# Canterbury VISUM Model

# DRAFT Option Testing Report

December 2012

JACOBS

# Document Control Sheet

**BPP 04 F8**
Version 14 July 2012

| | | | |
|---|---|---|---|
| Project: | Canterbury VISUM | Project No: | B2508700 |
| Client: | CCC | | |
| Document Title: | DRAFT Option Testing Report | | |
| Ref. No: | v2 | | |

| | Originated by | Checked by | Reviewed by | Approved by |
|---|---|---|---|---|
| **ORIGINAL** | NAME **MN** | NAME **SM** | NAME **SS** | NAME **SS** |
| DATE | INITIALS | INITIALS | INITIALS | INITIALS |
| **31/10/12** | **Document Status: DRAFT** | | | |
| **REVISION** | NAME **MN** | NAME **LE** | NAME **SS** | NAME **SS** |
| DATE | INITIALS | INITIALS | INITIALS | INITIALS |
| **6/12/12** | **Document Status** | | | |
| **REVISION** | NAME | NAME | NAME | NAME |
| DATE | INITIALS | INITIALS | INITIALS | INITIALS |
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| | **Document Status** | | | |

# Contents

# 1 Introduction

Jacobs UK Ltd were appointed in May 2008 by Kent County Council (KCC) in association with Canterbury City Council (CCC) to develop a VISUM transport model of Canterbury City and its satellite towns to support the Local Development Framework (LDF) process. It is a 4-stage multimodal transport model developed to assess demand from car travel, commercial road vehicles, park & ride, bus and rail services. The model encompasses Canterbury District but the detailed model area is focussed on Canterbury itself **Figure 1-A**. The Highways Agency have confirmed that they consider the model appropriate for the assessment of local land use development and the impact on the strategic road network.

In 2012 Canterbury City Council commissioned Jacobs to develop forecast year models for 2026 to assist in the formulation of a development strategy. The 2026 Do-minimum scenario was established as the platform from which three alternative forecast options have subsequently been developed.

This report outlines the development of the three options and summarises the output of the models.


Study Area

Figure 1-A

# 2 Model Sectors

It is often easier to visualise the travel demand in a condensed form. Model sectors have been used to provide a better understanding of the travel demand and impact of development across the Canterbury District.

The 221 model zones have been grouped to 20 sectors which are arranged to represent broadly the urban area of Canterbury, the wider Canterbury District and the rest of Kent / Britain. The sectors are listed in **Table 2-A** and shown in **Figure 2-A**.

| Sector | Description | |
|---|---|---|
| 1 | Canterbury Centre | Canterbury urban area |
| 2 | Wincheap and Thanington | Canterbury urban area |
| 3 | S Canterbury | Canterbury urban area |
| 4 | E Canterbury | Canterbury urban area |
| 5 | Sturry Road | Canterbury urban area |
| 6 | Hale Place | Canterbury urban area |
| 7 | St Stephen's / University | Canterbury urban area |
| 8 | St Dunstan's / Harbledown | Canterbury urban area |
| 9 | Sturry / Hersden | Wider Canterbury District |
| 10 | Chartham / Petham | Wider Canterbury District |
| 11 | Bridge / Barham | Wider Canterbury District |
| 12 | Littlebourne / Bekesbourne | Wider Canterbury District |
| 13 | Broad Oak / Hoath | Wider Canterbury District |
| 14 | Blean | Wider Canterbury District |
| 15 | Whitstable | Wider Canterbury District |
| 16 | Herne Bay | Wider Canterbury District |
| 17 | Thanet / Dover / East Kent | Kent / Britain |
| 18 | Folkestone / Ashford / S Kent / Sussex | Kent / Britain |
| 19 | W Kent / Medway / London | Kent / Britain |
| 20 | UK | Kent / Britain |

***Table 2-A Canterbury Sectors***

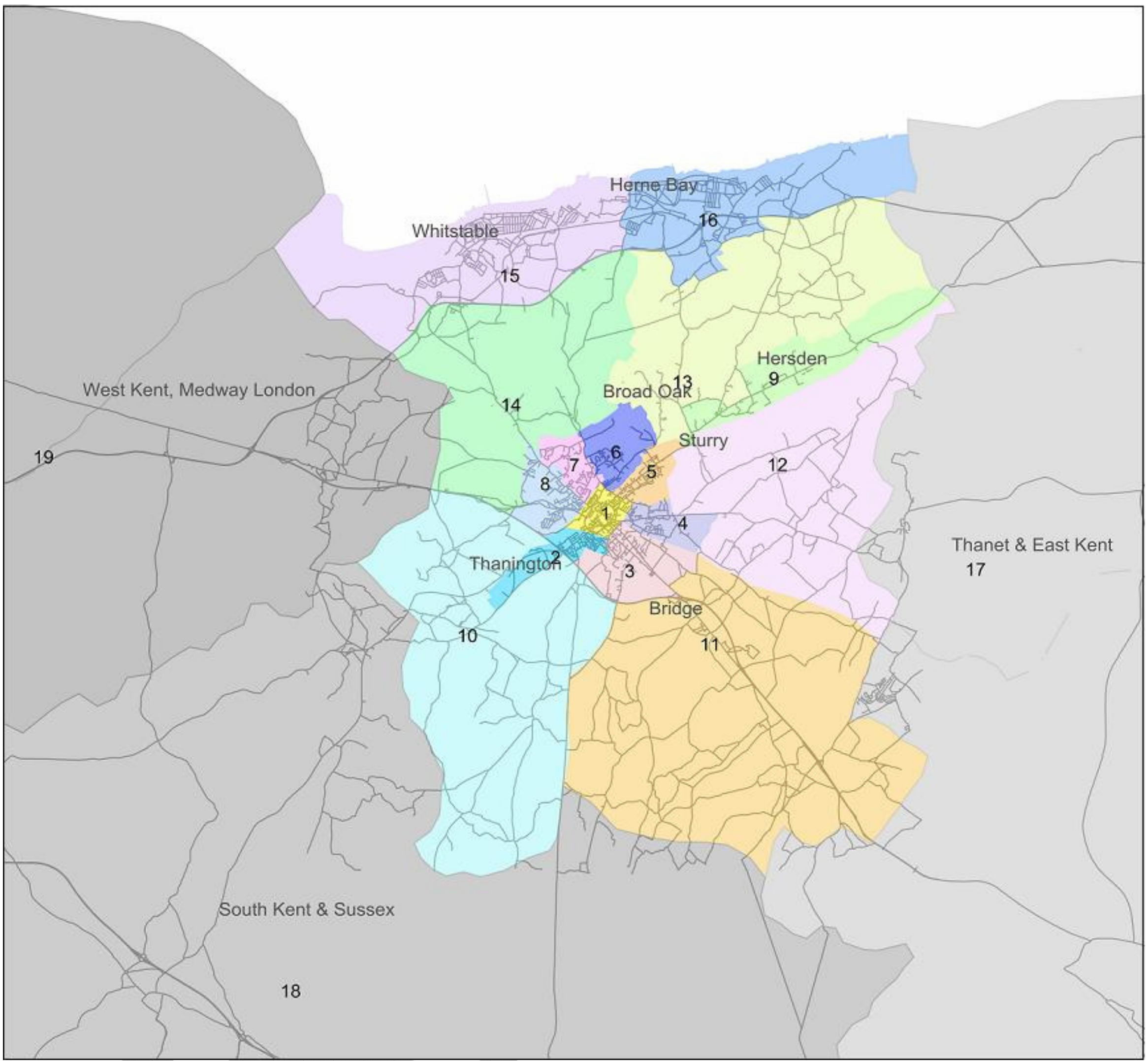



*Figure 2-A Canterbury Sectors*

# 3 Modelled Scenarios

The three modelled scenarios have been developed based on the 2026 Do Minimum models for the AM and PM peaks. The three scenarios include development in and around the city and the coastal towns in differing proportions. The options modelled are as follows:

**Option 1** includes residential development primarily in and around Canterbury and the Herne Bay area. Option 1 has the higher allocation of commercial development which is also focussed in the same areas.

**Option 2** has the lowest allocation of residential units more of which are located in the coastal areas and on the A28 corridor around Sturry and Hersden. Commercial development is located near Herne Bay, Sturry and Hersden.

**Option 3** includes a significant amount of residential development in the Canterbury area together with a more dispersed distribution across the district. Option 3 has the lowest commercial development which has a similar distribution to Option 2.

## 3.1 Development Assumptions

The development assumptions provided for the three options were processed and allocated to appropriate model zones. The total quantum of residential, commercial and retail development incorporated in each option is summarised in **Table 3-A**.

| Land Use | Option 1 | Option 2 | Option 3 |
|---|---|---|---|
| Housing (units) | 12,570 | 11,991 | 12,090 |
| Business (sqm) | 125,000 | 119,500 | 99,500 |
| Retail (sqm) | 43500 | 42100 | 42100 |

***Table 3-A Summary of Land-use Assumptions for Options 1, 2 and 3***

In addition to the development allocations, gains from expected windfall developments were included. These were distributed among residential and mixed use zones in the Canterbury urban area and weighted by the existing numbers of household units per zone.

## 3.2 Housing

The composition of housing for all development is assumed to be as follows:

| | |
|---|---|
| 1 bedroom flat | 15% |
| 2 bedroom flat | 15% |
| 2 bedroom house | 30% |
| 3 bedroom house | 30% |
| 4+ bedroom house | 10% |

**Figure 3-A** shows the distribution of new housing across the district for each option by sector. The housing allocation for Option 1 is focussed on the south of Canterbury and Herne Bay. For Option 2 the housing is distributed between Whitstable, Herne Bay, Broad Oak and Hersden and Option 3 is characterised by a more dispersed allocation.

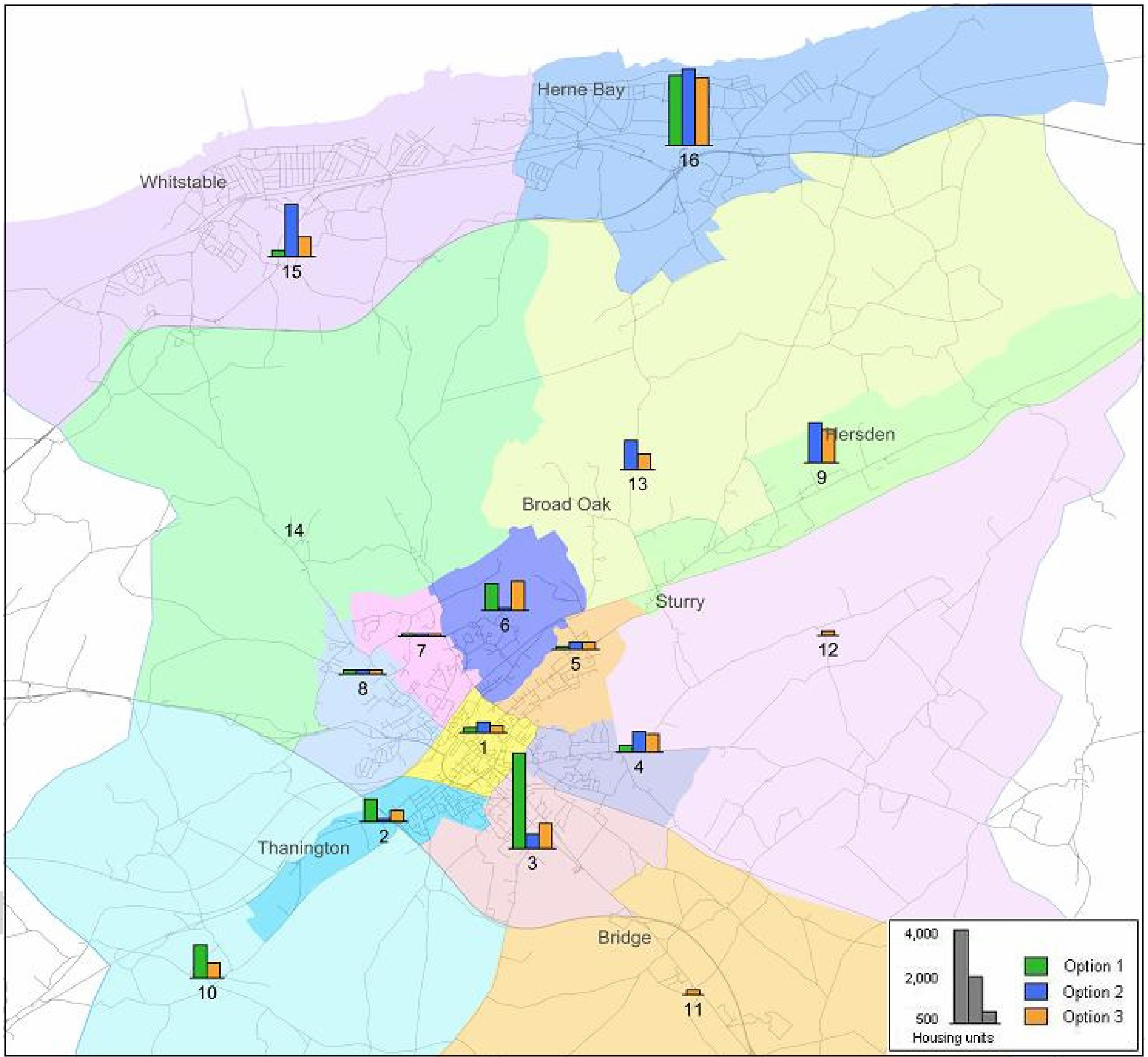



*Figure 3-A Housing Allocation*

### 3.2.1 Commercial Development

Commercial development had been assumed to be primarily a standard mix of B1 uses with a small proportion of B8 use and 'sui generis' uses such as car showrooms. The business development was split with 90% allocated to B1 use and 10% allocated to B8 use.

The distribution of commercial development by sector is illustrated in **Figure 3-B** , which indicates that Option 1 has the highest level of commercial development, located primarily near to the city but also at Herne Bay (sector 6). Options 2 and 3 have lower overall levels of commercial development, focussed on the Herne Bay sector 6 and Hersden sector 9.

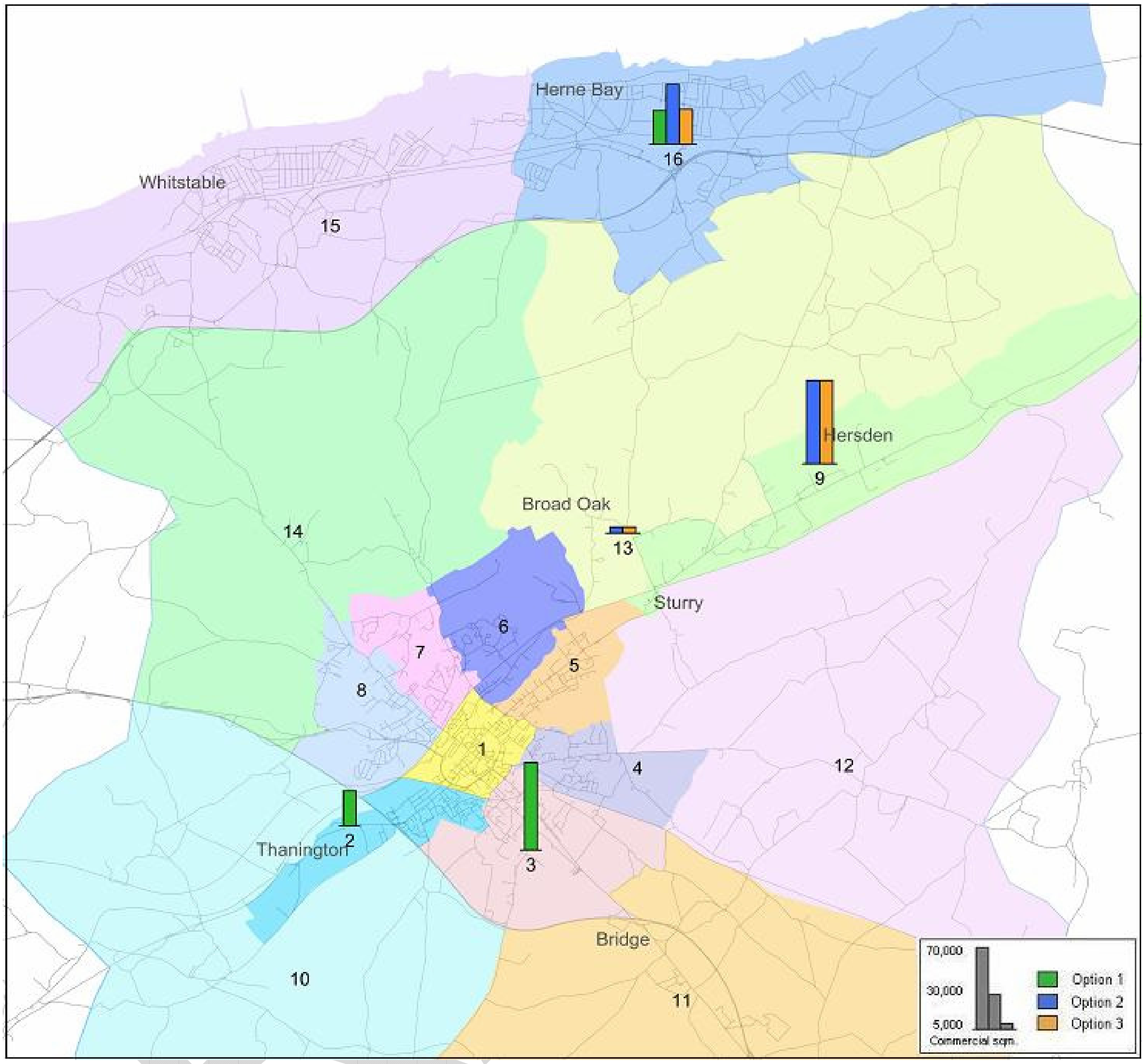



***Figure 3-B Commercial Land Use Allocation***

### 3.2.2 Other Development

Retail development in all three options is primarily located in sector 2 which includes Wincheap and Thanington zones. There is a smaller element of retail development in the Whitstable and Herne Bay areas (Error! Reference source not found.)

Option 1 also includes a 4 form primary school and a 3 doctor GP Surgery. The primary school was assumed to be a single form entry school with around 120 pupils. The 3 doctor GP surgery was assumed to have a gross floor area of 500sqm.

The land use assumptions built in to the model for each option are listed in **Appendix A**. The model zones to which residential and commercial developments were allocated for each option are shown in **Appendix B**.

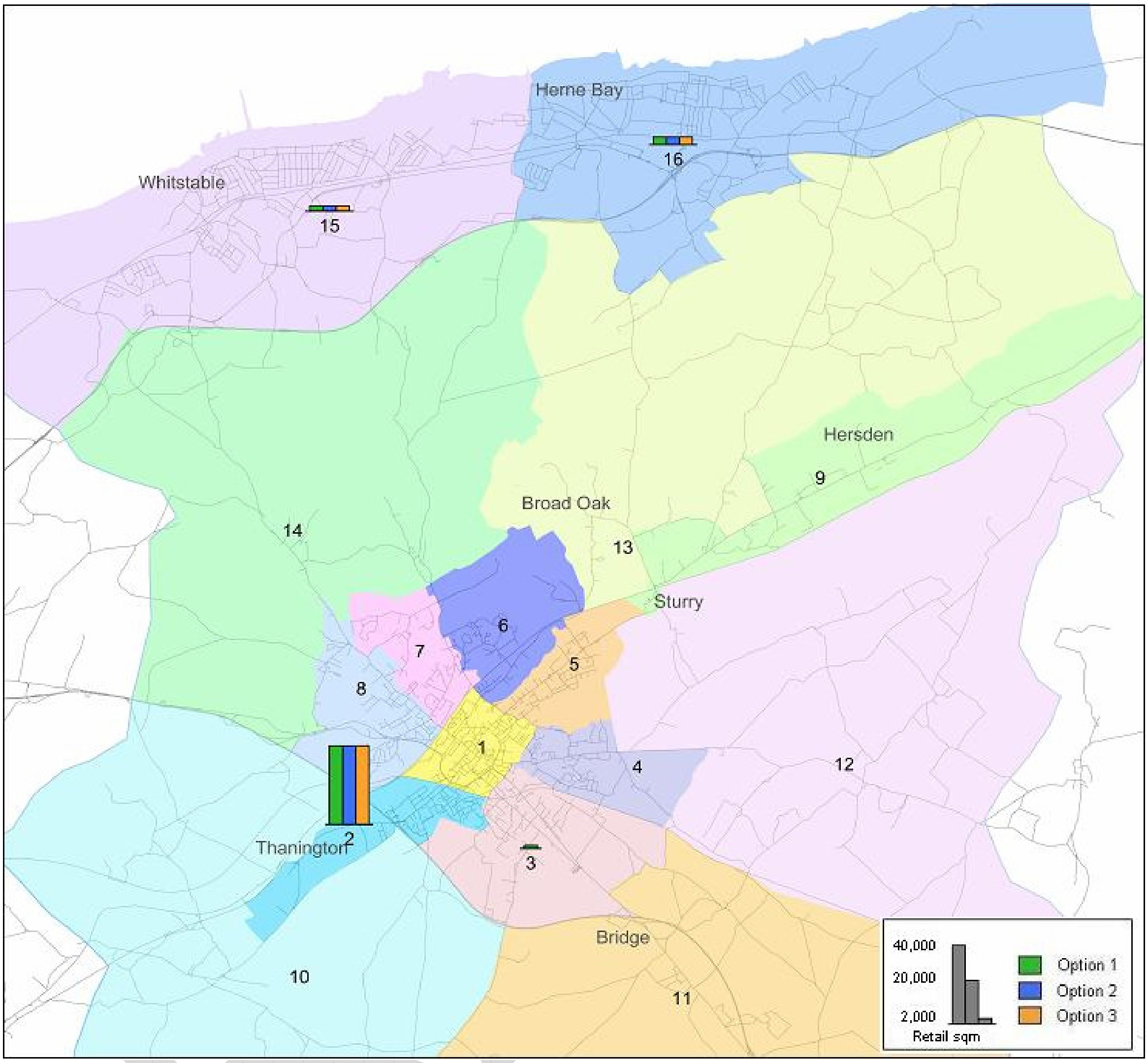



***Figure 3-C Retail Land Use Allocation***

## 3.3 Infrastructure

A number of infrastructure changes were identified with selected development locations and these are summarised in **Table 3-B** below and their general location identified in **Appendix A**. The highway changes which were specifically incorporated within the model are numbered 1 to 6. The remainder (7 to 9) were accommodated within the existing model network.

| ID | Highway Measures | Option 1 | Option 2 | Option 3 |
|---|---|---|---|---|
| 3,6 | Improved access at selected locations | ✓ | ✓ | ✓ |
| 2 | Roundabout on A2990 | ✓ | ✓ | ✓ |
| 1 | Herne Bypass | ✓ | ✓ | ✓ |
| 5 | A2 junction at Bridge | ✓ | | |
| 4 | A2 southbound off slip to Wincheap | ✓ | | |
| 4 | A28 / Ten Perch Road junction | ✓ | | |
| 7 | Junction on B2205 Whitstable Road | | ✓ | |
| 8 | Junction provision on the A28 | | ✓ | ✓ |
| 9 | Junction on Thornden Wood Road | ✓ | ✓ | ✓ |
| | **Public Transport Measures** | **Option 1** | **Option 2** | **Option 3** |
| | Express bus service | | ✓ | |
| | Extended bus route | ✓ | ✓ | ✓ |
| | New bus service | ✓ | | |
| | Increase bus frequency | ✓ | ✓ | ✓ |

***Table 3-B Highway and Public Transport Infrastructure Modifications***

All three options include a new Herne Bypass link, improved access to certain development locations, a new roundabout on the A2990, a new junction with Thornden Wood Road, increased bus frequencies and extended or modified bus routes to serve developments where feasible. The rerouting of the A28 through the Wincheap Industrial Estate was included in the Do Minimum model and is also included in the three options.

Option 1 includes a southbound off slip from the A2 to the A28 at Wincheap, together with a new junction arrangement with Ten Perch Road, and a replacement junction with the A2 near Bridge.

Option 2 includes an express bus service on the A28 corridor to the city centre and a new bus link to Thanington development with a bus service to the city centre is included in Option 1.

The Herne Bypass, A2 junction at Bridge, A2 off slip at Wincheap and reconfiguration of the A28 route from Thanington through the Wincheap industrial estate are all based on broad concepts with very limited detail available. Modifications made to the network to accommodate these changes included assumptions about link and junction capacity that were considered necessary to provide a reasonable functioning network.



***Key points***

- *Overall development input for all options of a similar order of magnitude*
- *Option 1 has largest number of houses and business sqm*
- *Option 2 had the smallest number of houses*
- *Option 3 has lowest commercial sqm*

# 4 Travel Demand

The estimated travel demand which is generated for each option has been built on to the existing 2026 Do Minimum models, using the same trip generation assumptions as far as possible. The total travel demand for highway and public transport trips for each option is summarised in **Table 4-A** below. Walking and cycling trips are not modelled. The travel demand generated for each option takes no account at this stage of potential sustainable travel initiatives which may be supported by future policy decisions.

| | Do Minimum | Option 1 | Option 2 | Option 3 |
|---|---|---|---|---|
| AM Peak | 44400 | 50100 | 49900 | 49900 |
| PM Peak | 43200 | 49700 | 49400 | 49500 |

***Table 4-A Total Highway and Public Transport Travel Demand (person trips)***

The total travel demand for the three options ranges from 49,400 to 50,100 person trips per hour. The additional development accounts for an increase of 12 to 15% in person trips over the Do Minimum (**Table 4-B**). The AM peak has a higher number of person trips than the PM peak and Option 1, with the highest development allocation, has the highest level of total travel demand.

| | Do Minimum | Option 1 | Option 2 | Option 3 |
|---|---|---|---|---|
| AM Peak | | 13% | 12% | 12% |
| PM Peak | | 15% | 14% | 15% |

***Table 4-B Increase in Total Travel Demand over Do Minimum (person trips)***

## 4.1 Travel Demand by Sector

In order to fully understand the highway issues and public transport use it is important to have an appreciation of where trips are being generated (origins) and where they are being attracted to (destinations). To make this easier the travel demand has been analysed by sector and the sectors used are listed in **Table 2-A** and shown in **Figure 2-A**.

### 4.1.1 Development Trips

In all three options the development included has contributed significantly to the total forecast demand, with the emphasis on different locations. **Figure 4-A** and **Figure 4-B** below show the origin and destinations of the additional trips generated by development in the AM peak for each option. The increase in travel demand for Option 1 is largely focussed on Wincheap/Thanington, south Canterbury and Herne Bay (sectors 2, 3 and 16) and for Option 2 on Sturry / Hersden, Broad Oak, Whitstable and Herne Bay (sectors 9, 13, 15 and 16). Option 3 has a broader impact over a larger number of sectors.

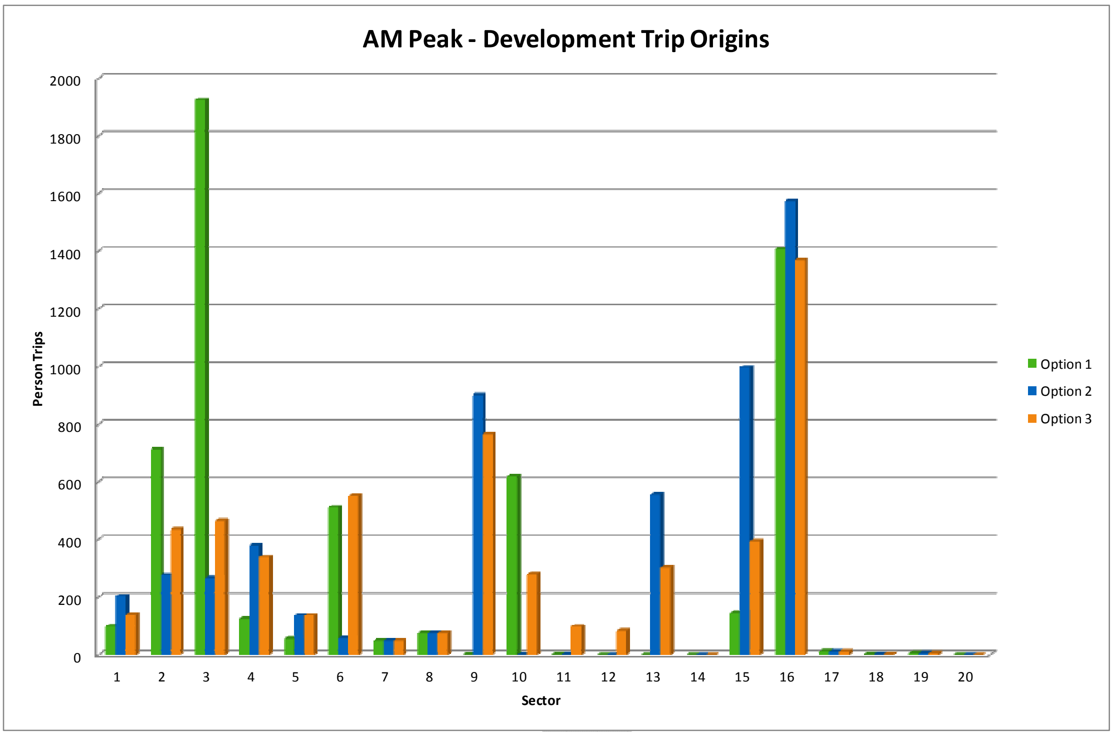



*Figure 4-A Development Trip - Origins*

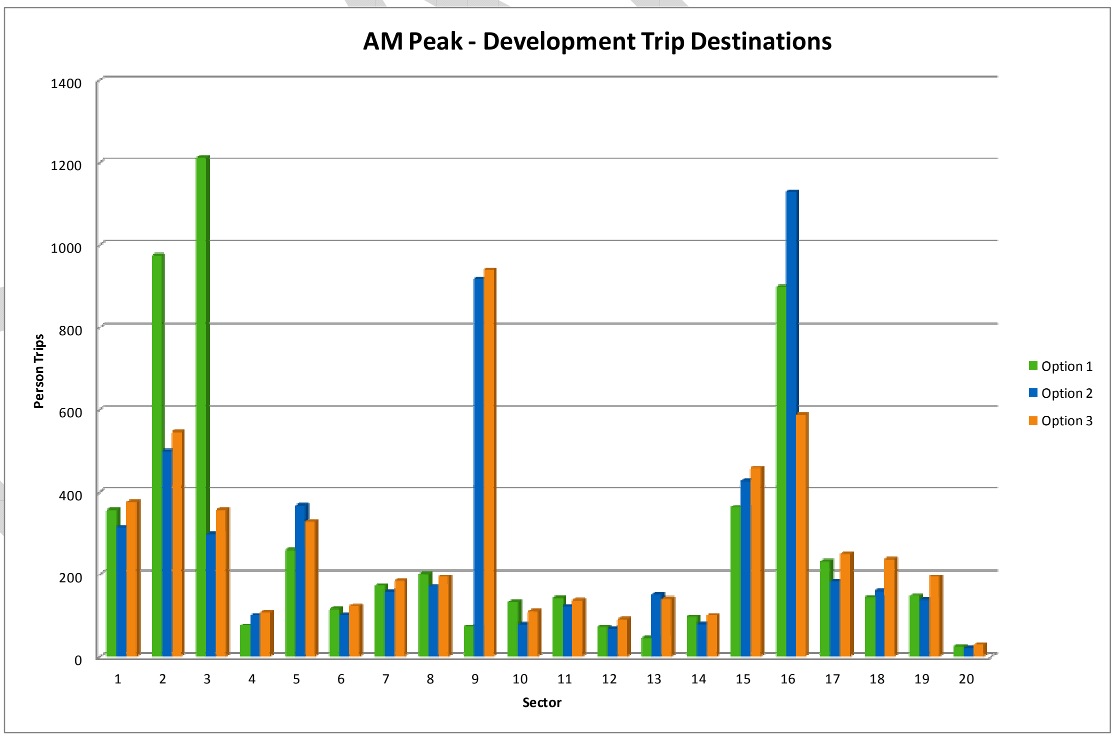



*Figure 4-B Development Trip - Destinations*

### 4.1.2 Pattern of Travel Demand

The pattern of travel demand is a function of the nature of the journey and time of day. The PM peak has a different basic composition to the AM peak, including for example a larger proportion of shopping and other trips and few school and work trips.

Business development attracts a higher proportion of trips than it generates in the AM peak and this pattern is reversed in the PM peak. This is illustrated in **Table 4-C** below where, for Option 1 development at Thanington, there is a significant attraction of business trips in the AM peak, accounting for over 65% of all arrivals. The business trip departures amount to around 6% in the AM peak. The PM peak has a more evenly balanced pattern of arrivals and departures for all development but a high proportion of departures for business development.

A similar pattern is indicated for development at Strode Farm in Option 2 where business trips account for 63% of arrivals in the AM peak and 39% of departures in the PM peak.

The development at Thanington contributes to the congestion on the A28 Wincheap corridor through outbound trips to destinations across the district, generated by housing, and inbound trips attracted to business in the AM peak.

| | AM Peak | | PM Peak | |
|---|---|---|---|---|
| **Option 1 - Thanington** | **Departures** | **Arrivals** | **Departures** | **Arrivals** |
| Thanington – all development (28,000sqm business and 2500 housing units | 1095 | 519 | 825 | 968 |
| Thanington business development (28,000sqm) | 61 | 339 | 309 | 60 |
| Proportion of trip for business | 6% | 65% | 37% | 6% |
| | **AM Peak** | | **PM Peak** | |
| **Option 2 – Strode Farm** | **Departures** | **Arrivals** | **Departures** | **Arrivals** |
| Strode Farm – all development (18,000sqm business and 800 housing units) | 369 | 253 | 369 | 370 |
| Strode Farm business development (18,000 sqm) | 28 | 159 | 143 | 28 |
| Proportion of trip for business | 8% | 63% | 39% | 8% |

***Table 4-C Thanington and Strode Farm Development Trips***

### 4.1.3 Total Travel Demand

The total travel demand is the net result of Do Minimum trips and those generated by or attracted to new development. The distribution of total travel demand by sector for each option is shown in **Figure 4-C** to **Figure 4-F** below. The AM and PM peak periods have different patterns of trip generation and destination. Canterbury urban area (sectors 1 to 8) attracts more trips in the AM peak and generates more trips in the PM peak. Whitstable and Herne Bay (sectors 15 and 16) generate and attract a significant proportion of trips in both peak periods.

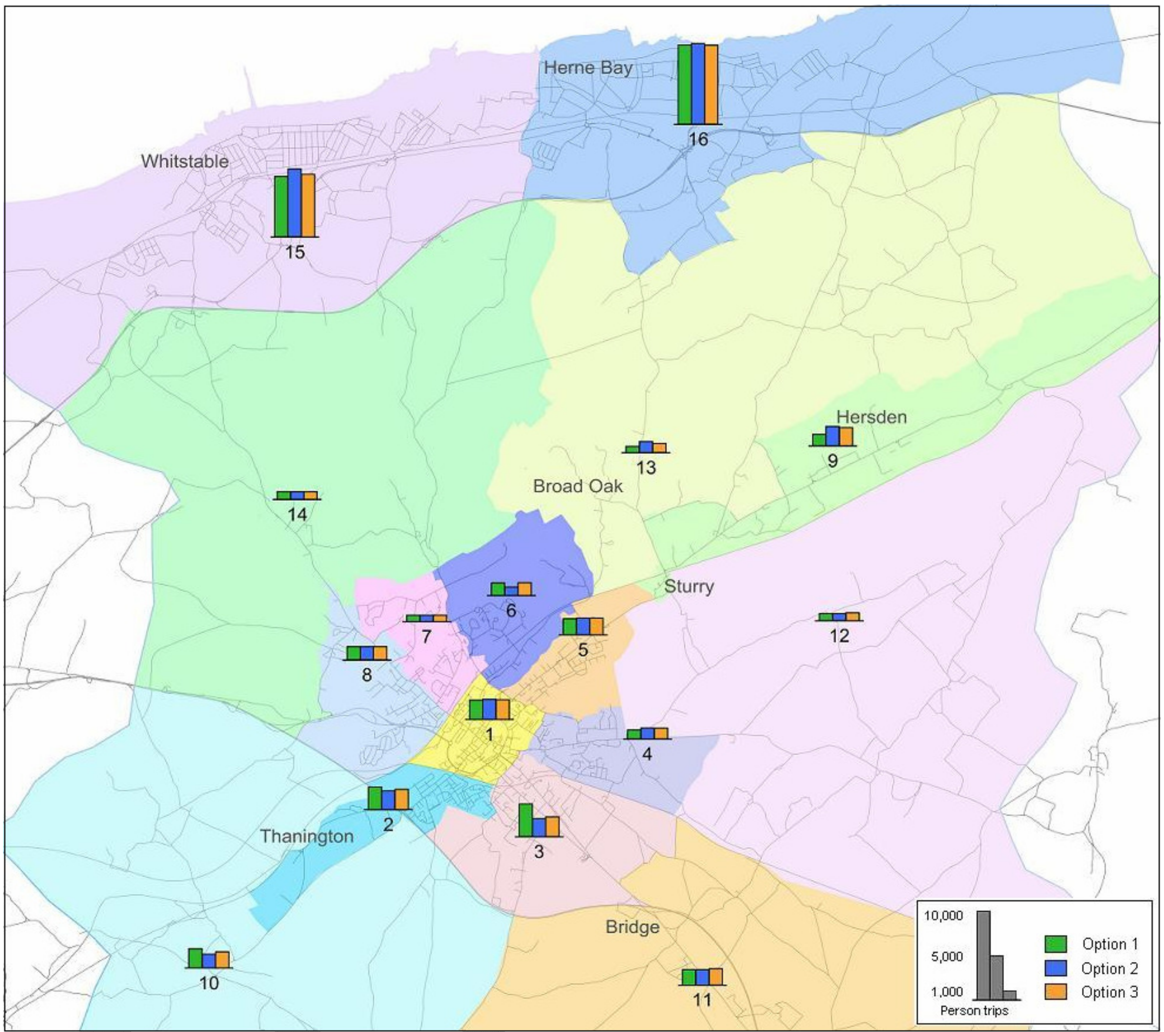



*Figure 4-C AM Peak – Trip Origins by Sector*

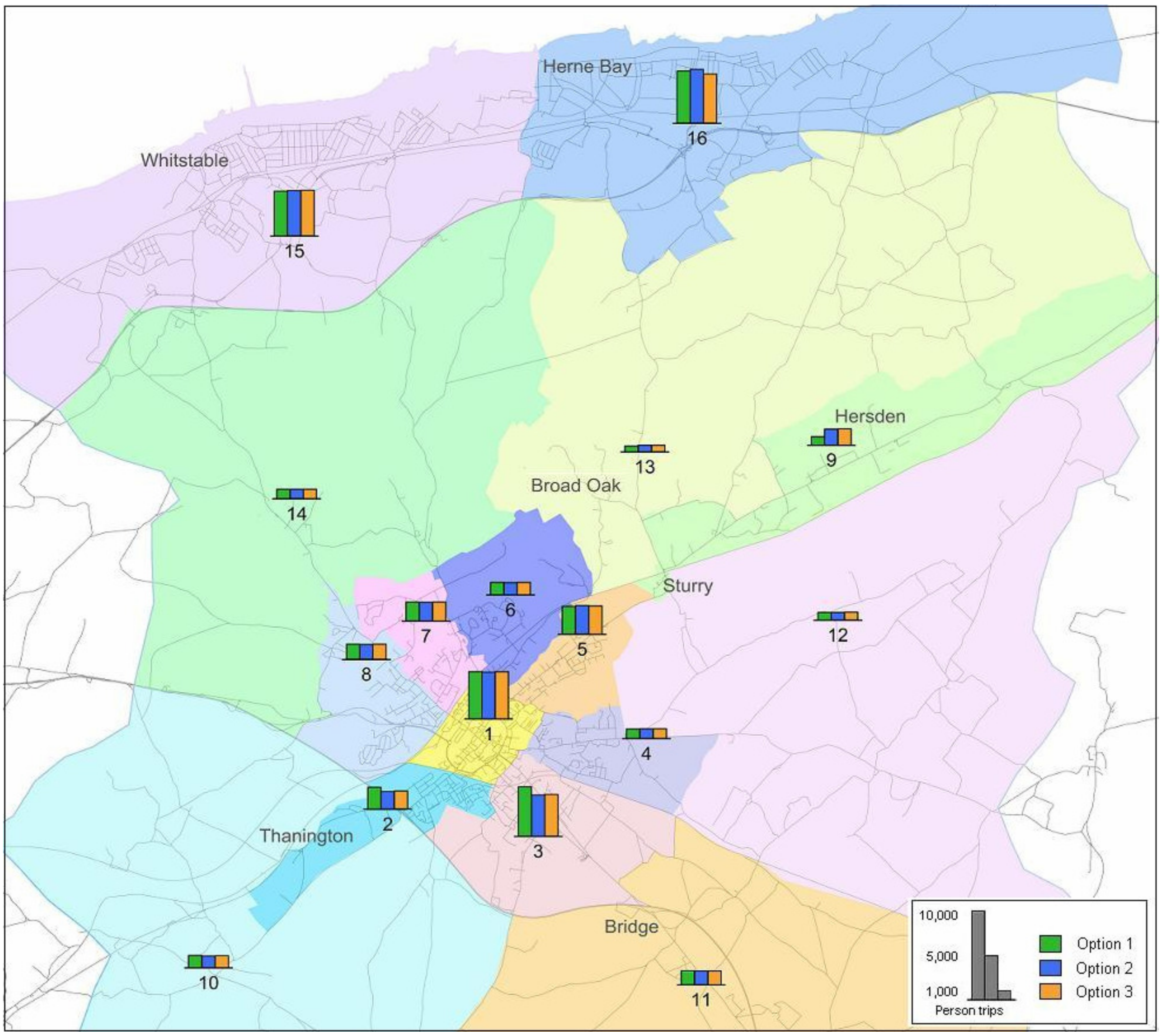



***Figure 4-D AM Peak – Trips Destinations by Sector***

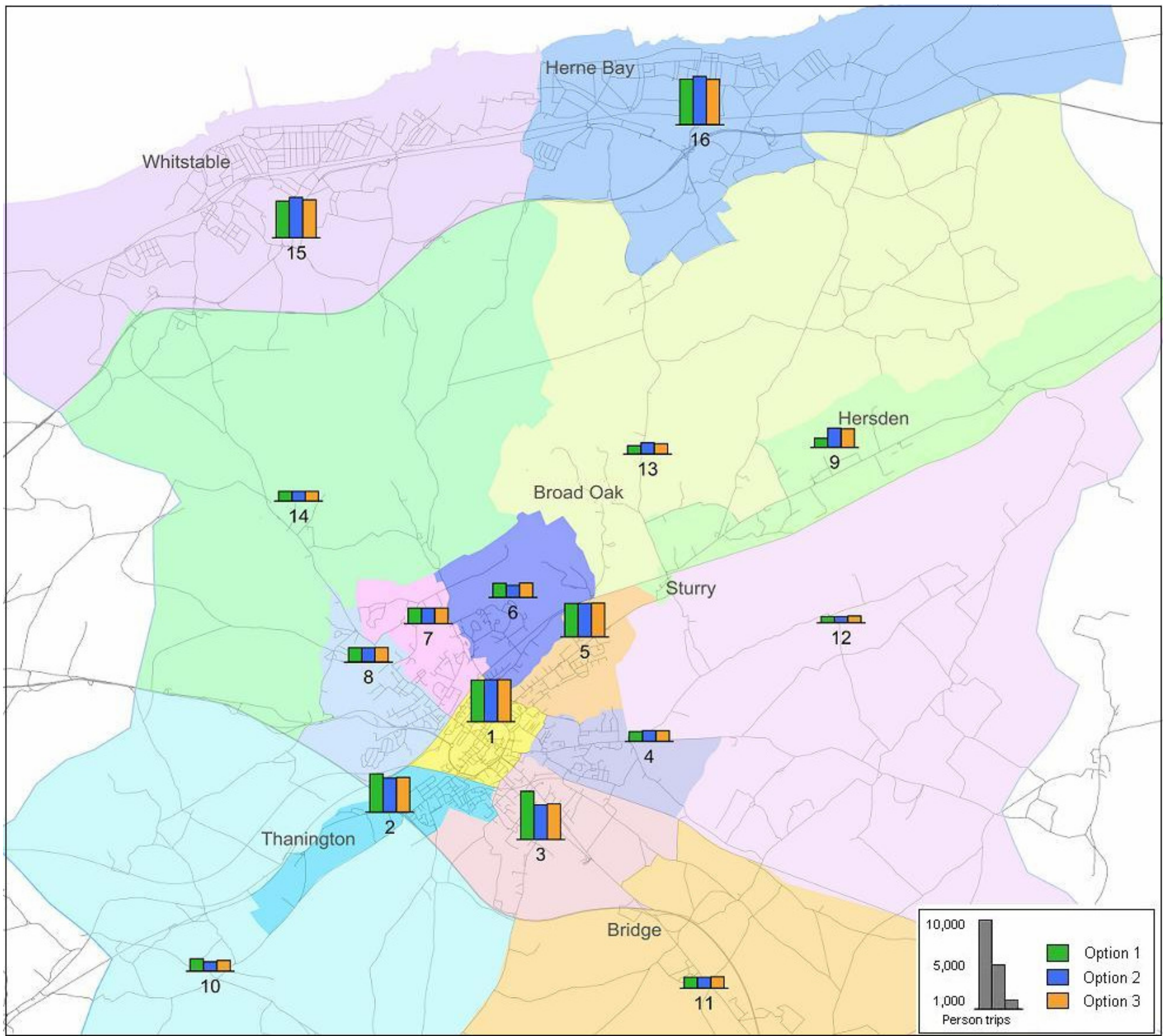



***Figure 4-E  PM Peak – Trip Origins by Sector***

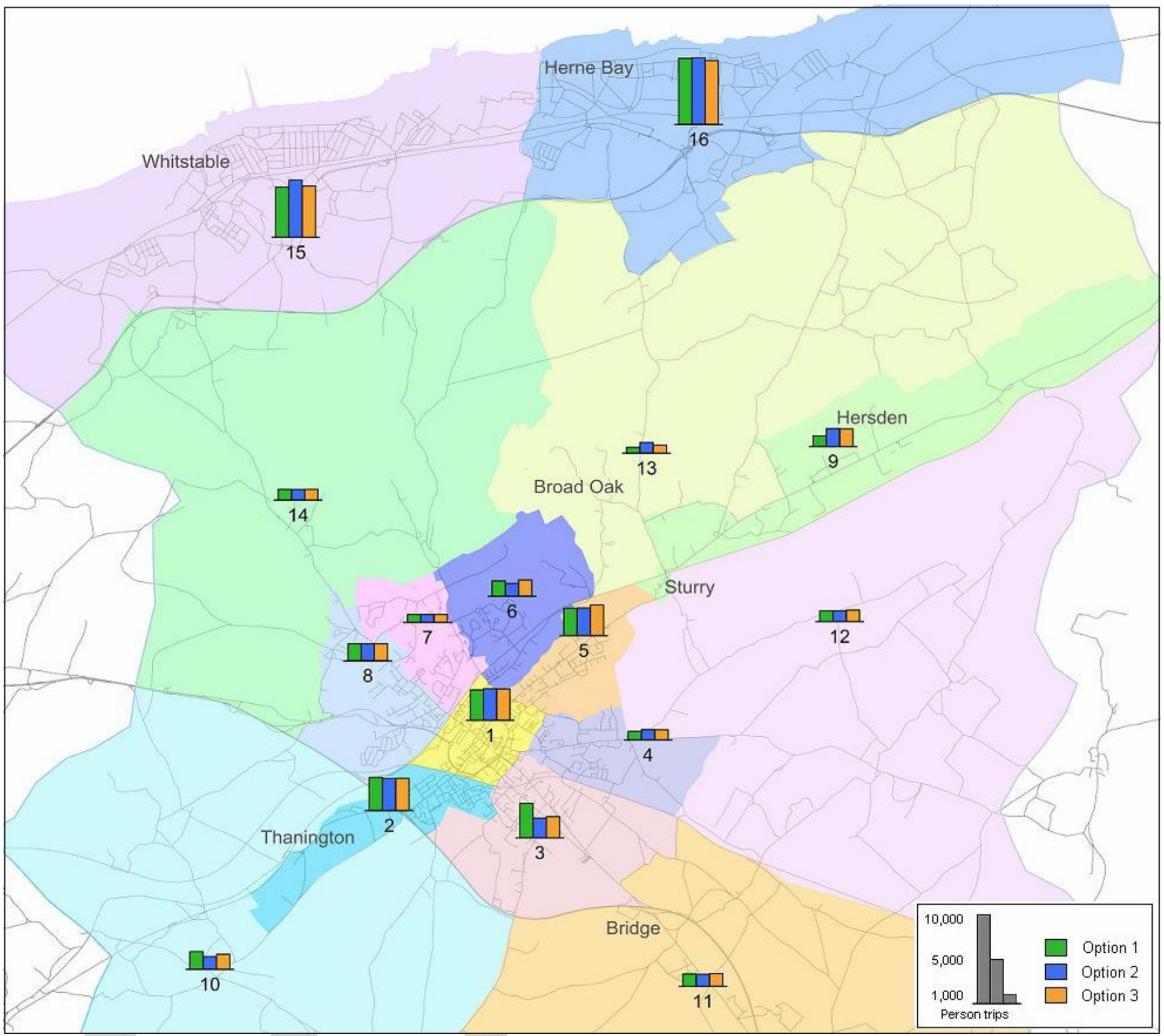



***Figure 4-F PM Peak – Trip Destinations by Sector***

Of the total travel demand for all three options, around 58% of the trips start and end within the Canterbury District (sectors 1 to 16) and 15% to 16% of trips occur between the coastal towns.

### 4.1.4 Canterbury City Area Travel Demand

Travel demand to and from the urban area of Canterbury City (sectors 1 to 8) account for up to 61% of the total travel demand. **Table 4-D** indicates the source of AM peak trips to and from the Canterbury City sectors for each option.

| Source of Travel Demand (sector) | Option 1 | Option 2 | Option 3 |
|---|---|---|---|
| Canterbury City area (1 to 8) | 24% | 19% | 21% |
| Canterbury District (excluding coastal towns) (9 to 14) | 20% | 21% | 21% |
| Whitstable and Herne Bay (15 to 16) | 17% | 17% | 16% |
| East Kent & Thanet (17) | 17% | 15% | 16% |
| South Kent & Sussex (18) | 10% | 10% | 10% |
| West Kent & Medway & London (19) | 11% | 10% | 10% |
| External zones (20) | 1% | 1% | 1% |

***Table 4-D Composition of Travel Demand to and from Canterbury City area – AM Peak***

The composition of travel demand to and from Canterbury is also shown in the figures in **Appendix C**. Option 1 has the highest proportion (24%) of trips entirely within the Canterbury City sectors (1 to 8). This is a consequence of the location of development nearer to the urban centre for this option. East Kent accounts for 15 to 17% of trips and London and the rest of the south east account for around 20% of trips.

The pattern of travel demand to and from the Canterbury City area (sectors 1 to 8) is illustrated in **Figure 4-G,** for Option 1 AM peak. Options 2 and 3 have patterns of demand for travel to and from the city similar to Option 1.

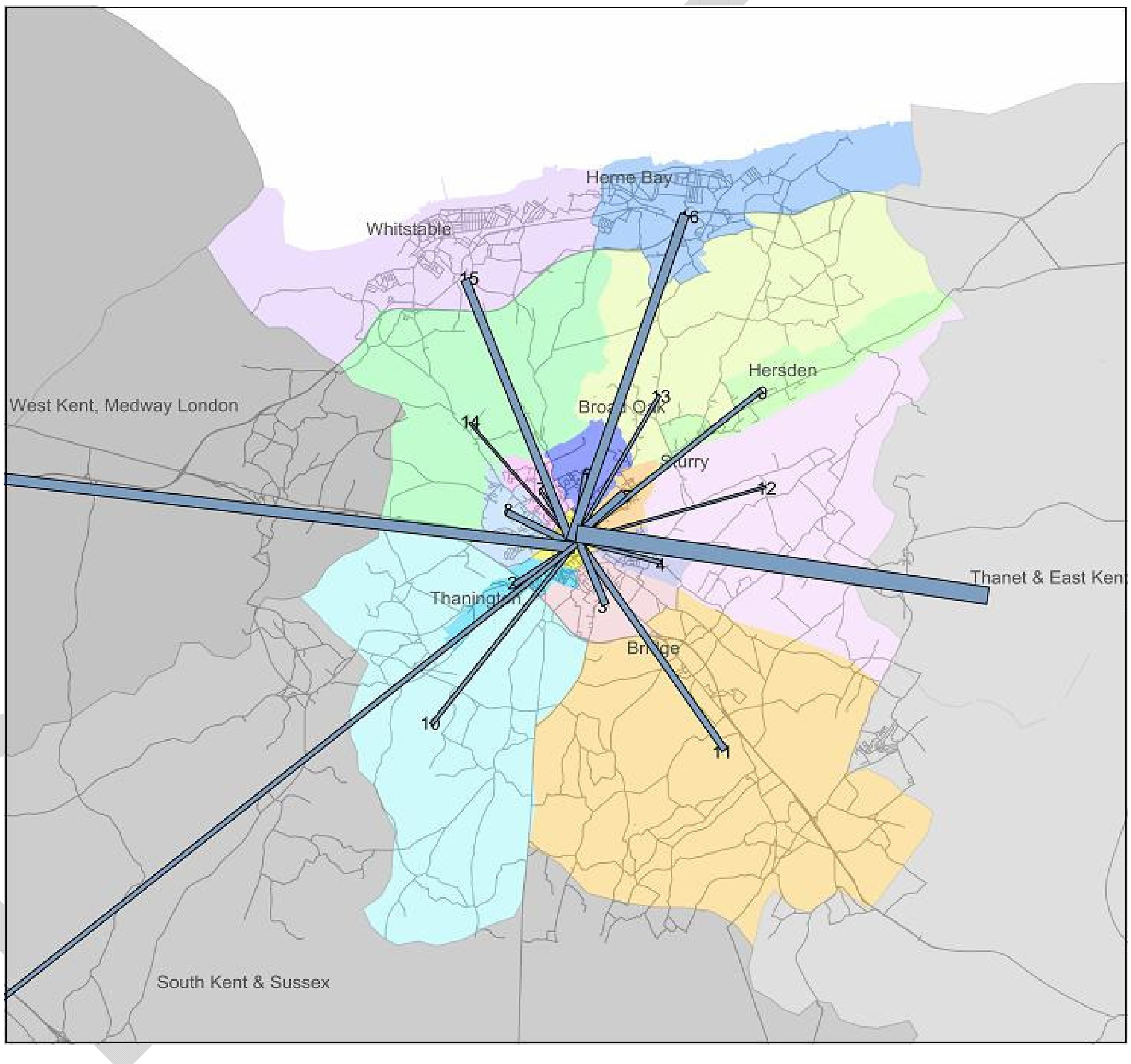



***Figure 4-G Option 1 AM Peak – Pattern of Travel Demand to and from the Canterbury City Area (sectors 1 to 8)***

The sources of trip generation and attraction across the district result in a complex pattern of movement within the district and the city area. This is illustrated in **Figure 4-H** which shows the AM peak desire lines for trips across the wider Canterbury District for Option 1. **Figure 4-I** shows the AM peak desire lines of trips that are entirely within the Canterbury City area. Options 2 and 3 have similar patterns of movement.

The highway and public transport network clearly has to cater for a diverse pattern of movement across the district and across the city area. However the essentially radial character of the highway and bus route network means that much of the movement across the city is funnelled through the centre.

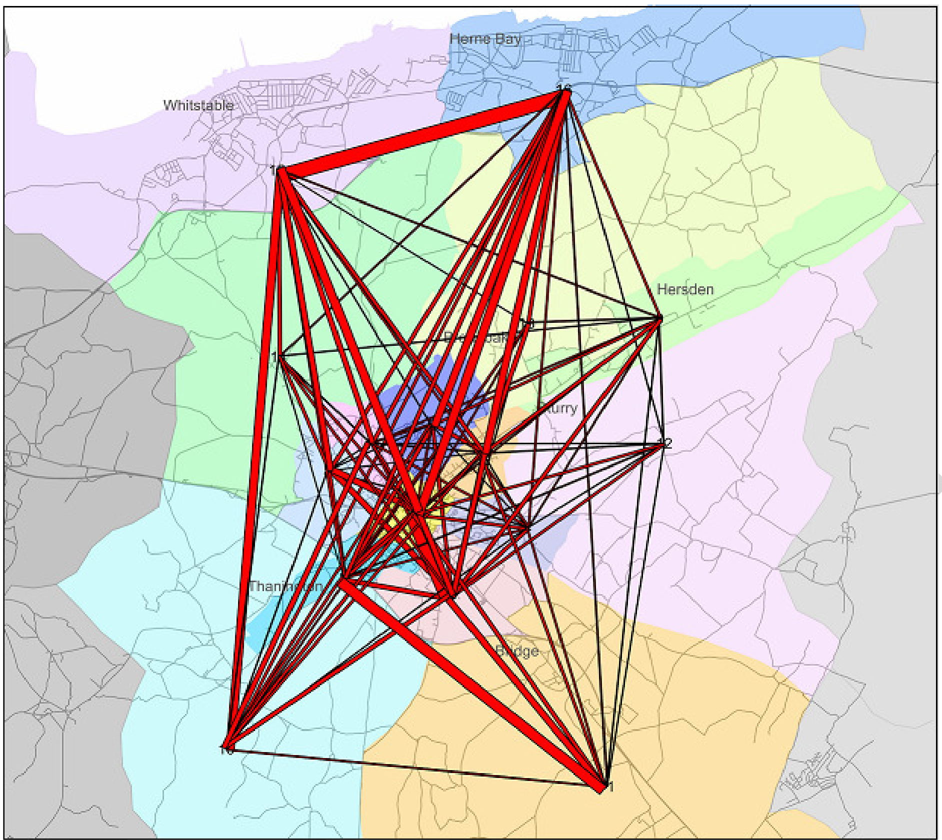



***Figure 4-H Option 1 AM Peak – Pattern of Trip Movements Across the Wider Canterbury District***

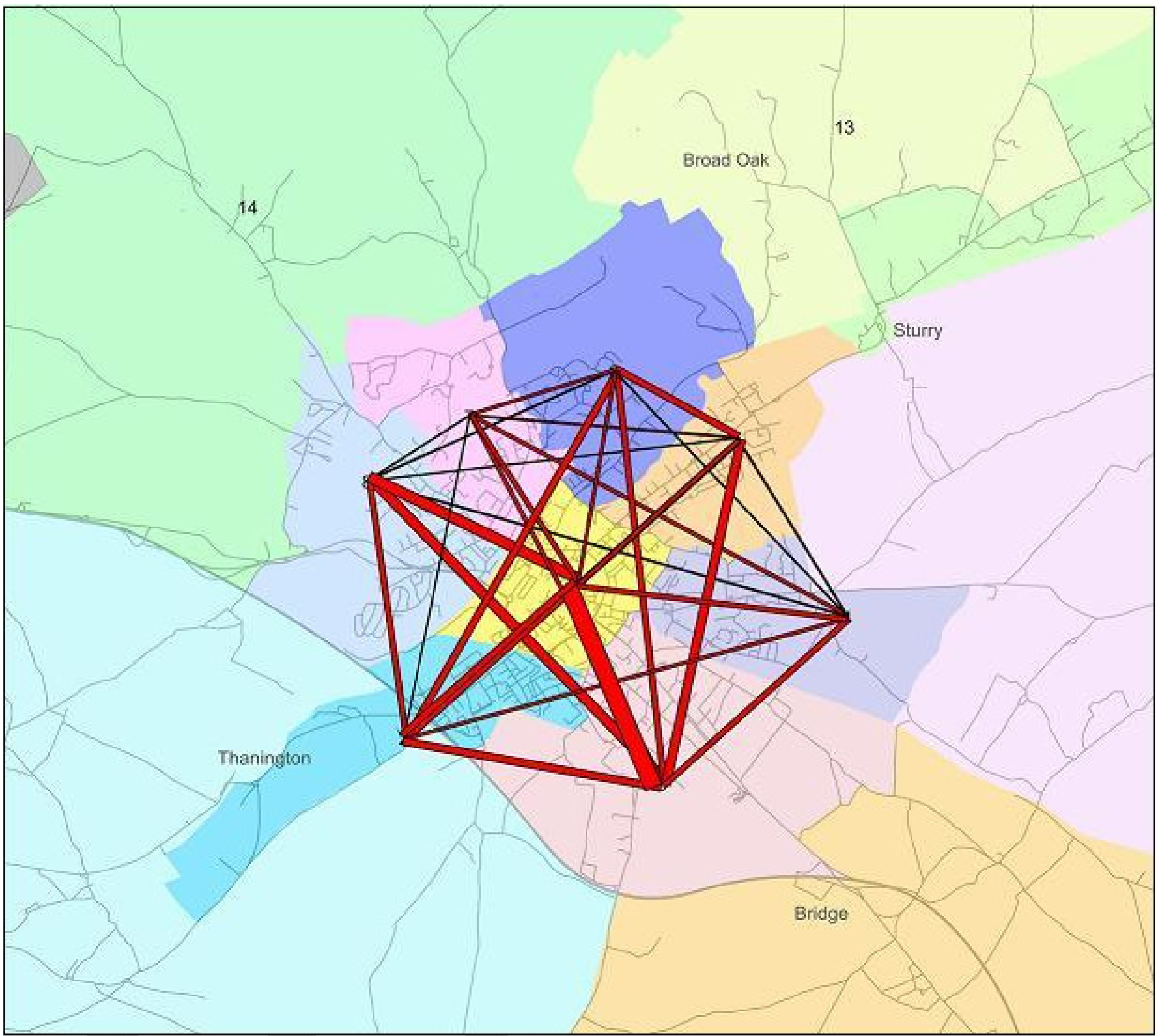



***Figure 4-I*** ***Option 1 AM Peak – Pattern of Trip Movements Within the Urban area of Canterbury City***

# 5 Mode Share

## 5.1 Car, Bus and Rail Trips

The forecast mode share is based on the balance of the generalised cost of travel by car and by public transport. Travel costs are determined from parking costs, vehicle operating costs, value of time, bus and rail fares etc. The base year values have been retained for this stage of testing of the options.

The attraction of trips to bus or rail is also dependant on the origin and destination of trips, on the accessibility to public transport at each end of the journey, on the services provided and on the level of delay that will be tolerated by drivers. The mode choice model estimates the forecast year mode share based on information input.

All three options include an increase in bus frequency and extended bus routes to access some development locations. Option 1 has an additional bus service serving development at Thanington and Option 2 has an express bus service with limited stops serving development at Hersden.

The mode choice is calculated for home-based work and home-based other trips as these trips are most likely to have the opportunity to change their mode of travel. It is assumed that employers business and non home-based other trips are unlikely to be able to change mode.

The forecast average peak mode share for home based work and home based other trips is summarised in **Table 5-A**. The three options tested indicate a comparatively small difference in the proportion of trips using bus, rail and car. Option 1 has a higher proportion of car and rail trips and Option 2 has the higher proportion of bus trips.

| | Do Minimum | Option 1 | Option 2 | Option 3 |
|---|---|---|---|---|
| Car | 81.5% | 84.2% | 83.0% | 83.8% |
| Bus | 12.9% | 11.0% | 12.7% | 11.7% |
| Rail | 5.6% | 4.8% | 4.3% | 4.5% |

***Table 5-A Peak - HBW & HBO Trips by Mode (person trips)***

The location of development has some impact on the mode choice of trips as does the service provision but the overall effect on mode share is relatively small. A more substantial mode shift to public transport would require a public transport strategy which combined positive incentives, such as service provision and favourable fare structures, with behaviour ‘drivers’, such as limited parking provision, raised parking cost etc.

In reality public perception of public transport services and travel costs also has an impact on the use of bus and rail services. This aspect can not easily be reflected in the model.

## 5.2 Park and Ride Trips

The Park and Ride Model determines the proportion of car trips that might be expected to divert to park and ride sites provided. This is dependant on travel time, travel costs, location of the park and ride sites and the level of bus service provided. The forecast options include the existing park and ride sites and an additional site at Harbledown. For Option 1, the Dover Road site is assumed to be relocated to a position nearer to the proposed new Bridge junction with the A2. The Wincheap site remains in the current position. Bus fares and services remain as existing.

The proportion of trips which are diverted to park and ride for each option are summarised in **Table 5-B**.

| | Do Minimum | Option 1 | Option 2 | Option 3 |
|---|---|---|---|---|
| AM Peak | 4.2% | 4.1% | 4.0% | 4.0% |
| PM Peak | 3.3% | 2.4% | 2.4% | 2.6% |

***Table 5-B Park and Ride as % of Car trips (person trips)***

Park and ride trips account for approximately 4% of the AM peak and 2.4 to 2.6% of the PM peak car person trips. Generally there is very little difference in the proportion of park and ride trips between the modelled options.

As for bus and rail modes, a more positive shift to park and ride from car could be possible with the application of positive incentives and behaviour ‘drivers’. The positive incentives may include improved service provision, fast bus services and favourable park and ride parking/fares. The behaviour ‘drivers’ may include a town centre parking policy limiting parking provision and raised parking costs.

The attraction of trips to park and ride is affected by the location of the sites provided, accessibility of the sites, low cost parking and the journey time advantage to be gained from a fast bus service with no search time for a parking space.

# 6 Network Performance

## 6.1 Network Performance Indicators

The model network performance has been assessed based on selected key performance indicators:

- *Average network speed (mph)*
- *Total vehicle distance travelled (kms)*
- *Total congested travel time (mins)*

The congested travel time is a measure of the amount of vehicle travel time across the whole network which is as a result of delays on the network, as opposed to free flow travel time. The average network speed, total vehicle travel distance and congested travel time have been extracted for the fully modelled area which is focussed on Canterbury and the immediate surroundings (**Table 6-A**).

| | Option 1 | Option 2 | Option 3 |
|---|---|---|---|
| Average peak speed (mph) | 19.7 | 19.5 | 19.5 |
| Total vehicle kilometres | 200551 | 184704 | 186600 |
| Total congested travel time (mins) | 313951 | 306444 | 302374 |

***Table 6-A Network Performance Indicators – Average Peak***

The average peak period speed across the Canterbury area is fairly consistent between the options. Much of the additional demand generated by development is focussed on Canterbury as an attractor or generator of trips. The highway network, which is already under pressure, has limited spare capacity. The network absorbs as much demand as possible, reassigning traffic to different and longer routes as necessary. The average peak speed across the network is the net outcome of the balance between the delays on the network and the reassignment of traffic to longer routes with less delay.

Option 1 has the highest total vehicle kilometres of the three options and Option 2 the lowest. The higher lever of vehicle distance travelled for Option 1 is the net result of a higher travel demand, generated by higher level of development, and the improved accesses to the A2 at Wincheap and Bridge. These highway additions may attract traffic to make longer journeys using the A2 to move around Canterbury rather than opt for the shorter route travelling on the congested network through the centre. Options 2 and 3 have no major highway network additions. Trips are therefore constrained to the existing network where they contribute to the delay, resulting in a lower average speed.

The total congested travel time is highest for Option 1. One reason for this may be the higher level of demand generated closer to the city centre. In addition the Option1 highway network was modified to reflect the outline plans for the A2 / A28 Wincheap junction. This junction arrangement attracts additional traffic from the A2 to the A28 Wincheap access to Canterbury and generates a significant amount of delay in the model. This in turn contributes to the higher level of congested travel time.

## 6.2 Cordon Traffic Movements

The total traffic movement crossing an inner and outer cordon around the city have been extracted to provide a measure of the volume of traffic movement (**Table 6-B**). The cordons used are shown in **Figure 6-A**.

***Figure 6-A Cordons Used to Assess Traffic Movements***

| AM Peak | Do Minimum | Option 1 | Option 2 | Option 3 |
|---|---|---|---|---|
| Inner Cordon | 15500 | 16900 | 17000 | 17200 |
| Outer Cordon | 17100 | 19600 | 17700 | 17800 |
| **PM Peak** | **Do Minimum** | **Option 1** | **Option 2** | **Option 3** |
| Inner Cordon | 17600 | 16300 | 16400 | 16200 |
| Outer Cordon | 15500 | 18500 | 15600 | 15500 |

***Table 6-B 2026 AM and PM Total Cordon Flows***

The AM peak has the higher trip total traffic movement crossing both cordons. The inner cordon shows comparable traffic totals for all three options ranging from 16900 to 17200 in the AM peak and 163200 to 16400 in the PM peak, suggesting that the inner cordon may have reached the feasible capacity.

The outer cordon has higher total flows as a result of the additional link from the A2 to the A28 at Wincheap. The new junction with the A2 also contributes to the cordon flow as it provided access to development located to the south of Canterbury.

## 6.3 Level of Congestion

The degree of congestion on the network is the cumulative effect of heavy traffic demand on roads of limited capacity, delays at junctions and complex patterns of traffic movements. Delays can accumulate on the approach and on the exit from junctions and from blocking back across junctions. There is no single simple measure to gauge the level of congestion.

The public perception of congestion and delay is often influenced by local experience. It can be difficult to reconcile a measure of actual congestion with the public perception of congestion.

For the purposes of this study the level of congestion across the network has been assessed using the ratio of traffic flow to capacity on links and on the mean turning delay at junctions extracted from the model. The ratio of traffic volume to capacity on the links is illustrated in **Figure 6-B** to **Figure 6-D**. The links highlighted green are at or approaching their nominal capacity and the orange and red links carry traffic flows in excess of their expected capacity.

The average turning delay at junction is shown in **Figure 6-E** to **Figure 6-G**. All the junctions highlighted have a high level of turning delay and would require serious consideration, whilst those with a delay of 2 minutes or more would require immediate attention.

The link flow to capacity ratio plots indicate that key links around the city centre (Kingsmead, Military Road, Broad Street, Pin Hill, Rhodaus Town and Upper Bridge Street) all remain over capacity for all options. The junction of St George's Place with Upper and Lower Bridge Street has high levels of turning delay in all three options.

Despite the additional development in the south of Canterbury, Option 1 shows a lower volume to capacity ratio on the A2050 south of the city than the other options. This is also reflected in the lower level of delay at the junctions of Old Dover Road with Oaten Hill and of St George's Place with New Dover Road and Chantry Lane. The new A2 junction at Bridge helps to reduce the pressure on the New Dover Road / Old Dover Road corridor.

Options 2 and 3 show a higher volume to capacity ratio on the A28 corridor. The development at Broad Oak, Sturry and Hersden in Option 2 and 3 contribute to increased pressure on the A28 corridor and on Shalloak and Broad Oak Road.

There are significant turning delays in all three options at junction of A291 Sturry Hill with the A28. The developments at locations near to Herne Bay contribute to the level of delay at the A291 / A28 junction for all options.

The junction of the A290 Whitstable Road with London Road caters for complex traffic movements from the Whitstable area and the northern part of the city to the west of the city and to the A2. This junction is under pressure for all three options. Options 2 and 3 indicate a higher volume to capacity ratio for the A290 Whitstable Road and on London Road.

The A28 Wincheap corridor is heavily trafficked in all options but comes under more pressure for Option 1. This is likely to be a consequence of the attraction to trips of the additional slip road from the A2 southbound.

**Key locations identified:**

- *St George's Place with Upper and Lower Bridge Street – all options*
- *Kingsmead, Military Road, Broad Street, Pin Hill, Rhodaus Town and Upper Bridge Street – all options*
- *A28 / A291 junction – all options*
- *A28 Wincheap route – Option 1*
- *London Road / A290 – Options 2 and 3*
- *A28 Sturry and Broad Oak Road – Option 2 and 3*

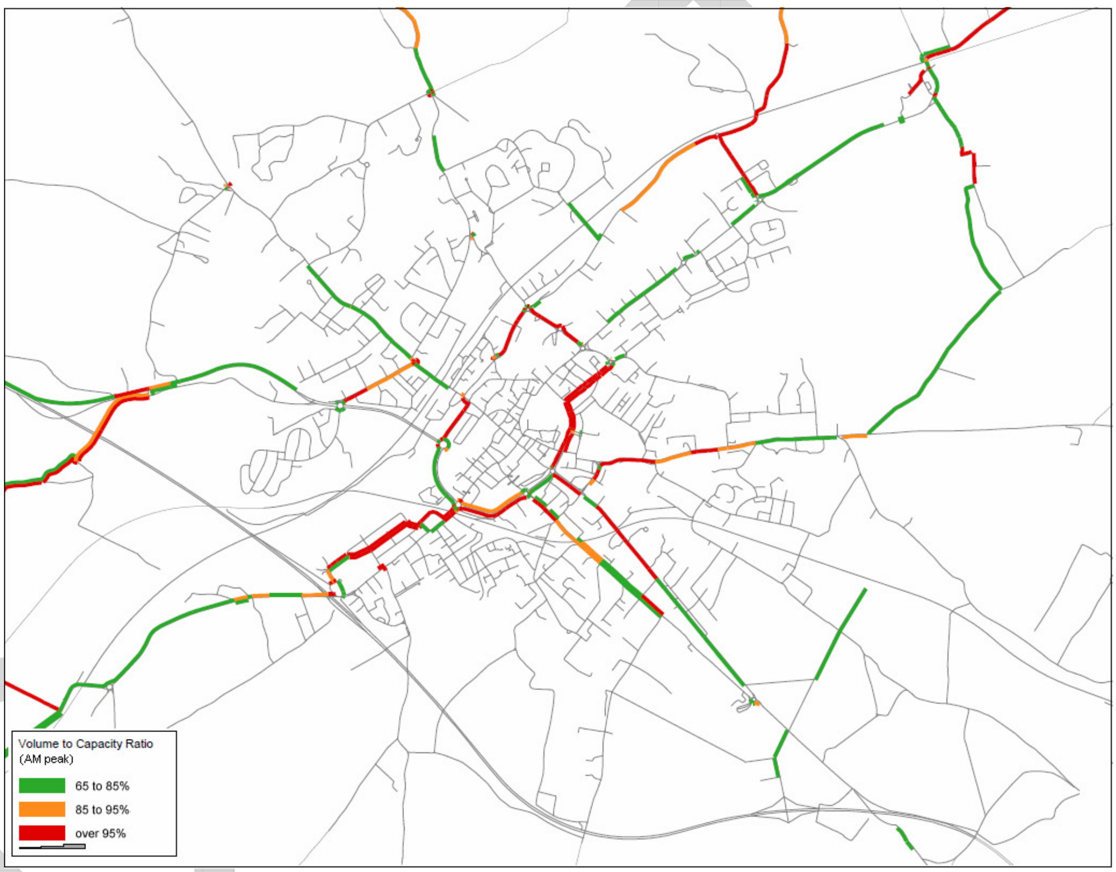



***Figure 6-B Option 1 Link Volume to Capacity Ratio***

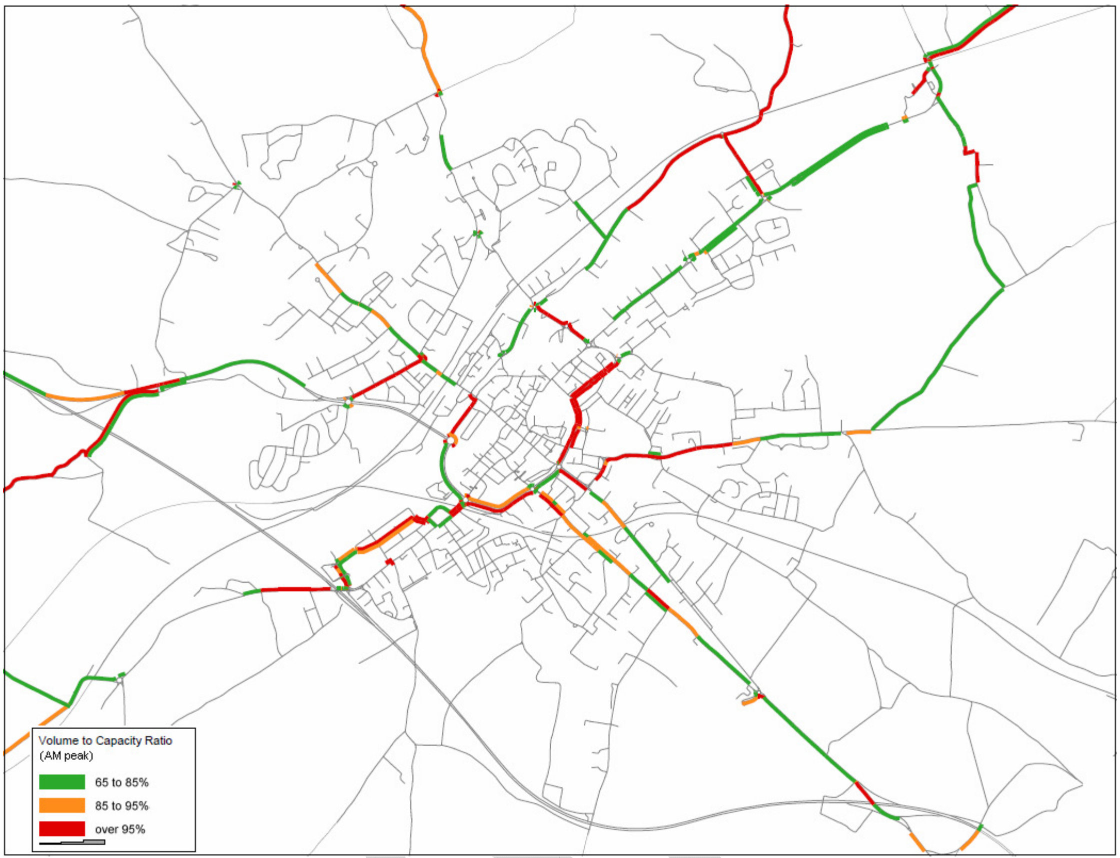



***Figure 6-C Option 2 Link Volume to Capacity Ratio***

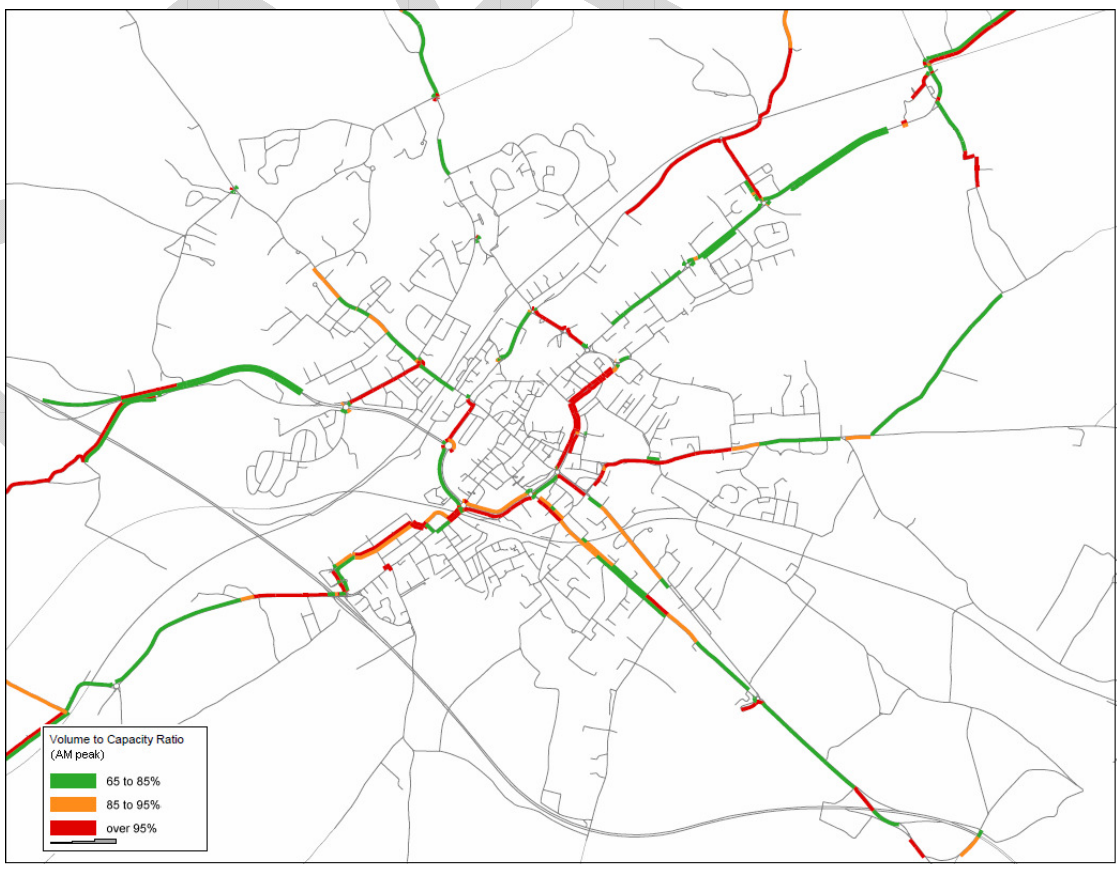



***Figure 6-D Option 3 Link Volume to Capacity***

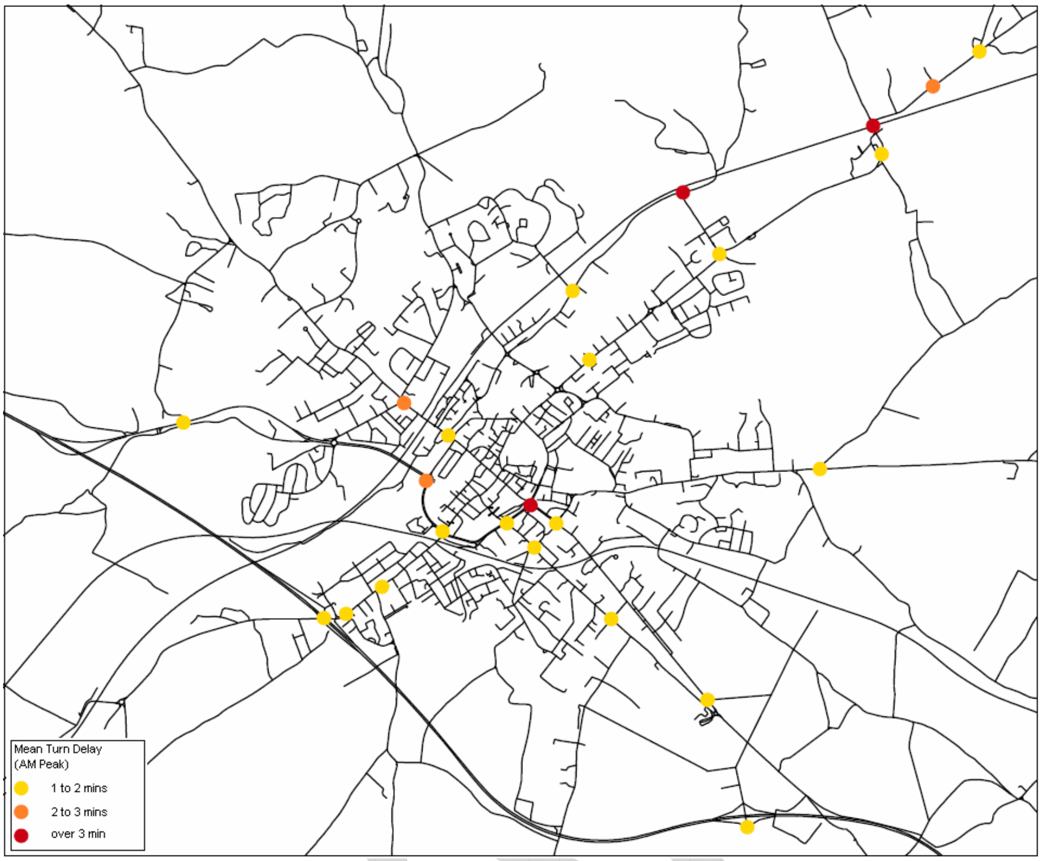



***Figure 6-E Option 1 Mean Turn Delay***

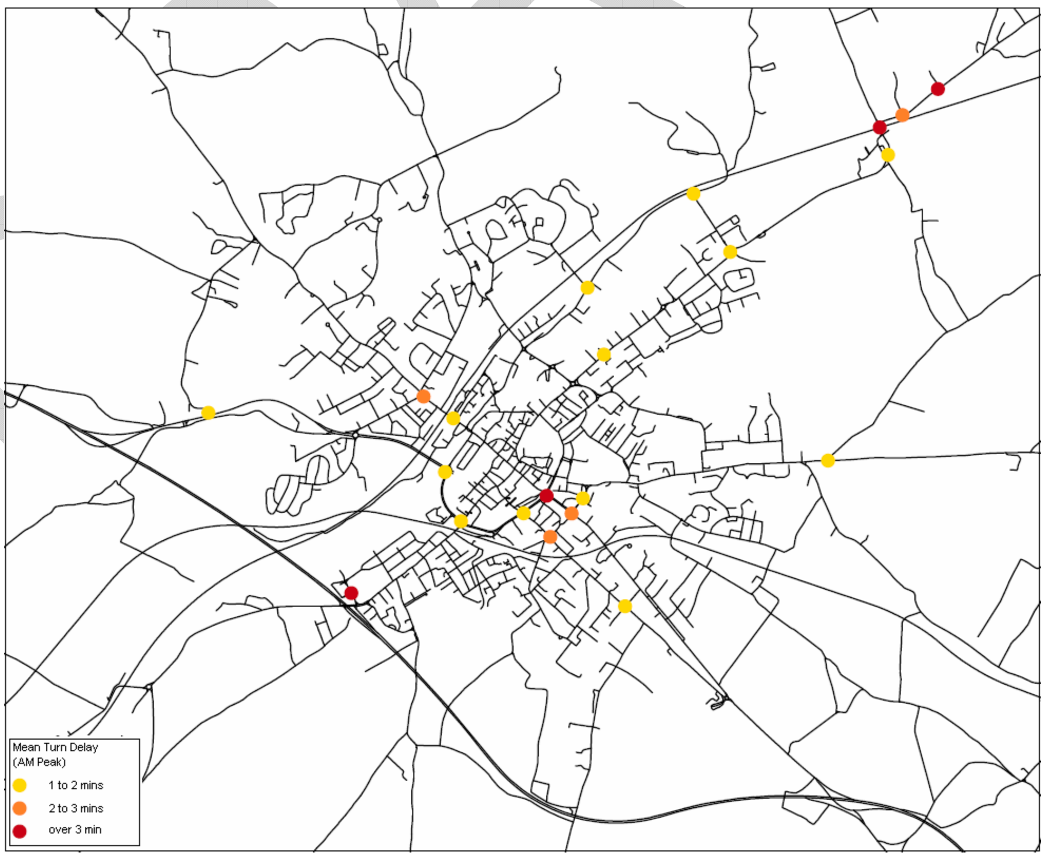



***Figure 6-F Option 2 Mean Turn Delay***

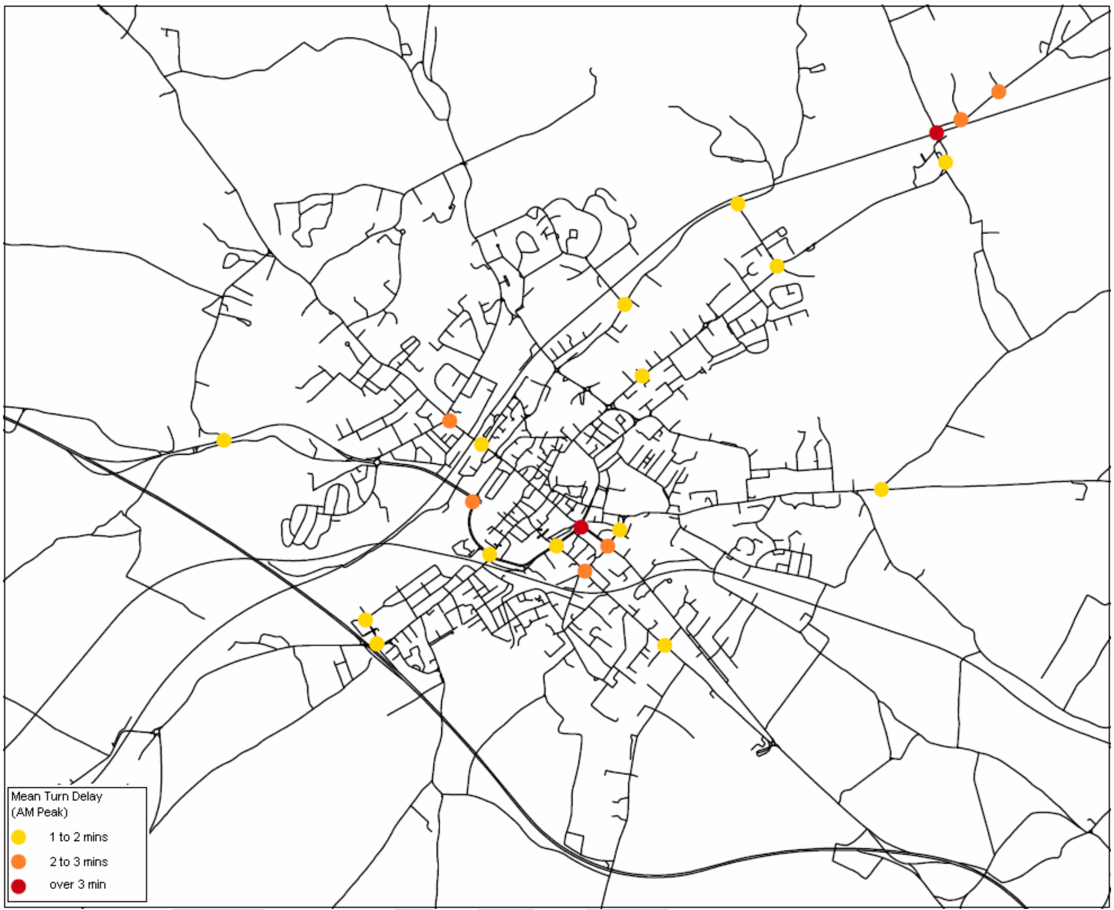



***Figure 6-G      Option 3 Mean Turn Delay***

# 7 Summary of Options

The three options tested demonstrate a similar level of overall network performance but each option has a unique set of characteristics summarised below:

**Option 1**

- This option presents the highest development potential which is accompanied by high levels of travel demand.
- Increased pressure on the Wincheap corridor is partly due to traffic attracted to the new A2 off slip and partly to development at Thanington.
- The new A2 junction at bridge helps to reduce pressure on the A2050 approach to the city from the south even with new development in this sector.
- Lower traffic movement are recorded across the inner cordon in the AM peak indicating some release of pressure on the city centre network.
- Lower levels of delay are recorded at St Georges Place and Oaten Hill junctions.
- Higher traffic movements are recorded crossing the outer cordon as traffic uses the new access to/from the A2 at Bridge and Wincheap.

**Option 2**

- This option has a lower net development which generates a similar level of travel demand to Option 3.
- Development at Broad Oak, Sturry and Hersden contribute to increased pressure on the A28 corridor, on Broad Oak Road / Shalloak Road and on the A290 / A28 junction.
- There is an increase in pressure on radial routes from the north including Whitstable Road, Tyler Hill and Broad Oak Road / Shalloak Road.
- Higher levels of traffic movements are recorded across the inner cordon in the PM peak.
- Lower levels of traffic movements are recorded across the outer cordon in both peaks.
- Congestion is indicated at St. George's Place, and Oaten Hill junction.

**Option 3**

- This option has a lower net development allocation which generates a similar level of travel demand to Option 2.
- In the AM peak this option results in a high total vehicle distance travelled and a higher volume of traffic crossing the inner cordon.
- Development at Broad Oak, Sturry and Hersden contribute to increased pressure on the A28 corridor, on Broad Oak Road / Shalloak Road and on the A290 / A28 junction.
- Congestion is indicated at St. George's Place, and Oaten Hill junction.
- There is an increase in pressure on radial routes from the north including Whitstable Road and Broad Oak Road / Shalloak Road.
-

# 8 Conclusion

Canterbury is the primary centre for retail, employment, services and education etc for the district. The city is the key trip attractor / generator and development outside Canterbury will inevitably generate a significant number of trips to and from the city.

The highway and public transport network caters for a complex web of movement around the city between different sectors. The essentially radial character of the highway and bus network means that much of the movement across the city is funnelled through the central area.

The Canterbury VISUM model has been used to assess three scenarios which include potential development in and around the city and the coastal towns in differing proportions.

The existing model network is already operating at capacity. Additional trips generated by the development for each option puts pressure on the already overloaded model network. The model attempts in the first instance to accommodate the additional travel demand making the maximum use of the highway network within the constraints it presents. The increase in delay and travel time generated results in the shift of a higher proportion of trips to bus and rail modes.

In general larger development sites have more potential for mode shift and for the containment of more trips locally. It would be more difficult to encourage mode shift for a more fragmented development which is likely to generate more car trips. Development further away from Canterbury but served by good access to public transport would have potential to shift modes given sufficient incentives eg well planned services, attractive fares, avoidance of delay by buses.

The options tested at this stage are based on preliminary assumptions about highway improvements, proposed PT provision and on existing costs for fuel, parking and fares. Refinement of these assumptions, to include sustainable travel initiatives and anticipated policy changes, will have an impact on the travel demand generated and on the likely impact on the highway and public transport network.

The outcome of the assessment is that the differences seen in the highway model performance and output between the options are limited in scale. Option 1 currently appears to have a marginally better performance than the other options despite the higher development allocation. Network improvements, such as those proposed for Option 1, provide some more capacity and flexibility for highway traffic. The shift to public transport is enhanced by the provision of additional or more frequent services but this could be increased by incorporating additional incentives.

# Appendix A Development Data

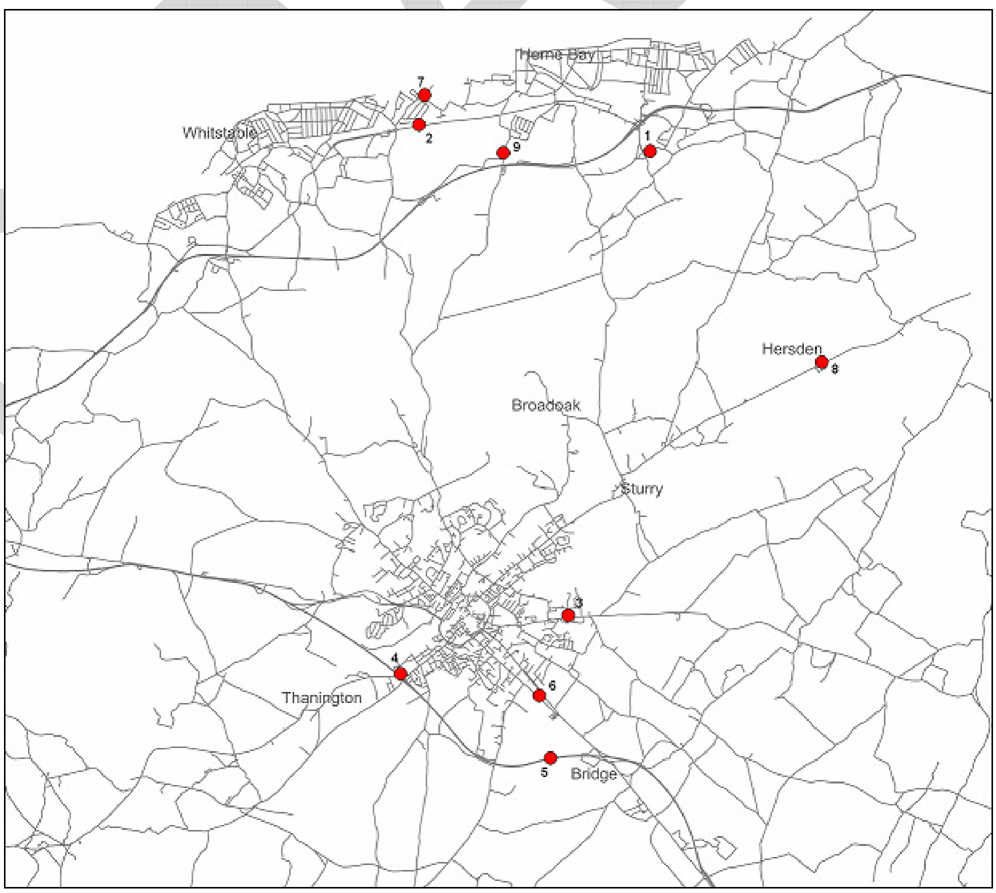
| Site id | Model Zone | Location | Residential Units | | |
|---|---|---|---|---|---|
| | | | Option 1 | Option 2 | Option 3 |
| 001 | 301 | Land north of Thanet Way Whit | | 400 | 400 |
| 007 | 237 | Golden Hills Farm,Bushy Hill Rd, CT2 0HE | | 140 | |
| 009 | 308 | Land at Maydowns Rd | | 50 | |
| 010 | 313 | Greehhill, Herne Bay | 500 | 500 | 500 |
| 011 | 234 | Strode Farm, Herne Bay | 800 | 800 | 800 |
| 012 | 316 | Herne Bay golf driving range Bullockstone rd | | 40 | |
| 013 | 313 | Land west of Bullockstone Rd | | 190 | |
| 032 | 318 | Cedar House Blacksole Bridge Margate Rd | | 60 | |
| 038 | 62 | St Martin's Hospital | 200 | 200 | 200 |
| 041 | 237 | Former colliery land,south of A28 | | 540 | (with site 148) |
| 051 | 310 | Land at Studd Hill Whitstable Rd CT6 8B | | 250 | |
| 061 | 44 | Canterbury TEC Littlebourne rd | | 100 | |
| 070 | 216 | Thanington | 1500 | | |
| 071 | 309 | Thornden Close, Herne Bay | | 200 | |
| 074 | 94 | Land East of Hollow Lane | | 100 | |
| 076 | 237 | Land at Bredlands Lane | | | (with site 148) |
| 083 | 205 | Land South of Little Hall Farm, St Stephens Hill - Alcroft Grange | 1100 | | 1200 |
| 086 | 105 | Part of Nackington Farm, Nackington Rd | | | 500 |
| 090 | 241 | Land rear of 32 Jubilee Rd, Littlebourne | | | 200 |
| 091 | 241 | Land rear of The Hill, Littlebourne | | | (with site 148) |
| 096 | 237 | Spires Academy, Bredlands Lane, CT2 0HD | | 120 | (with site 148) |
| 105 | 72 | 6/7 Rhodaus Town, CT1 2RJ | | 100 | 100 |
| 106 | 216 | Ashford Rd Thannington | | | 480 |
| 107 | 39 | Parkside County Primary School, Tennyson Ave | | 200 | 200 |
| 121 | 58 | Spring Lane | | 100 | 100 |
| 123 | 86 | Land at Langton Lane | | 160 | 160 |
| 129 | 319 | Hillborough, Herne Bay | 1400 | 1400 | 1400 |
| 130 | 308 | Land south of Ridgeway Chestfield CT5 3LY | | 250 | |
| 135 | 304 | 42 Golden Hill | | 200 | 200 |
| 136 | 308 | Land at Grasmere Rd, South Tankerton | | 90 | |
| 137 | 216 | Thanington | 1000 | | |
| 138 | 244 | Barham Court Farm, The Street | | | 50 |
| 140 | 247 | Land East of Rattington Street | | | 675 |
| 143 | 206 | Broad Oak / Sturry | | | 700 |
| 147 | 102 | Simon Langton Girl's School | 270 | 270 | 270 |
| 148 | 237 | Hersden north | | 800 | 1500 |
| 177 | 206 | Land at Broad Oak Farm,Sturry Hill, Sweechgate | | 1200 | |
| 178 | 308 | Land at Bodkin farm Thanet Way Chestfield | | 650 | |
| 183 | 44 | MoD Land at junction of Howe Barracks | | 200 | 200 |
| 184 | 35 | MoD Land at Chaucer Rd & Garrison Hill | | 225 | 225 |
| 186 | 212 | Land at Brickfield Farm Mill Lane, Bridge | | | 100 |

| | | | | | |
|---|---|---|---|---|---|
| 187 | 237 | Hopland Farm, Island Rd Hersden CT3 4HD | | 140 | |
| 190 | 108 | Ridlands Farm Stuppington Lane CT13LJ | | 150 | 150 |
| 196 | 26 | Craddock House, Craddock Rd | | 156 | |
| 200 | 237 | Westbere Quarry, Island Rd, Westbere | | 90 | |
| 201 | 212 | Land west of A2 at Bridge | | | 80 |
| 202 | 233 | Land off Bramley Gardens | | 120 | |
| 206 | 60 | Mountfield Park (S Canterbury) | 2000 | | |
| 206 | 105 | Mountfield Park (S Canterbury) | 2000 | | |
| 208 | 316 | Herne Bay Golf Course | 300 | 300 | 200 |

***Residential Development***

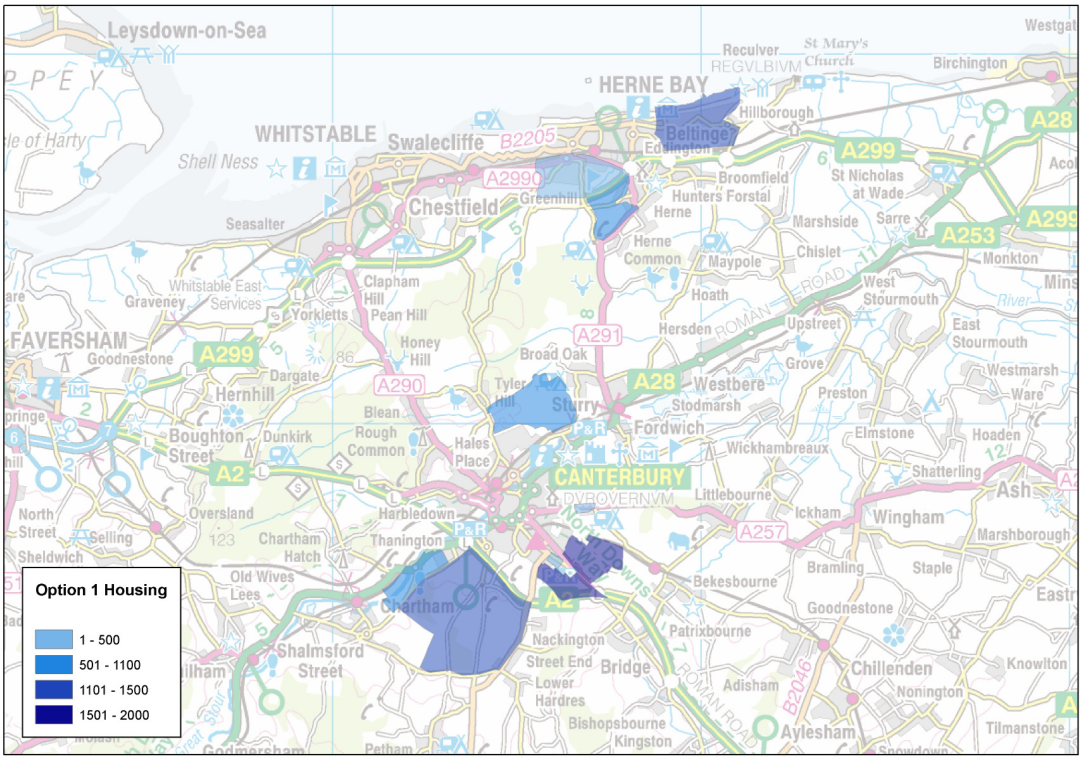
| Site id | Model Zone | Location | Commercial (sqm) | | |
|---|---|---|---|---|---|
| | | | Option 1 | Option 2 | Option 3 |
| 011 | 234 | Strode Farm, Herne Bay | 12000 | 18000 | 12000 |
| 083 | 205 | Land South of Little Hall Farm, St Stephens Hill - Alcroft Grange | 28000 | | |
| 140 | 247 | Land East of Rattington Street | 15000 | 30000 | 16000 |
| 184 | 35 | MoD Land at Chaucer Rd & Garrison Hill | | | 5000 |
| 190 | 108 | Ridlands Farm Stuppington Lane CT13LJ | | 5000 | |
| 206 | 60 | Mountfield Park (S Canterbury) | 70000 | | |
| SR3 | 237 | Land adjacent to Lakesview, Hersden | | 66500 | 66500 |

***Commercial Development***

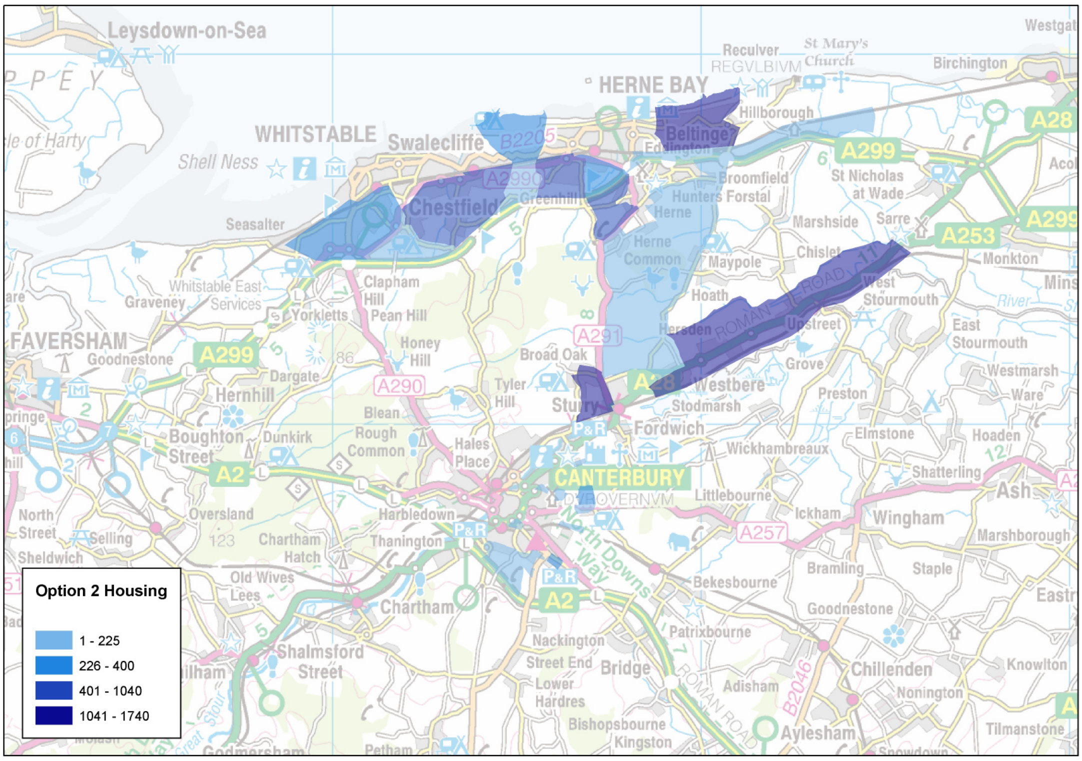



***Location of Infrastructure Changes***

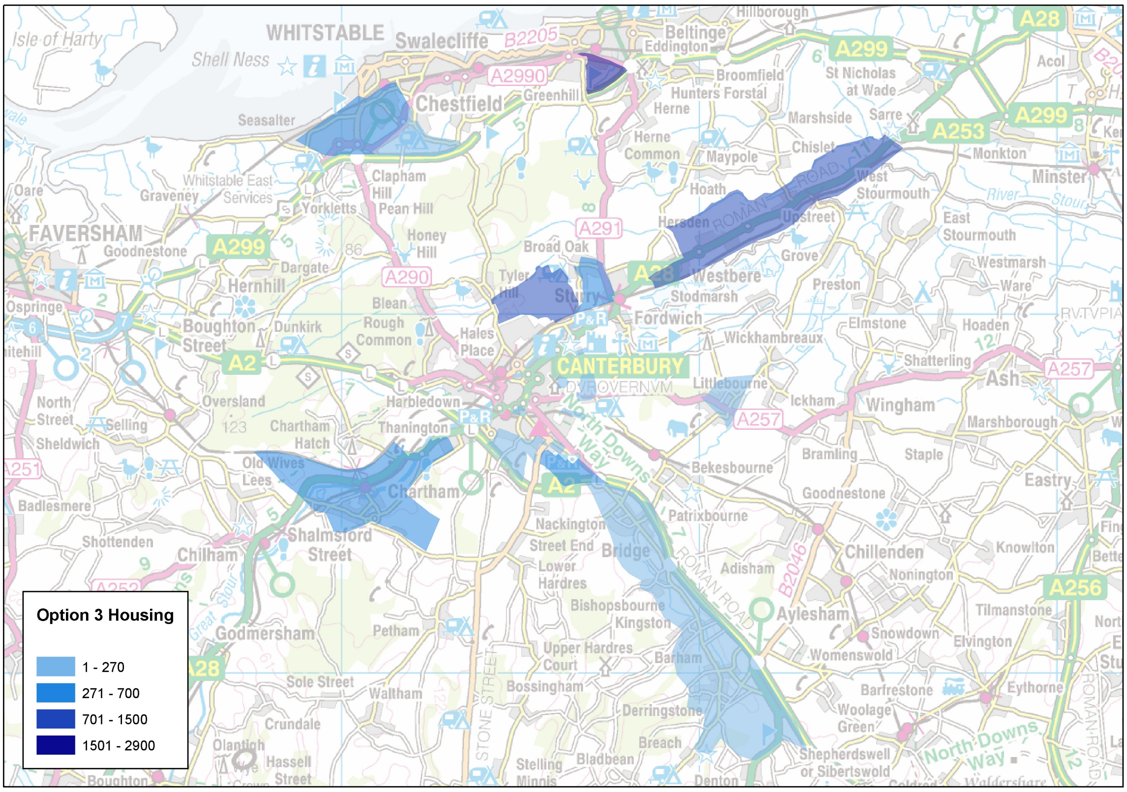
# Appendix B Location of Housing and Commercial Development



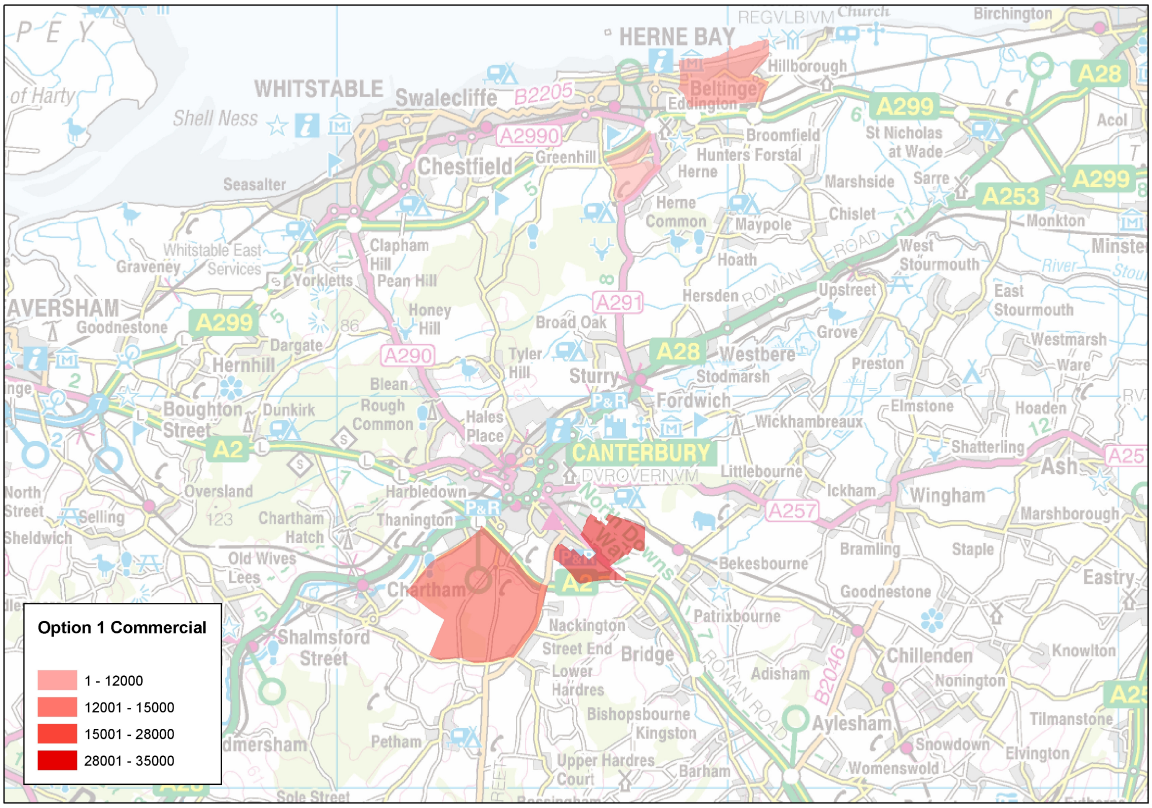

*Option 1 - Location of Housing Development by Model Zone*



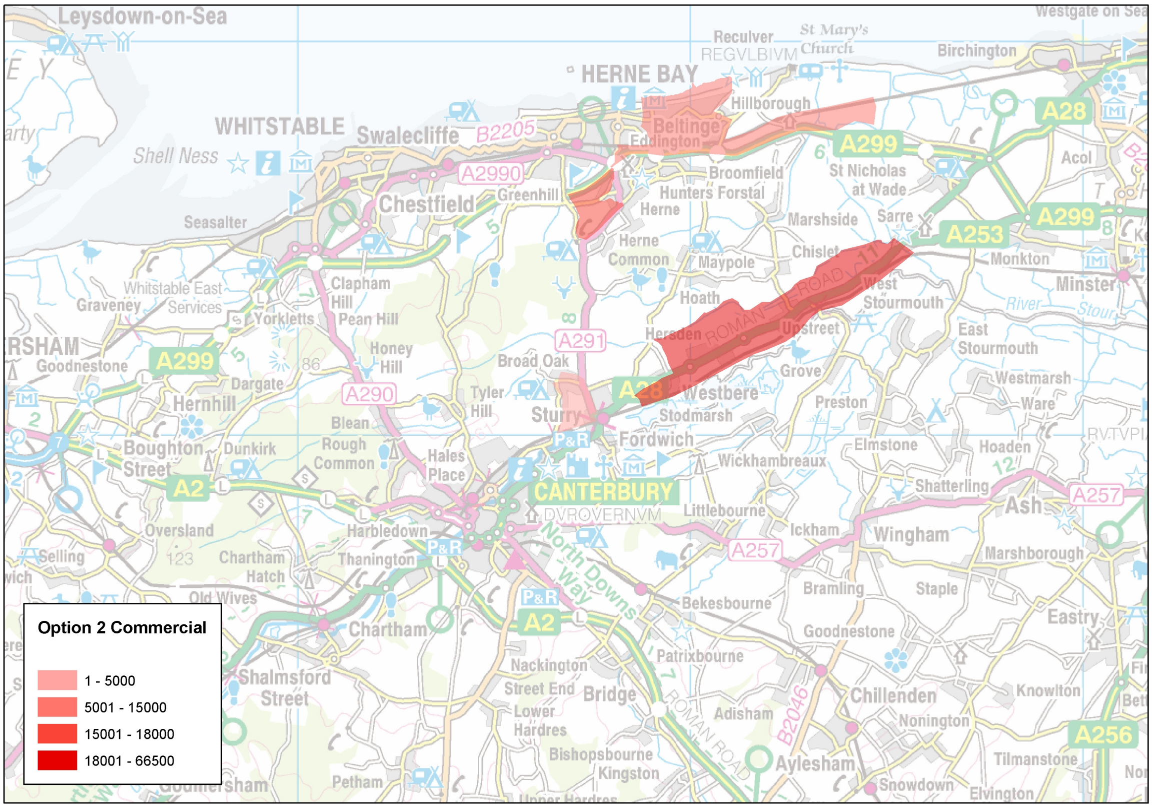

*Option 2 - Location of Housing Development by Model Zone*



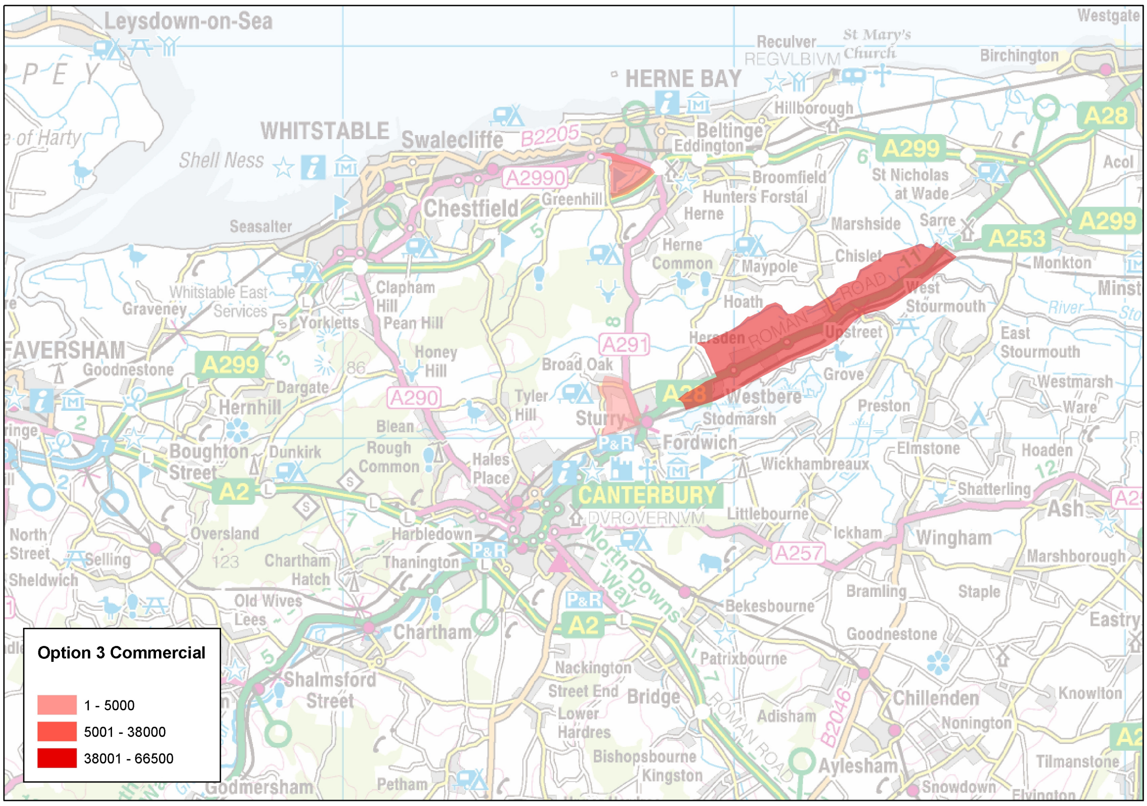

***Option 3 - Location of Housing Development by Model Zone***




***Option 1 - Location of Commercial Development by Model Zone***

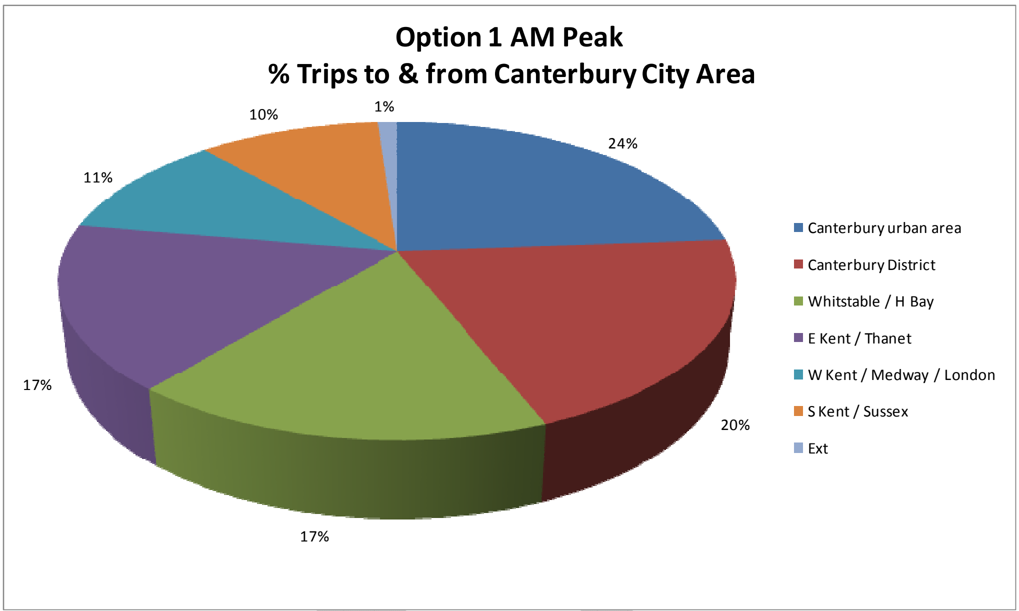



***Option 2 - Location of Commercial Development by Model Zone***

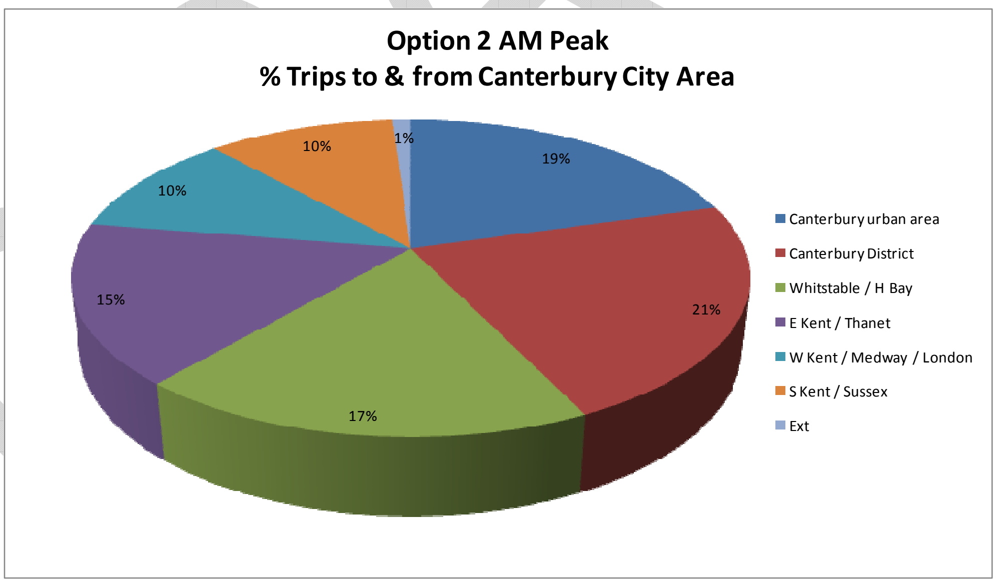



***Option 3 - Location of Commercial Development by Model Zone***

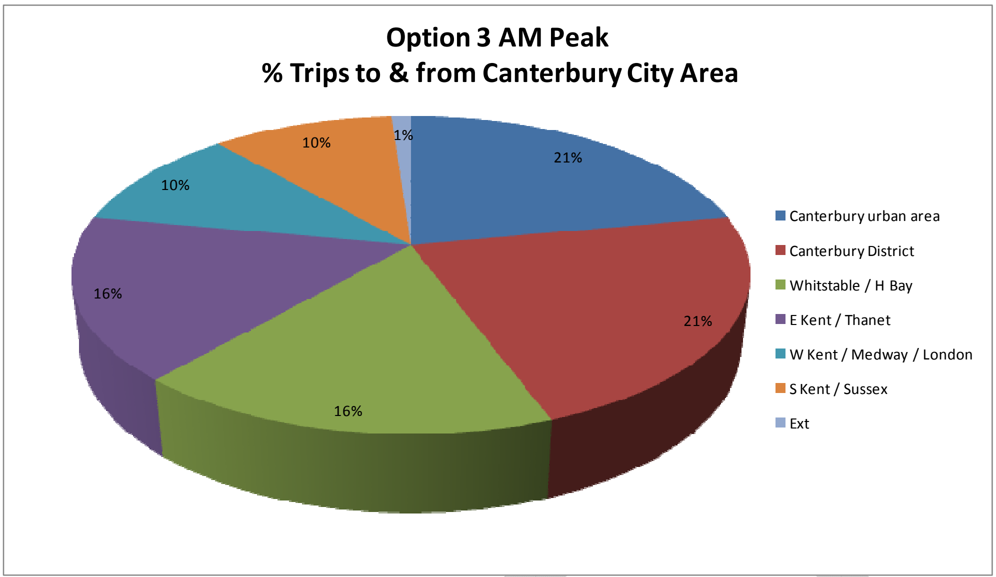
# Appendix C Composition of Canterbury City Travel Demand




***Option 1 AM peak – Composition of Trips to and from the Canterbury City Area***




***Option 2 AM peak – Composition of Trips to and from the Canterbury City Area***




***Option 3 AM peak – Composition of Trips to and from the Canterbury City Area***

# Appendix D Summary Notes

- *Canterbury is the primary centre for retail, employment, education, services etc. The city is a key attractor and generator of trips across the district. The highway network in Canterbury is already at capacity. Additional development will inevitably put pressure on an overloaded network.*

- *The model has been used to assess three potential development scenarios and outline measures to support them. The models have been developed to provide a reasonable and balanced comparison between the scenarios, based on the information available.*

- *The three scenarios include development in and around the city, nearby centres and coastal towns in differing proportions. The three development scenarios result in a total demand of between 49500 and 50100 person trips across the model in the peak hour.*

- *Increased highway demand and consequent delays result in traffic taking longer routes, longer journey times which in turn causes an increase in travel costs. Increase in travel time and delay encourages a shift to public transport.*

- *Option 1 has the highest total development allocation and also includes improved access to the A2 at Wincheap and Bridge. This option generates the highest travel demand and the highest total vehicle kilometres across the city, but the lowest level of congested travel time. The new links to the A2 provide some additional network capacity and flexibility.*

- *The key differences between the options emerge from the quantity of development being handled by the modelled networks and the potential for mode shift from highway to public transport.*

- *The model output indicates that given the constraints on the highway network, one of the key targets must be to encourage walking or cycling or public transport modes where possible. The means to achieve this may be through targeted travel plans for schools and businesses, parking policy to control availability and fees, public transport fares, services and routes, park and ride promotion and provision.*

**General comments**

- *Larger scale residential development sites present the opportunity for the inclusion of local facilities and services such as schools, health provision etc. It would be reasonable to assume a higher proportion of walk and cycle trips in this case, reducing the demand on the network. The larger developments may also have the potential to support highway and infrastructure improvements to benefit Canterbury as a whole.*

- *Developments outside the city centre are likely to generate less sustainable trips. The potential for walk and cycle trips is more limited if the destination of the trips is outside the immediate area. Access to a public transport may be more limited than that available within the city.*

- *Development near to the A2 and A299 will benefit from the access to the available capacity on the major road network. However trips destined for the city will contribute to and suffer from the overloaded network in Canterbury.*