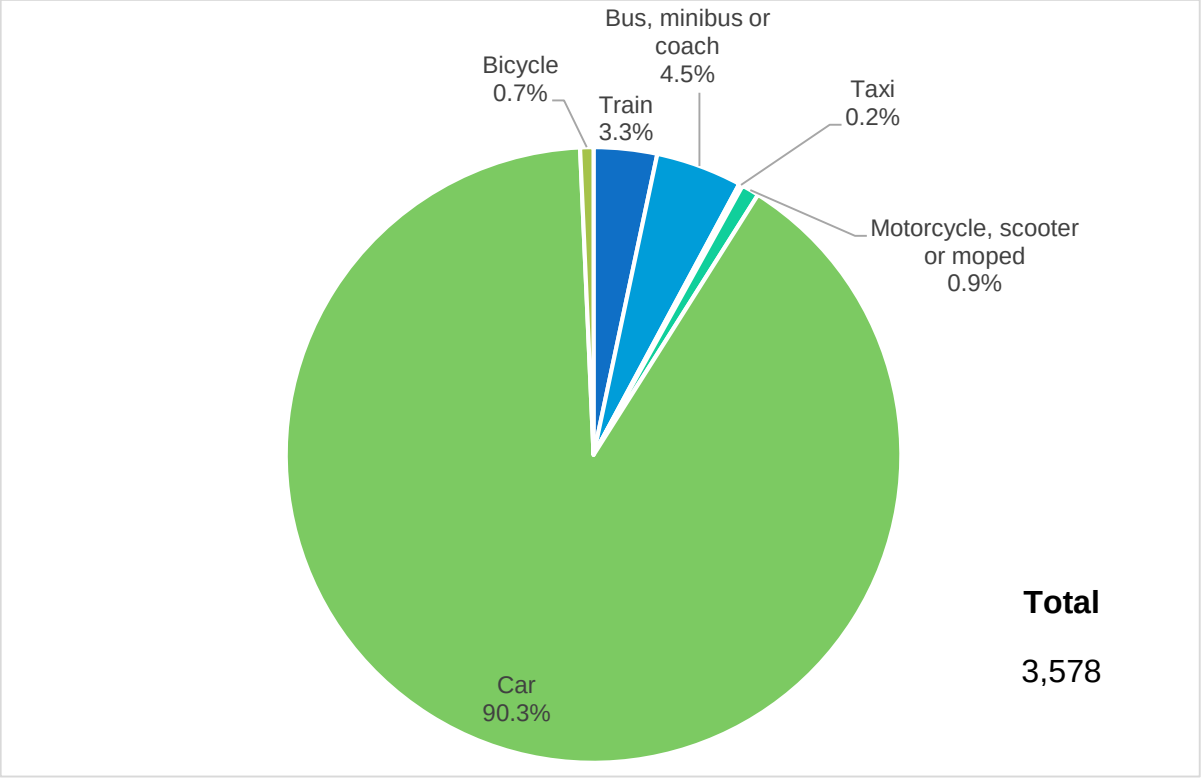


*Figure 1.8: Modal Splits for Residents of Braintree Working in Colchester (2011 Census JTW)*

Figure 1.8 shows that 90% of people who live in Braintree and work in Chelmsford travel by car, 5% by bus and 3% by train.

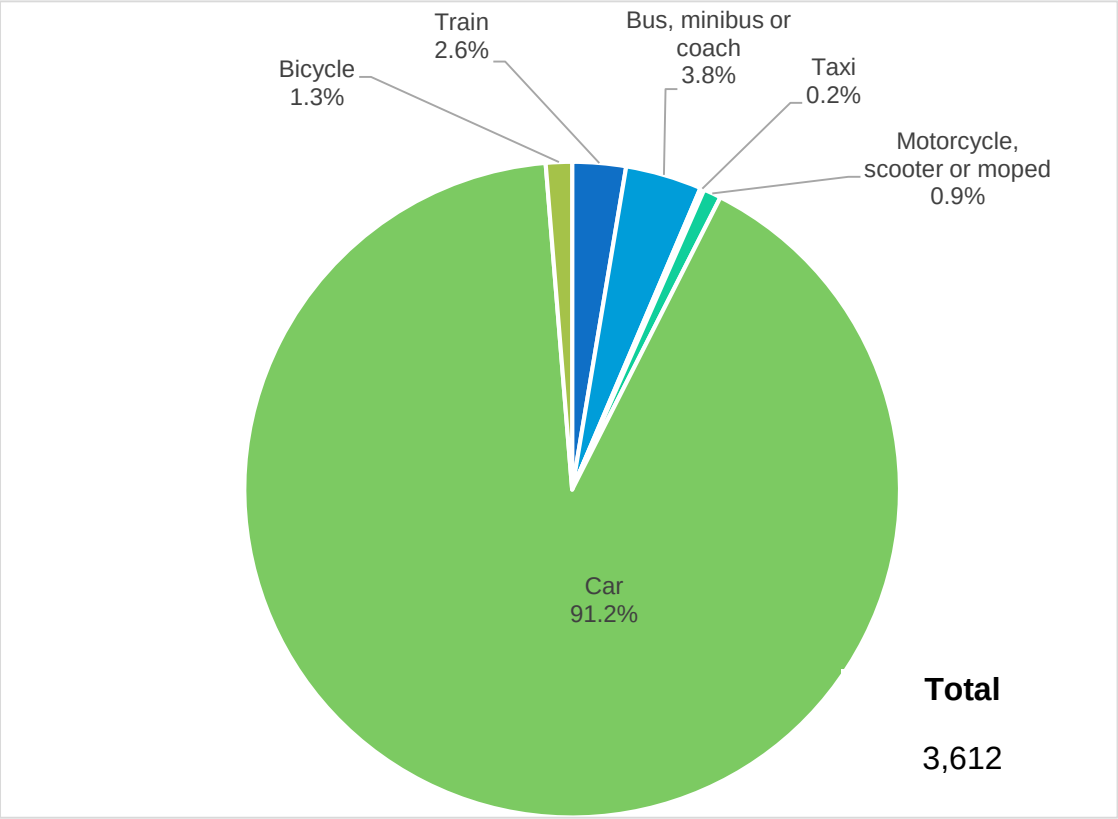


*Figure 1.9: Modal Splits for Residents of Colchester Working in Braintree (2011 Census JTW)*

Figure 1.9 shows that 91% of people who live in Colchester and work in Braintree travel by car, 4% by bus and 3% by train.

### 1.3.4 London

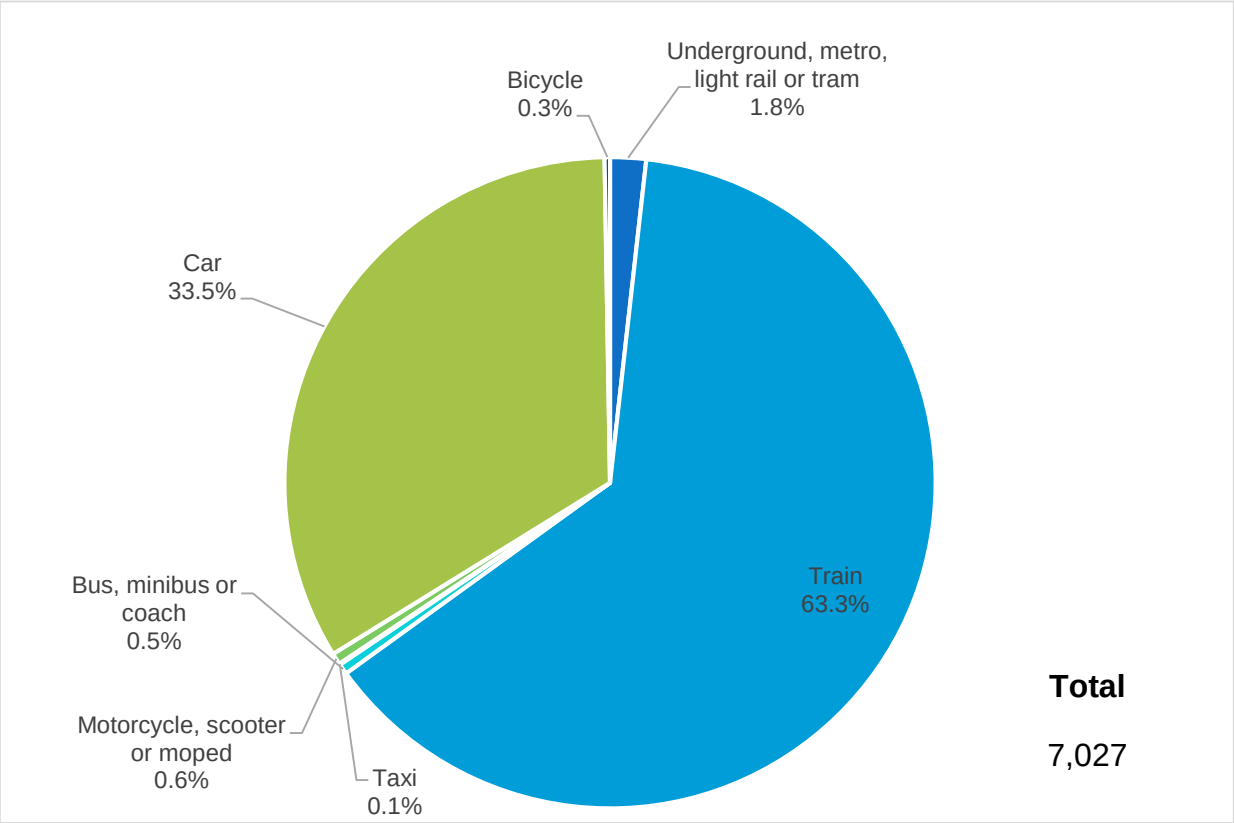


*Figure 1.10: Modal Split for Residents of Braintree Working in London (2011 Census JTW)*

Figure 1.10 shows that 63% of people who live in Braintree and work in London travel by train, 33% by car and 2% by the Underground.

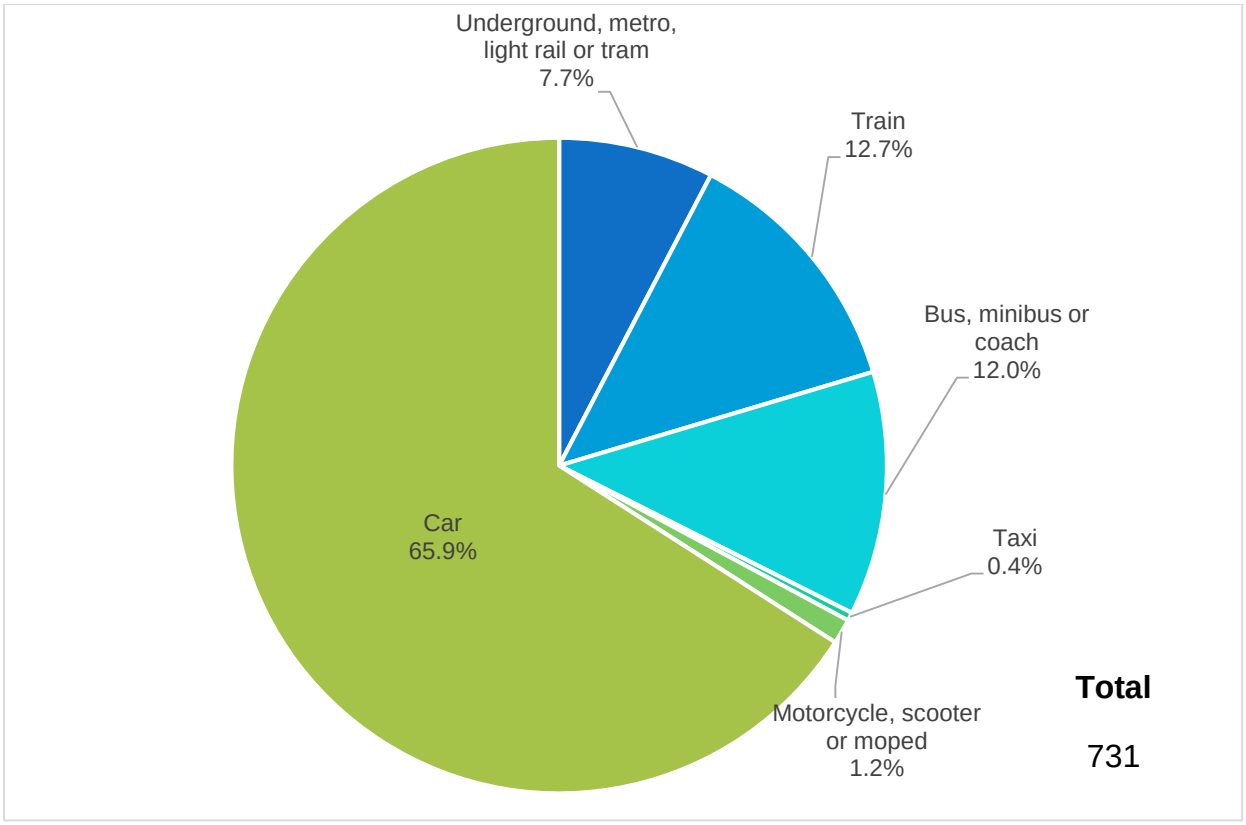


*Figure 1.11: Modal Splits for Residents of London Working in Braintree (2011 Census JTW)*

Figure 1.11 shows that of the 731 that travel from London to Braintree for work, 66% travel by car, 13% by train, 12% by bus and 8% by the Underground.