MOTT MACDONALD

Ely to Cambridge Transport Study

Strand 3 CNFE/CSP Transport Report

21 February 2018

Cambridgeshire County Council

Mott MacDonald
22 Station Road
Cambridge CB1 2JD
United Kingdom

T +44 (0)1223 463500
F +44 (0)1223 461007
mottmac.com

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Contents

Executive Summary

The Cambridge Science Park and neighbouring innovation centres and business parks on the northern fringe of Cambridge are home to an exceptionally high-performing cluster of knowledge-based and high-tech businesses, which have benefited from close associations with the University of Cambridge and generate Gross Value Added well in excess of county and national averages.

This report sets out the findings of a transport study into how further growth at Cambridge Northern Fringe East and the Cambridge Science Park might be accommodated on the transport network. It sets out how development has been tested, what the effects on the transport network are, and identifies possible interventions. It also highlights where further work is needed to better understand certain impacts that have been identified. This report forms part of a suite of reports that make up a wider study of the transport requirements of the Ely to Cambridge area.

The importance of Cambridge Northern Fringe East and the Cambridge Science Park

The Cambridge Northern Fringe East (CNFE) is one of the last remaining significant brownfield sites in Greater Cambridge, extending to almost a square kilometre. It has long been an ambition of the local councils to take advantage of the opportunity this site affords to regenerate this part of the city and to support the continued economic success of the local economy.

To the west of CNFE, the Cambridge Science Park (CSP) has provided crucial research space in the city since the 1970s and continues to make an important contribution to the Cambridge Cluster of research and high-tech sectors. However, some of the older buildings were built at very low densities and there is scope for further intensification of the site; indeed the CSP and other business and innovation parks in the area all have aspirations to expand.

An accessible area, on a constrained and congested road network

The CSP and its neighbouring sites have increasingly good transport connections, with the Cambridgeshire Guided Busway and the new station at Cambridge North. They will benefit from the Chisholm Trail pedestrian and cycle route, and also from the segregated public transport, pedestrian and cycle routes proposed from the new town north of Waterbeach in the ‘Ely to Cambridge Transport Study: Preliminary Strategic Outline Business Case’.

However, they also currently have high levels of parking provision, and this provision is in many cases very significantly underutilised. Further, these employment sites generally have higher levels of car use than other large employment areas in the city. While good progress has been made in reducing this in recent years, the proportion of workers at these sites who drive to work is almost double that of the Cambridge Biomedical Campus on the southern fringe of the city, and the road network around the sites is severely congested in peak periods.

Whilst the CNFE and CSP sites are well located in terms of access to the strategic road network, the Milton Interchange acts as a significant throttle to traffic flows from the A10 and A14 onto the A1309 Milton Road. This is an important issue when considering the potential transport impact of further development at CNFE and the CSP.

The A14 itself is very likely to be operating over capacity between the Girton and Milton interchanges by 2031, even with the improvements currently being delivered, and without development at CNFE or a fully built out new town north of Waterbeach. The provision of extra capacity on this stretch of the A14 would likely be challenging and costly, and could also be counterproductive in terms of the wider available capacity of the

M11 south of Girton, and of the A14 west of Girton and east of Milton. These wider network impacts would, of course, need further more detailed consideration.

In part because of the constraint created by Milton Interchange and the Cambridge Northern Bypass, analysis suggests that without mitigation or measures to limit car use and provide better alternatives for many trips into the area, development traffic would displace other traffic to less appropriate routes. These include Kings Hedges Road and other routes through the city, and routes through villages to the north of the A14. Analysis has shown that whilst growth at CNFE and CSP would contribute to the increase in flows on the A10, the largest movements associated with development of these sites would be from the east and west on the A14 and from the south on the M11.

Unlocking growth

The recommended strategy for unlocking significant further growth on these sites lies in:

- Providing a form and mix of development that enables access to many services and facilities by residents, workers and visitors to be made locally or without the need to travel by car, supported by a policy of demand and parking management for developments in the area
- Reducing the number trips that are made to and from the CNFE / CSP area by car, and providing infrastructure and services to allow for these trips to be made by other means
- Further study into the provision of additional vehicular capacity where it would address access and congestion issues without adding to congestion problems elsewhere on the strategic and local road networks. This should include consideration of the capacity that could usefully be provided at the site accesses and at the A14 / A10 / A1309 Milton Interchange.

Considering these three elements in turn:

1. Form and mix of development and management of demand and parking

The form and transport characteristics of new development at CNFE, CSP and neighbouring business parks and innovation centres could mimic what is already in place in the area. If this happened, the amount of development that is possible would be severely limited by the capacity of the strategic and local road networks.

To maximise the amount of development in the area, the form and mix of new development should maximise the opportunity for internal trips, and minimise the need to use cars for those trips, and for trips to and from the area. Mixed use development at CNFE with a diverse range of residential, employment, education, retail and local amenities would provide the opportunity for those living and working in the area to access many services without using a car. Movement networks in the area should be designed around people rather than cars, and the development should take advantage of the opportunities provided by Cambridge North Station and the busway to take people to and from the area.

Effective ‘last mile’ links from the station and from the busway stops should be a key part of the master planning of the new development and for intensification of use of CSP and other business parks. The opportunity for innovative solutions for longer local ‘last mile’ trips, such as from Cambridge North Station to CSP should be considered as part of the master planning of the area.

While CSP currently achieves around 30% of all trips to work by cycle, analysis also shows that around 15% of car trips to work into the area would involve journeys of less than two kilometres in length. Many of these trips could potentially be made by walking, cycling or public transport. Comprehensive high quality pedestrian and cycle networks should permeate the area and link to villages to the north of Cambridge and the new town north of Waterbeach. Improvements to the network linking to Cambridge city centre and to other key destinations in the city are also needed. This will include the Chisholm Trail, which will provide links to the city centre and the east of the city.

The work undertaken to date indicates that the development of these sites will need to move away from the traditional approach of predicting the level of unrestrained trip generation and then providing highway capacity mitigation to accommodate the predicted level of trip making. Further detailed work should be undertaken in partnership with the local planning authorities to establish how this might be done and to set the wider policy requirements for the sites. This will need to look at measures such as stringent parking constraints, and a vehicular trip budget for the sites which will help to control the number of vehicular trips accessing the site. This will also help inform the mitigation needed to provide sufficient transport capacity catering for all modes to accommodate the number of people looking to access the level of development proposed on each site. The vehicular trip generation outlined in Section 4.2.1 of the document gives a feel for the level of trips that could potentially be accommodated on the surrounding highway networks but this would need further more detailed analysis.

Going forward, the developers of these sites will need to show how they can reduce the car mode share from that currently seen on the sites to enable more development on the sites without exceeding the agreed trip budget. The level of on-site parking provision will be key to determining the level of trip generation from the site and this, in turn, will inform the mix of development that can be accommodated. Key to this will be the provision of a wide range of facilities on the site to minimise the need for residents and employees to travel. However, there will also be a need to look at measures on the wider transport networks to intercept trips to and from the sites and transfer them on to non-car modes, which will require the provision of such facilities as extended/new park and ride facilities to intercept trips further from the sites and then provide direct routes into the area to make these options attractive.

This approach could provide a significant opportunity for more intensive and efficient use of development land, while reducing impacts on the highway network.

2. Reducing the number trips that are made by car, and providing infrastructure and services to allow for these trips to be made by other means

Analysis of the results of transport modelling looking at development in the CNFE / CSP area without mitigation indicates that large numbers of trips into the area would be made by car using the A14 from the east and the northwest, the A428 from the west and the M11 from the south. There are also significant traffic flows from the A10 to the north, although new development traffic on this link is largely from the new town north of Waterbeach. Public transport infrastructure and services that provide segregated, high quality links into the CNFE / CSP area would allow for many of these trips to be intercepted before they reach the A14 Cambridge Northern Bypass.

- From the **A10 to the north of Cambridge**, this could be provided by measures identified in the 'Ely to Cambridge Transport Study: Preliminary Strategic Outline Business Case', which include:
  - A relocated Waterbeach railway station serving both the village and the new town.
  - Segregated public transport links between the new town north of Waterbeach and Cambridge, and park and ride capacity at the new town to intercept trips into the city.
- From the **A14 to the east of Cambridge**, this could potentially be addressed by:
  - Intercepting trips at a park and ride facility to the east of the city, and providing segregated public transport / pedestrian cycle links into the area. This might be achieved by:
    - The Newmarket Road, Airport Way Park and Ride, and Eastern Orbital proposals set out in the GCP's initial programme.
    - Improved vehicular access to the Airport Way Park and Ride site from the A14, including improvements to the Quy Interchange between the A14, A1303 and B1102 which are being investigated by the Cambridgeshire and Peterborough Combined Authority.
    - The Chisholm Trail pedestrian and cycle route and bridge over the River Cam, which would allow for 'Park and Cycle' trips into the area from Newmarket Road / Airport Way.

  - Improvements to the frequency, capacity and journey times of rail links into Cambridge from the east. Trains from Norwich could directly serve Cambridge North. For trains from Ipswich this would involve changing at Cambridge and a three minute trip to Cambridge North.
- From the **M11 to the south of Cambridge**, this could potentially be addressed through:
  - Interception of trips at Trumpington or Hauxton for an onward public transport journey into the area using the GCP's Western Orbital route proposals and/or via the proposed park and ride site in the Cambourne to Cambridge area that is currently being investigated via the GCP scheme.
  - Additional rail services into Cambridge North station from the south, over and above those that are already planned to stop there. This would provide for trips by people living near to the railway, and would provide opportunity for longer trips to be intercepted at Meldreth, Shepreth, Foxton, Audley End, Great Chesterford, Whittlesford Parkway and Shelford. This could be achieved by:
    - Extending all stopping services between Royston and Cambridge and Stansted Airport, Audley End and Cambridge to Cambridge North.
    - Cross Country services from Birmingham to Stansted Airport serving Cambridge North.
- From the **A428 to the west of Cambridge**, this could potentially be provided by:
  - Bus services between St Neots, Cambourne or a Park and Ride facility on the A428, and the CNFE / CSP area. This could utilise:
    - The GCP's Cambourne to Cambridge Scheme.
    - The segregated bus links that are being provided through the Cambridge Northwest and NIAB developments between Madingley Road and Histon Road.
    - The existing Busway between Histon Road and Cambridge North Station.
- From the **A14 to the northwest of Cambridge**, this could be provided by:
  - Existing, and expanded, busway services between St Ives, Northstowe, the CSP and Cambridge North Station.

There is further scope to reduce pressure on the A14, A428, M11 and A10 for trips into the area by providing effective alternative provision for other trips that travel on these routes through the area rather than having the area as an origin or destination. Measures that could contribute to achieving this include:

- Cambridge South Station, providing for trips into the Cambridge Biomedical Campus from the north by rail, taking pressure off the A10, A14 and M11.
- Improved rail links into Cambridge from the east and west, taking pressure of the A14 and A428.
- Further development of the GCP City Access suite of measures to improve conditions for pedestrians, cyclists, and public transport in the city more widely.

Many of the interventions noted above are already included in plans of, or being investigated by, the Greater Cambridge Partnership, the Cambridgeshire and Peterborough Combined Authority and Cambridgeshire County Council. Further, it is understood that a number of the rail interventions noted above are being investigated by Network Rail and local / regional partners. These include:

- Cambridge South Station
- A new rail link between Oxford and Cambridge (East West Rail western and central sections)
- Improved links between Cambridge, Norwich and Ipswich (East West Rail eastern section)
- Further development of the GCP City Access proposals that are seeking to help more people get into, out of and around the city by sustainable means, offer better alternatives to travel by car and boost economic growth and quality of life.

The overall capacity for current and new rail services in the Cambridge area to cater for growth and new travel demand is likely to need to be considered in detail, and the growth context in the CNFE / CSP area and the recommendations from this study should inform any such work.

3. Highway capacity

It is recommended that further work looks at the operation of the Milton Interchange between the A14, A10 and A1309 alongside the consideration of options for the dualling of the A10 recommended by the 'Ely to Cambridge Transport Study: Preliminary Strategic Outline Business Case'. This work would establish what additional highway capacity at the interchange could usefully be provided. It would also need to consider linkages with the work looking at extending the M11 to the A47, as it is possible that provision of this route could provide for many of the longer distance movements that a major improvement to the Milton Interchange might cater for.

It is noted that, even with car growth restrictions in place, the highway access – and particularly egress – capacity of both sites will need to be addressed as development comes forward. It is recommended in the light of the sites' limited highway access points and proximity to the strategic network that further detailed work and stakeholder liaison will be required to identify and agree a suitable and proportionate highway access strategy for the sites that reflects the needs of pedestrian, cyclists, and public transport users in addition to rationalising car access.

Next Steps

The study has shown that whilst the sites have good access to the strategic highway network and to wider public transport connections through the busway and Cambridge North station, in order for the sites to be developed to their full potential there will need to be far less reliance on the private car to access the sites and much greater emphasis on the use of non-car modes. Delivery of a number of schemes already being planned across the city is one key aspect to unlocking further significant growth at these sites. There may be a role for developers to support delivery of these measures in some instances. There are also potentially other measures that will need to be delivered and these should be explored through detailed masterplanning and transport assessment work. The study has also shown that further work will be needed in the following areas to progress the planning of this important area of the city.

- Further detailed work should be undertaken in partnership with the local planning authorities to look at measures such as stringent parking constraint and a vehicular trip budget for the sites which will help to control the number of vehicular trips accessing the site. This will help inform the mitigation needed to provide sufficient transport capacity catering for all modes to accommodate the number of people looking to access the level of development proposed on each site.
- Further work is undertaken to look at the operation of the Milton Interchange to establish what additional highway capacity at the interchange could usefully be provided.
- Further detailed work and stakeholder liaison will be required to identify and agree a suitable and proportionate highway access strategy for the sites that reflects the needs of pedestrian, cyclists, and public transport users in addition to providing appropriate car access.

1 Introduction

1.1 Study Background

Mott MacDonald has been commissioned by Cambridgeshire County Council (CCC) to deliver the Ely to Cambridge Transport Study. The indicative study area includes the rail route and the A10 route between Cambridge and Ely, the B1049 between Wilburton and the A14 at Histon Interchange, and the B1047 though Horningsea and Clayhithe to the A14.

As specified in the study brief, the outputs of the study will be:

- Strand 1 – An Options Study and Strategic Outline Business Case for the overall package of interventions in the Ely to Cambridge study area, including development of principles/mechanisms for securing appropriate developer contributions.
- Strand 2 – A Transport Study to identify the specific transport requirements, access options and measures, their costs, acceptability and any implications for the phasing of development of a new town north of Waterbeach.
- Strand 3 – A Transport Study to identify the specific transport requirements, access options and measures, their costs, acceptability and any implications for the levels of development and phasing of, a significant parcel of land in the north-east of Cambridge, known as Cambridge Northern Fringe East (CNFE) and Cambridge Science Park (CSP).

This report outlines the findings of the Strand 3 Transport Study. The CNFE and the CSP sites are key trip attractors at the south end of the study corridor and locations of significant potential future development as allocated in the submission South Cambridgeshire and Cambridge City Local Plans[1].

1.2 Report Structure

The report is structured as follows:

- The existing conditions are outlined in Section 2
- The development proposals are outlined in Section 3
- The future conditions are described in Section 4
- The proposed interventions are identified in Section 5
- Implementation considerations are discussed in Section 6
- The report is summarised in Section 7

[1] South Cambridgeshire Local Plan, Proposed Submission, July 2013

2 Existing Conditions

The purpose of this section is to provide a summary of the existing status of the development sites, the travel demand they generate and the performance of the surrounding transport network.

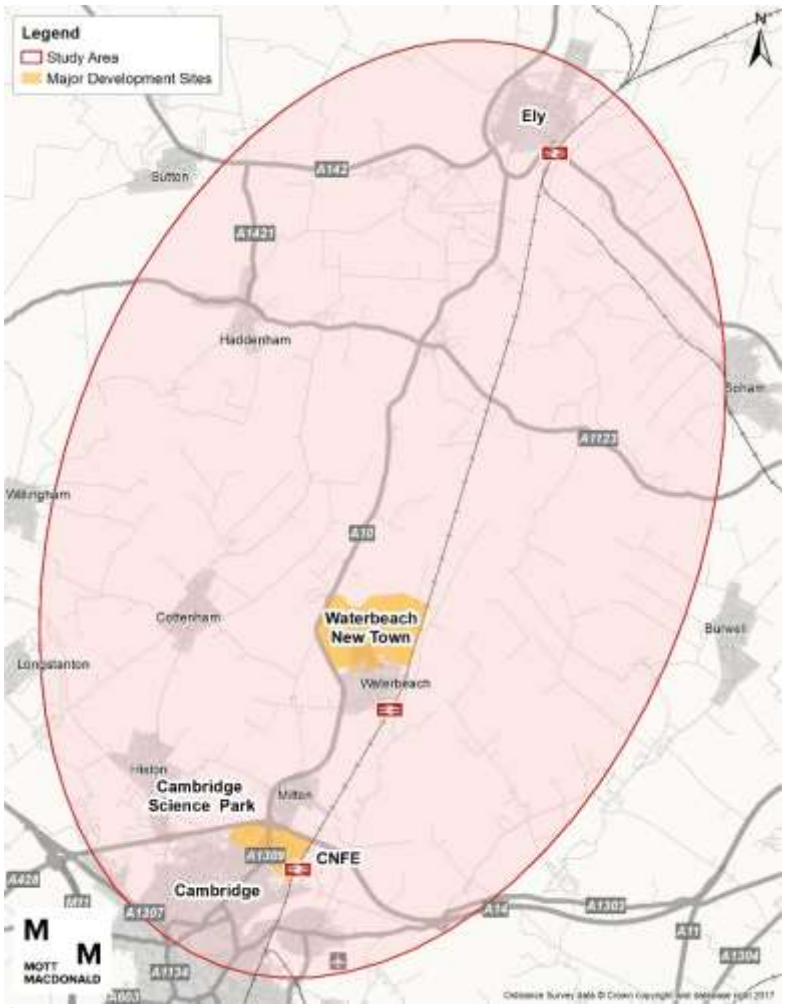
2.1 Development Site Status

The CNFE and CSP sites are key trip attractors at the southern end of the study corridor, together accounting for approximately 30% of the office and research space in Cambridge. Further future development opportunities of the sites are allocated in the South Cambridgeshire Local Plan.

The CNFE site is currently comprised of office and industrial uses, while the CSP site is predominantly office use. Employment levels at both sites equates to approximately 6,000 employees.

A location plan of the two sites and their relationship with the study corridor is illustrated in Figure 1.

Figure 1: Indicative Ely to Cambridge Transport Study Area



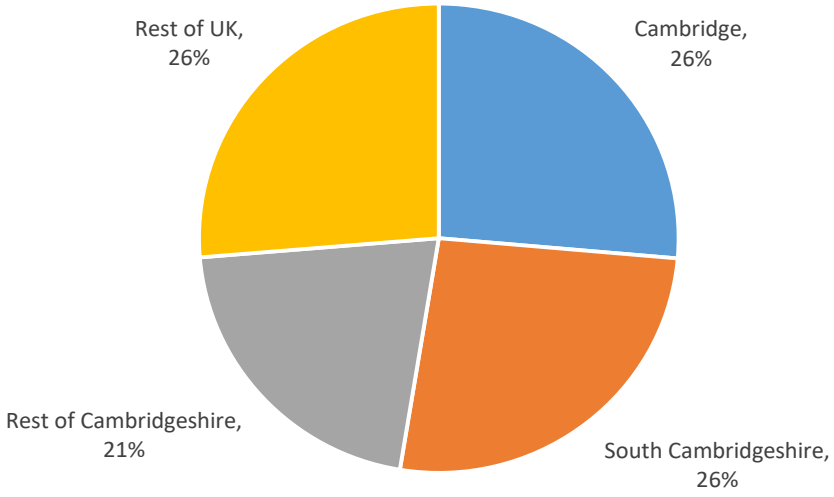
Source: MM

2.2 Development Travel Demand

2.2.1 Existing Distribution

Figure 2 below illustrates the distribution of commuting origins of people working in the two Middle Super Output Areas (MSOA) that included CNFE and CSP at the time of the 2011 Census (see Appendix A). These MSOAs also include employment locations within Milton and Chesterton, but the sites comprise the majority workplace destinations within these areas. It is also appreciated that there has been some further development at these sites since 2011, but it is not expected that this will have significantly affected the catchment area.

Figure 2: Home locations of workers in the CNFE and CSP Middle Super Output Areas (MSOA)

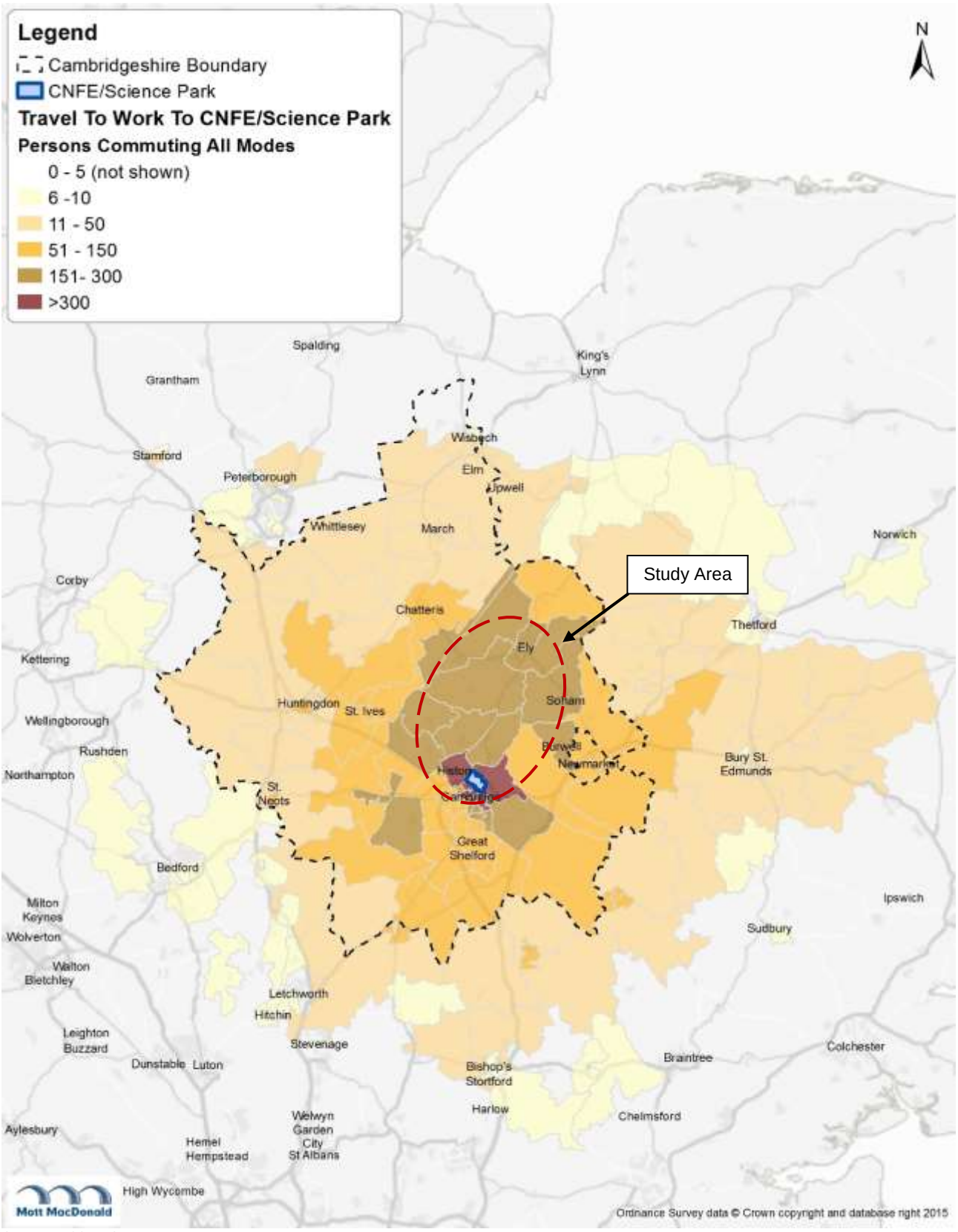


Source: 2011 Census

The chart demonstrates that over half of the employees in these MSOAs live within Cambridge and South Cambridgeshire, while a further 21% live in the rest of Cambridgeshire overall.

The following figure shows the full employee catchment area on which this chart is based, together with the indicative study area, and this shows that a sizeable proportion of Cambridge and South Cambridgeshire employees live in or near the study area.

Figure 3: CNFE/CSP MSOAs employee catchment distribution with indicative Study Area added



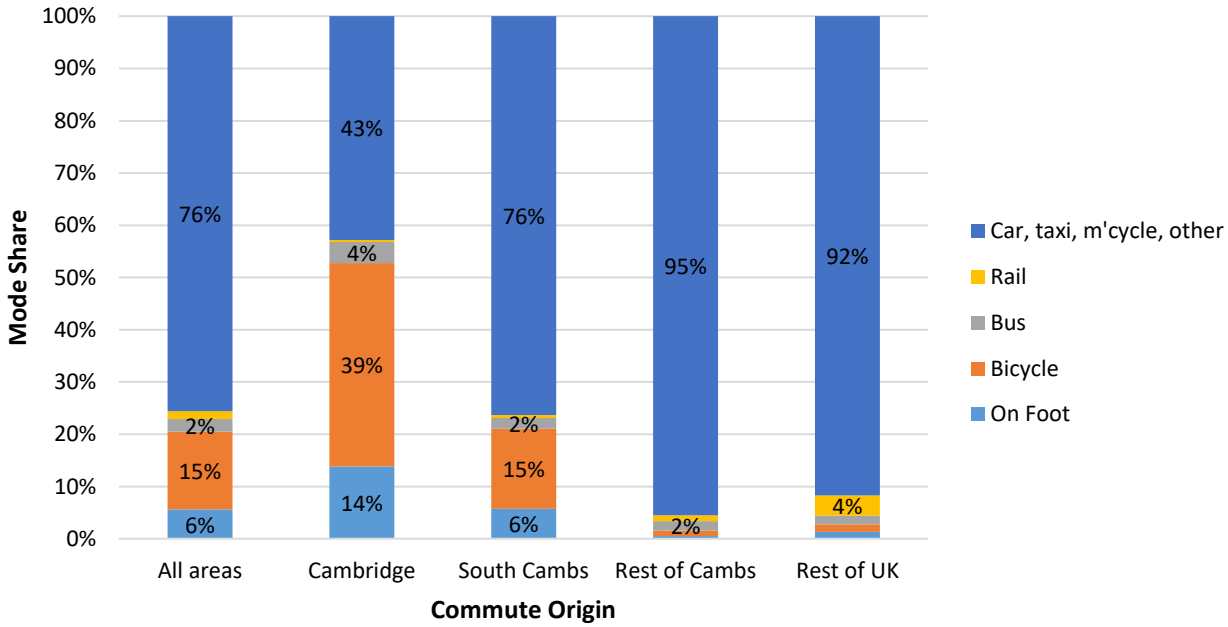
Source: 2011 Census

2.2.2 Mode Share

Further utilising the 2011 Census data, Figure 4 shows the average travel to work (main) mode distribution of all trips with a destination within the CNFE and CSP MSOAs. This result is then broken down to show average mode shares for those commuting to the CNFE and CSP MSOAs from the following localities:

- Cambridge
- South Cambridgeshire
- Rest of Cambridgeshire
- Rest of UK

Figure 4: Travel-to-work mode shares for all trips with a destination within the CNFE / CSP MSOAs



Source: Census 2011

It is noted that the 2011 census took place prior to the opening of the Cambridge North rail station in 2017. As a result, the existing public transport mode share is likely to be under represented in these figures.

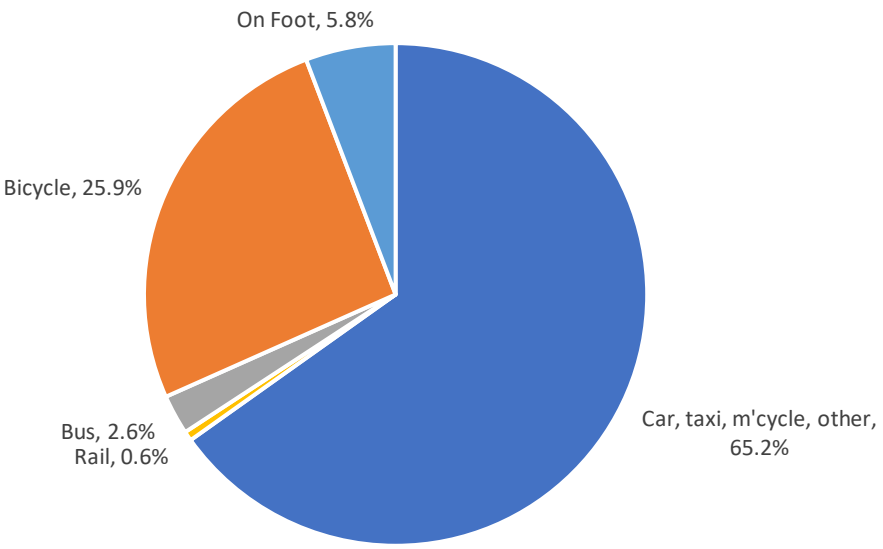
In summary, Figure 4 demonstrates that:

- Overall mode shares for travel to work trips in the MSOAs is 76% car, 21% active modes and 3% public transport.
- When analysing the commuting origin, the car mode share increases as the availability of alternative active modes or public transport modes decreases:
  - Cambridge trip origins have mode shares of 53% active modes, 4% public transport and 46% car.
  - However, the rest of Cambridgeshire and rest of the UK yield car mode shares of 91% and 92% respectively, due to fewer opportunities for non-car modes.
  - South Cambridgeshire presents a mode share pattern that lies between these two extremes, highlighting that some parts of this district are well served by non-car modes and others less so. Given the proportion of employees that live in this district, however, an improvement in non-car mode availability and performance would potentially deliver overall mode share improvements for the sites.

- Cycling is the predominant active mode choice, being nearly three times higher than walking. This partly reflects the size of the sites and the distance from much of the residential area of Cambridge, paired with the extensive cycle network within the city.
- Bus is the predominant mode choice over rail, due to the direct accessibility of the sites to the local bus network, though rail access has since been improved with the opening of the Cambridge North Rail Station. However, the mode share for both bus and rail are very low overall, even for local trips from Cambridge where cycling is the preferred car alternative. Outside Cambridge, a combination of factors is likely to contribute to making these modes unattractive, including uncompetitive journey times, poor bus stop coverage and limited public transport catchment.

Mode share data for travel to and from the CSP and CNFE sites is also collected annually by the Travel for Cambridgeshire Partnership. This 'Travel Plan Plus' area covers the Cambridge Regional College, Cambridge Science Park and the Cambridge Business Park. Unlike the census result, it does not cover the whole of the CNFE site, but neither does it include Milton and Chesterton. It also represents a lower sample rate than the census, but covers all journey purposes – not just travel-to-work – and provides data from 2016. With these differences in mind, the following figure shows the 2016 mode share result (excluding home workers) derived from this data source.

Figure 5: Travel Plan Plus area 2016 survey mode share result



Source: Travel for Cambridgeshire Partnership

Relative to the Census, this survey shows similar results for walking, bus and rail, but a 11% higher result for cycling and a 11% lower result for car travel. This latter difference will be at least partly due to the fact that this survey includes all trip purposes including student travel to and from the college rather than just journeys to work, and student travel is more likely to be by bicycle than by car. It is therefore expected that this car mode share result is more reflective of overall travel patterns to the site than the census mode share which focusses on work trips only.

2.3 Transport Network Performance

2.3.1 Summary of Transport Provision

Figure 6 shows the main transport networks which serve the CNFE/CSP sites, which are analysed in turn in the following sections.

Figure 6: CNFE/CSP transport network

Source: OpenStreetMap and TRACC

2.3.2 Highway Network

Both the CNFE and CSP sites are well located with respect to the strategic network. The A14 runs east-west along the north of the sites and can be accessed via Milton Interchange, or via Histon Interchange by using King Hedges Road. The A10 can be also be accessed at Milton Interchange. The A10 route connects Kings Lynn to London, via Downham Market, Ely, Cambridge and Royston. Similarly, the A14 is a strategic road of national importance that links the Port of Felixstowe to the M1 and M6, via Bury St Edmunds, Newmarket, Cambridge, Huntingdon and Kettering.

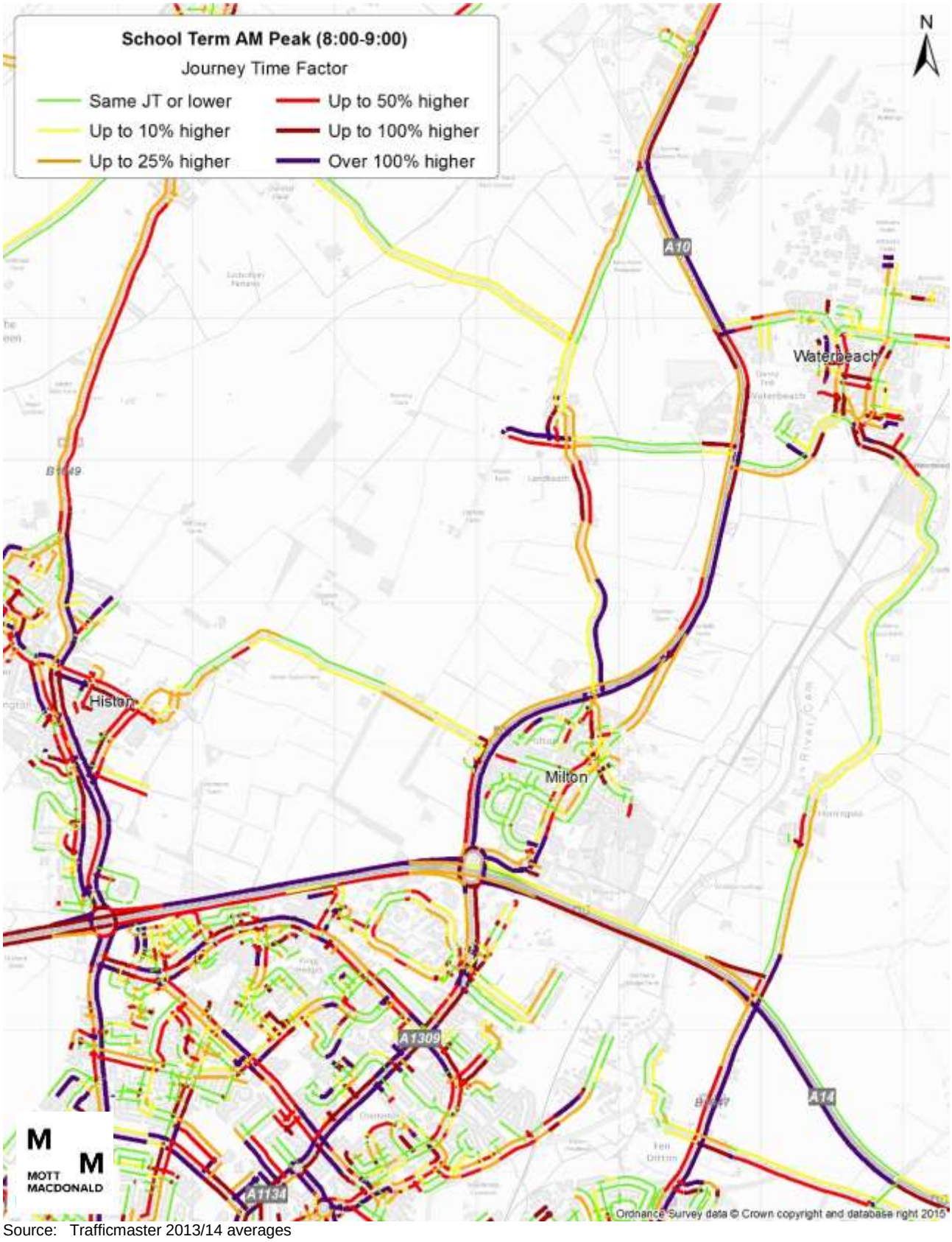
To access these strategic routes, both sites must use the A1309 Milton Road which runs between the two sites and provides a connection with the A10/A14 at Milton Interchange. The CNFE has its main access points on Cowley Road and Cowley Park, both of which are signalised junctions with the A1309. The small portion of the site to the south of the Guided Busway is accessed via Nuffield Road, which connects to the A1309 via Green End Road. The CSP has direct access onto Milton Road, using a signalised junction from Cambridge Science Park Road. An alternate egress point for the CSP is via the Cambridge Regional College onto Kings Hedges Road, which also provides access to the A14 at Histon Interchange.

A full journey time assessment of the existing road network is provided within the Baseline Report, and the Trafficmaster 2013/14 journey time results are repeated in Figure 7 and Figure 8 below to illustrate peak hour congestion conditions in the vicinity of the two sites.

These show:

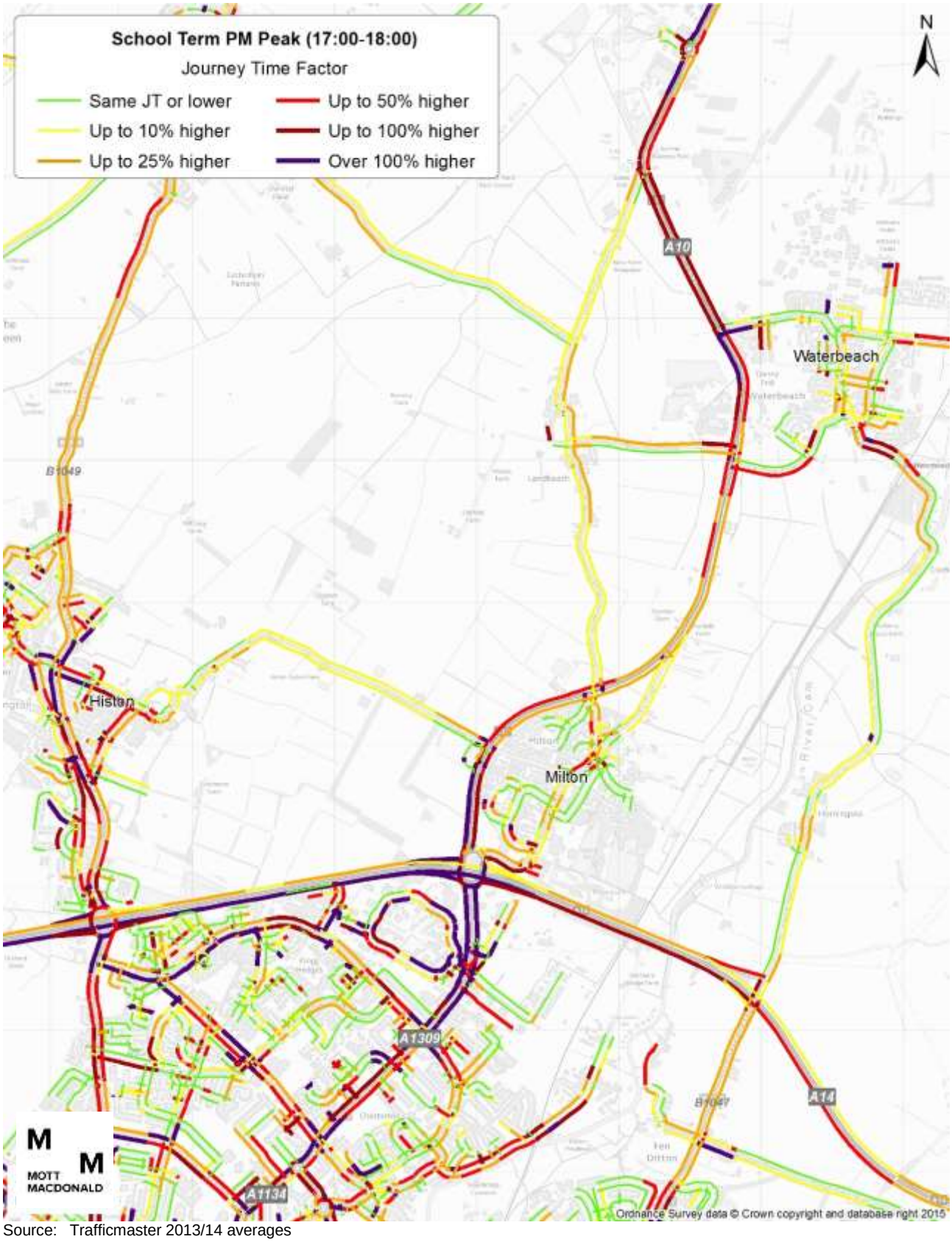
- Significant AM peak delays on all approach arms to the Interchange at Milton, including the A14
- Significant AM peak congestion on the A1309 into Cambridge city centre, and on Kings Hedges Road between the A14 and CSP
- Significant PM peak delays on either side of the Milton Interchange on the A10 and the A1309, resulting in egress delays within the CSP site
- Significant PM peak delays on the A14 westbound from the Milton interchange, and on Kings Hedges Road between CSP and the A14

Figure 7: School term-time AM Peak journey times as factor of free-flow journey times



Source: Trafficmaster 2013/14 averages

Figure 8: School term-time PM Peak journey times as factor of free-flow journey times



Source: Trafficmaster 2013/14 averages

2.3.3 Car Parking

In October 2016, a Cambridge-wide parking survey[2] was undertaken whereby capacity and weekday occupancy levels of all Private Non-Residential (PNR[3]) parking in the city was identified. The results for the study areas are summarised in Table 1.

Table 1: 2016 PNR measured capacity, demand and utilisation levels at CNFE / CSP

Zone	Capacity	Demand	Utilisation
CNFE	2,670	1,502	56%
CSP	6,911	3,473	50%
Total	**9,581**	**4,975**	**52%**

Source: Mott MacDonald Cambridge Private Non-Residential Parking Study, November 2016

The table above shows that overall only 52% of the existing parking spaces at CNFE and CSP are utilised. This therefore suggests that, across the area as a whole, there appears to be an overprovision of parking, such that it is not acting as a restraint on car use.

Table 2 shows the level of employment (to the nearest 100) in CSP and CNFE in 2014 (extracted from the Business Registered and Employment Survey). The table also shows the estimated B1 class floorspace area based on a typical ratio of 1:20 squares meters per employee (taken from the Employment Density Guide 3rd Edition published by the Homes and Communities Agency – November 2015[4]).

Table 2: CSP and CNFE estimated parking ratios based on parking supply

Site	Employees (2014)	Est B1 Floorspace (sqm)	Parking Supply (spaces)	Ratio (sqm per space)
CNFE	6,200	124,000	2,670	46
CSP	7,300	146,000	6,911	21
Total	**13,700**	**274,000**	**9,581**	**29**

Source: Business Register and Employment Survey and 2016 PNR survey

Considering the overall parking capacity of 9,581 spaces in the CSP / CNFE area, the resulting parking ratio across both sites is 1 space per 29 sqm of floor area. This figure exceeds the 1 space per 40 sqm standard in the submission Cambridge Local Plan and would likely exceed the emerging South Cambrideshire Local Plan standard also. Though 1 space per 30 sqm is the indicative standard provided by this plan for B1 development, the plan also requires that standards be set on a site-specific basis taking into account location and encouraging innovative solutions. Given the relative multi-modal accessibility of the CNFE/CSP sites, these would likely be subject to a more stringent standard than the indicative level provided by the plan. The above average parking ratio for both sites therefore exceeds the standards of both plans, while the ratio for the CSP site alone is significantly in excess.

However, since the above survey data shows that the total parking stock on both sites is not being fully utilised, the following table shows the equivalent estimated parking ratios based on actual use.

Table 3: CSP and CNFE estimated parking ratios based on surveyed parking demand

Site	Employees (2014)	Est B1 Floorspace (sqm)	Parking Demand (spaces)	Ratio (sqm per space)
CNFE	6,200	124,000	1,502	83
CSP	7,300	146,000	3,473	42
Total	**13,700**	**274,000**	**4,975**	**55**

Source: Business Register and Employment Survey and 2016 PNR survey

[2] http://www.gccitydeal.co.uk/citydeal/download/downloads/id/448/private_non-residential_parking_report.pdf

[3] PNR parking is defined as any off-street parking which exists to serve a non-residential land use. It therefore includes all off-street parking except public general use car parks and private residential parking. For clarity, all public car parks on the Council's website were not included in the survey.

[4] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/484133/employment_density_guide_3rd_edition.pdf

This table shows that the parking ratio for both sites, when based on actual utilisation rather than on total provision, falls within the indicative parking standards for both Cambridge and South Cambridgeshire. However, this level of utilisation is not constrained by a lack of supply, so it can be expected that the current provision levels are contributing to the current high car mode share level at the sites and that more stringent parking standards in future – in combination with improvements to non-car modes – would deliver a reduction in this mode share. Such future measures are discussed further in Section 5.1.1 below.

2.3.4 Rail Network

Prior to the opening of the Cambridge North railway station in May 2017, both sites were located approximately three miles north of the mainline Cambridge railway station. As a result, an additional transfer was required to active modes or public transport to access the CSP and CNFE sites.

Cambridge North railway station provides a closer rail connection to the CSP and CNFE sites, being located within one mile from CSP and 0.5 miles from CNFE. This provides an important rail connection to the site, and to the Cambridgeshire Guided Busway and Park and Ride bus services. Central London stations are also directly accessible from the CSP/CNFE sites, along with regional destinations such as Ely and Norwich. These services are summarised in the following table.

Table 4: Train services from Cambridge North rail station

Destination	Duration	Weekday Frequency
Cambridge	4 minutes	15 mins
Ely	13 minutes	30 mins
Norwich	48 minutes	60 mins
London King's Cross	54 minutes	30 mins
London Liverpool Street	1h 29 minutes	60 mins

Source: Rail timetables

Existing train services from Cambridge also provide direct services to London via the Great Northern line to Kings Cross or the West Anglia Line to Liverpool Street. Other regional centres also have connections from Cambridge station, which are detailed in the following table, with destinations ascending in order of journey time.

Table 5: Train services from Cambridge rail station

Destination	Duration	Weekday Frequency
Cambridge North	4 minutes	15 mins
Ely	16 minutes	10-20 mins
Stansted Airport	30 minutes	40-60 mins
Kings Lynn	45 minutes	30-60 mins
London King's Cross	50 minutes	15-30 mins
Peterborough	50 minutes	60 mins
Ipswich	1h 15 minutes	30-60 mins
London Liverpool Street	1h 15 minutes	20-30 mins
Norwich	1h 20 minutes	60 mins
Leicester	1h 45 minutes	60 mins
Birmingham New Street	2h 40 minutes	60 mins

Source: Rail timetables

Further destinations to Brighton and Maidstone East will commence when the Thameslink Programme is completed, anticipated in 2018. These are expected to operate on a fast timetable to Brighton, and a semi-fast service to Maidstone East.

As outlined in the Baseline Report, the journey times compare favourably to the highway peak period journey times to the same locations. Passenger numbers at Cambridge station have grown continuously since 1997/98 at above the average East region and England growth levels.

2.3.5 Bus Network

The CNFE and CSP sites are both served by several bus routes, in addition to the Cambridgeshire Guided Busway. These routes are outlined in Table 6 below.

Table 6: Bus frequencies for routes serving the CNFE and CSP sites

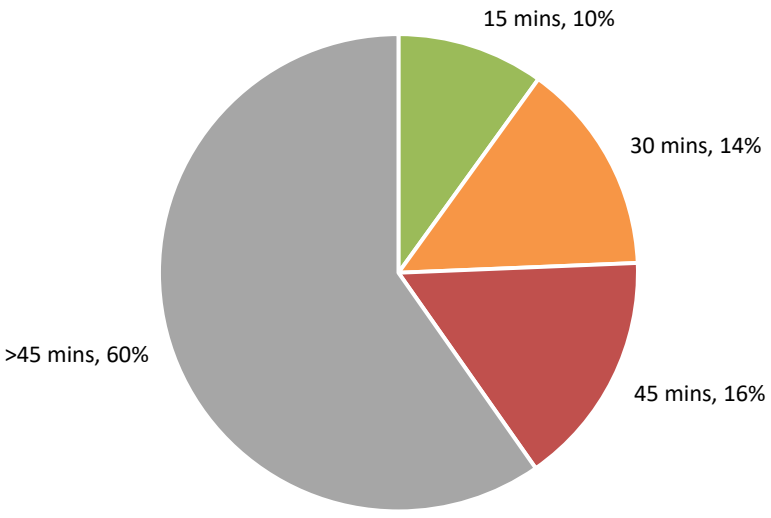
Service	Destination (from Cambridge)	Day Frequency	Evening Frequency	Weekend Frequency
9	Chatteris via Waterbeach	30 mins	30 mins until 19:15	Saturday only, 30 mins
X9	Littleport	60 mins (AM only)	60 mins	60 mins (morning/evening only)
99	Milton Park and Ride	10 mins	20 mins	Sat 10 mins, Sun 15 mins
Citi Network	Cambourne/Swavesey/Oakington	20 mins	30 – 50 mins	Sat 20 mins, Sun 60 mins
Busway (C)	St Ives via Longstanton	40 – 60 mins		Sat 40 – 60, Sun 1 – 2 hours
Busway (A)	Chatteris/Ramsey/Trumpington	15 mins	15 – 30 mins	Sat 15 – 30, Sun 30 mins
Busway (N)	St Ives via Longstanton	60 mins	-	Sat 60 mins

Source: Bus timetables

At present, bus services do not run directly through either of the sites, but there are several bus stops on Milton Road and Kings Hedges Road. Figure 10 below illustrates the 400m catchments of bus stops around the development sites. Approximately two thirds of the CSP site is covered by a bus stop with at least five services per hour, while only a portion of the CNFE site is within 400m of a bus stop. The furthest distance from a bus stop within the CSP site is about 700m, and about 1km within the CNFE site.

The Baseline Report also considers the overlap between public transport routes (including rail, but not the impact of Cambridge North station) serving the two sites and the residential locations of employees working at the two sites, as per the 2011 Census. The summary result is shown in the following figure, which shows that only 24% of employees' home locations is within 30 minutes' travel time of the sites by public transport, while 60% are either beyond a 45 minute travel time or without access to a service.

Figure 9: Distribution of CNFE and CSP workers' home locations (2011) by PT travel-time



Source: TRACC and Census 2011 data

Figure 10: 400m catchment areas for bus stops of different service frequencies

Source: TRACC

This service catchment, together with lack of bus penetration to the sites, the levels of peak-hour delay on the surrounding highway network and the high levels of cycle use in Cambridge, are all contributory to the low current public transport mode share of trips to and from the sites.

2.3.6 Active Travel Network

As illustrated in Figure 6, there is a good network of cycle routes in the vicinity of the site and there is a small cycleway network within the CSP. The CNFE site benefits from National Cycle Route 11 which passes directly through the site on Cowley Road. The full extent of the route links Harlow with King's Lynn via Cambridge and Ely, and is 91 miles long at present in its full extent.

National Cycle Route 51 is also in the vicinity, which is 209 miles long in total that links Milton Keynes, Bedford, Bury St Edmunds and Ipswich along with Oxford, Cambridge, Harwich, Colchester and Felixstowe.

The site also benefits from connections with extensive cycle routes within Cambridge, which are a mixture of dedicated cycle lanes on street and cycle routes.

It is noted from the above development mode share results that cycling represents the highest non-car mode share for trips to and from the sites, which is partly a reflection of these connectivity levels.

2.4 Summary

The sites are well located with respect to the strategic highway network and to Cambridge city centre, but this advantage is constrained at peak times by significant levels of delay on these routes. The sites also provide significantly more parking than is actually used, meaning that parking provision does not currently place a restraint on car use to and from the sites.

The sites are served by a number of bus routes, including along the adjacent busway, which results in a combined frequency of around nine services per hour during weekday peak hours. However, around a third of the CSP site and around half of the CNFE site lie beyond 400m of a high frequency bus stop, while the furthest distance from a bus stop within each site is about 700m and 1km respectively. Similarly, about 60% of the sites' employee catchment lies beyond a 45 minute travel time by public transport, though the nearby Cambridge North rail station, which opened in May 2017, should provide some improvement to this situation. The proximity of the sites to the extensive Cambridge cycle network also encourages use of this mode.

The outcome of these various factors is that the predominant mode for travel to these sites is the car, at an average mode share of 65%[5], while the active mode share (primarily cycling) accounts for 32%, but public transport (primarily bus) accounts for only 3%.

Overall, the challenge for increasing development at the CNFE and CSP sites is to deliver growth without also delivering a significant increase in car use to the sites and resulting traffic congestion. The current significant delays on the strategic routes around the site, the over-provision of on-site car parking, the under-utilisation of the Milton Park and Ride site, and the lack of bus penetration to the site will place a significant constraint on the potential for sustainable growth unless addressed.

[5] 2016 Travel Plan Plus

3 Development Proposals

The purpose of this section is to define the level and type of development proposed for the CNFE and CSP sites and assumed by this study to be in place by 2031.

3.1 Land Use Proposals

3.1.1 Cambridge Science Park

The Cambridge Science Park (CSP) has been identified in the South Cambridgeshire Local Plan as suitable for intensification[6]. New development proposals for CSP are shown in Table 7, including the development quantum, mix and phasing committed for 2016, as well as estimated net proposals through to 2031. In agreement with the study stakeholders, for the purposes of this modelling exercise a full build-out of the CSP expansion is proposed by 2031, although in reality the build out is likely to continue beyond this period.

Table 7: New development proposals: Trinity Cambridge Science Park

Description	Development Class	Quantity	Profile Through Time				Units	Jobs
		Total	2016	2021	2026	2031		
Office	Commercial	35,653	10,624	8,343	8,343	8,344	GFA sqm	2,996
	Academic Research	35,653	10,624	8,343	8,343	8,344	GFA sqm	2,996
						On Site Job Estimates		**5,992**

Source: Source: Cambridgeshire County Council

3.1.2 Cambridge Northern Fringe East

3.1.2.1 Area Action Plan Options

The Area Action Plan for the CNFE site being developed by local authorities as part of the local plan process has, to date, considered two main development scenarios: Option 2a+ and Option 4a+[7]. The main difference between the options is that Option 2a+ retains the existing Water Recycling Centre on the site, whereas Option 4a+ assumes that these works will be relocated off the site to allow the full site area to be redeveloped. The level of development for both options is outlined in Table 8 and Table 9.

Table 8 : Option 2a+ – CNFE Lower Level Developer option

Option 2a+ as amended by CB4	Units / Floorspace	Jobs	GFA per Job (m^2)
Chesterton Partnership And Nuffield Road Dwellings (no)	1,062	-	-
Chesterton Partnership - B1(a/b) Offices (GFA sqm)	248,932	20,919	12
Chesterton Partnership Retail (GFA sqm)	1,600	91	18
Chesterton Partnership Hotel (GFA sqm)	6,500	33	195
St.John's Innovation Park Office (GFA sqm)	25,000	2,101	12
Option 2a B1c/B2/B8 Industrial (GFA sqm)	50,180	1,416	35
Ancillary Facilities	To be agreed	To be calculated	-
Total Jobs	-	**24,560**	-
Total new jobs (assuming 3,800 existing[8])	-	**20,760**	-

Source: CCC

[6] South Cambridgeshire Local Plan, Proposed Submission, July 2013

[7] The designations '2a+' and '4a+' reflect that the land use numbers have been refined since those in the Land Use Figures paper dated 19th May 2016

[8] As per CSRM1 existing jobs provision for CNFE (source: CCC)

Table 9: Option 4a+ – CNFE Higher Level Developer option

Option 4a+ as amended by Grosvenor Estates	Units / Floorspace	Jobs	GFA per Job (m^2)
Grosvenor, Chesterton Partnership And Nuffield Rd Dwellings (no)	7,692	-	-
Grosvenor, Chesterton Partnership - B1(a/b) Offices (GFA sqm)	261,910	22,009	12
Grosvenor and Chesterton Partnership Retail (GFA sqm)	9,500	543	18
Grosvenor Leisure (GFA sqm)	18,000	277	65
Chesterton Partnership Hotel (GFA sqm)	6,500	33	195
St.John's Innovation Park Office (GFA sqm)	25,000	2,101	12
Option 4a+ B1c/B2/B8 Industrial (GFA sqm)	No space left	1,416	35
Ancillary Facilities	To be agreed	To be calculated	-
Total Jobs	-	**24,963**	-
Total new jobs (assuming 3,800 existing[2])	-	**21,263**	-

Source: CCC

Whilst the preparation of the Area Action Plan is part of the emerging Local Plan policies for the area, it is noted that both of these redevelopment options were presented as potential development outcomes for the site only and have no status in either planning or commercial terms.

3.1.2.2 Development Option Assumed for Initial Study Modelling

For initial Do Minimum modelling purposes in Cambridgeshire County Council's updated Cambridge Sub-Regional Model (CSRM2), and as described in the Strand 1 Options Modelling Report, a variant of the above options was tested. This approach identified 19,100 jobs that could be allocated to the CNFE/CSP sites, with these jobs being split 80:20 between CNFE and CSP respectively. It should be noted that this scenario was developed purely for the purposes of transport modelling and so does not take account of whether it represents either a viable or desirable development mix for the area.

The resulting modelling scenario was originally labelled 'Scenario 3' (later becoming the 'CNFE/CSP Scenario' in the Do Minimum report) and the job totals for this scenario are summarised in the following table, together with a comparison against that proposed for Option 2a+ and Option 4a+. The 1,062 dwellings proposal from Option 2a+ was also retained for this scenario.

Table 10: Comparison of new job totals per development option

Site	Option 2a+	Option 4a+	Scenario 3
CNFE	20,760	21,263	15,280
CSP	5,992	5,992	3,820
Total	**26,752**	**27,255**	**19,100**

This table shows that Scenario 3 included between about 72% and 74% the number of jobs for CNFE compared to the other two options, and about 64% for CSP.

The Do Minimum modelling results for this scenario are presented in full in the Do Minimum Modelling Report.

3.1.2.3 Scenario 3 Rebalanced

The results of the Scenario 3 modelling tests showed that the scale and tidal nature of trips generated by CNFE and CSP in the peak hours resulted in significant impact on the surrounding local and strategic highway networks. In practice, this impact could potentially be mitigated in part through the application of stringent on-site parking standards together with off-site parking management measures to prevent on-street

parking. The CSRM, however, is a strategic transport model and does not include a parking demand/supply sub-model.

It was therefore agreed with the client group to develop a further refined CNFE land use mix which offers greater levels of internalisation and better balanced access and egress flows in order to reduce potential impact on the external network. This, in part, represents a proxy for restricted parking supply by effectively capping car traffic generation levels at a certain level and has therefore been referred to as a 'highway trip budget'.

The process for calculating the revised distribution is described in our separate 'CNFE Alternative Land Use Options (Scenario 3 Rebalanced)' report of 22 January 2018 (attached in Appendix B), and it is important to note that the process outcomes were for the purposes of transport modelling only and so do not take account of whether these represent either a viable or desired development mix for the site. The resulting land use mix applied for modelling purposes is summarised in the following table and labelled 'Scenario 3 Rebalanced', while the equivalent mix from the above Scenario 3 is also shown to allow comparison.

Table 11: CNFE land use mix comparison

Scenario	New Dwellings	New Jobs
Scenario 3	1,062	15,280
Scenario 3 Rebalanced	3,920	3,908
Difference	**+2,858**	**-11,372**

This shows that the Scenario 3 Rebalanced land use mix would involve more houses but fewer jobs than for the above Scenario 3, which increases trip internalisation while reducing trip tidality and scale. The level of trips generated by this suggested development mix is discussed in Section 4.2.1 below.

However, although such an approach places a ceiling on car traffic generation levels, it should be noted that it does not place a ceiling on *development* levels. From a transport perspective, higher levels of development could be accepted provided it could be demonstrated that the highway trip budget is not breached and that other trips can satisfactorily be accommodated by non-car means.

3.2 Transport Proposals

The Do Minimum CSRM2 modelling forecast for 2031 includes a number of future transport measures with the planning status of 'certain' or 'near certain', and which will provide transport benefits to the two sites. A full description of these measures is described in the Do Minimum Modelling Report, but a summary of measures most relevant to the CNFE and CSP sites is as follows:

- A14 Cambridge to Huntingdon Improvement scheme Development Consent Order, including improvements to Milton Interchange
- Bus priority improvements on key radial routes in Cambridge
- Western Orbital bus service from Cambridge Science Park Station to Addenbrooke's
- Increased Park & Ride capacity
- Improvements in rail services, speed and capacity, including Thameslink upgrade and improved rolling stock to provide improved capacity to London, and onward accessibility to south London
- A major network of cycling improvements in and around Cambridge, including segregated routes along major roads and elimination of gaps in the network

In terms of highway access to both sites, the current expectation is that the various existing access points onto Milton Road for the CNFE site and the two existing access points for the CSP site will be retained but with enhanced capacity where deliverable. This provides the basis for the Do Minimum modelling results described in the next chapter. Further access considerations are discussed in Section 5.1.1 below.

3.3 Summary

For modelling purposes, the intensification of the CSP site is proposed to result in about 6,000 new jobs by 2031.

For the CNFE site, various development scale and mix options have been put forward for the site to support the emerging Local Plan, which are primarily employment-led. Modelling of a scenario based on these proposals showed that the scale and tidal nature of trips generated in the peak hours resulted in significant impact on the surrounding local and strategic highway networks.

It was therefore agreed with the client group to develop a further refined CNFE land use mix which offers greater levels of internalisation and better balanced access and egress flows in order to reduce potential impact on the external network. This suggests that a more residential-led development mix for the site, which increases trip internalisation and reduces trip tidality and scale, would provide better transport outcomes. The level of trips generated by this suggested development mix is discussed in Section 4.2.1 below. This level of trip generation forms the basis for deriving a trip budget for the area, but it does not place a ceiling on *development* levels on the sites; the level and mix of development will need to be agreed with the local planning authorities. From a transport perspective, higher levels of development could be accepted provided it could be demonstrated that the highway trip budget is not breached and that other trips can satisfactorily be accommodated by non-car means.

The Do Minimum CSRM2 modelling forecast for 2031 includes a number of future transport measures which will provide transport benefits to the two sites. These include improvements to the A14, and various improvements for bus, Park & Ride, rail and cycle modes. In addition, it is anticipated for modelling purposes that the CNFE and CSP sites will continue to be accessed in future via the existing highway accesses, with capacity enhanced where deliverable.

4 Future Conditions

The purpose of this section is to describe the future transport conditions predicted by modelling to result from the implementation of the full development proposals without development-specific mitigation in place.

4.1 Modelling Method

Modelling of future transport conditions in Cambridgeshire has been carried out using Cambridgeshire County Council's updated Cambridge Sub-Regional Model (CSRM2). CSRM2 is a WebTAG-compliant strategic model which uses base data from 2015, including:

- Validation against recently collected traffic and transportation counts
- All networks (highway, PT, walk, cycle)
- Representation of parking and Park & Ride
- Base transport movement data
- Base land use data
- Matrices derived using a mix of RSI and mobile phone data

Investigations undertaken on behalf of CCC of model performance and journey times in the study area confirm that the model is fit for use in the assessment of this phase of the project.

CSRM2 comprises a highway model, which uses SATURN software, and a multi-modal demand model. This combination allows CSRM2 to simulate the following transport user choices in response to a change in supply and/or demand:

- Change of travel route
- Change of travel time
- Change of travel mode
- Change of travel destination

The modelling results represented in this report are from two future modelling scenarios:

- The Future-Base Scenario, which represents the hypothetical future situation in 2031 where neither the new town north of Waterbeach, CNFE nor CSP intensification developments take place
- The Combined Scenario, which represents the future situation in 2031 where both the new town north of Waterbeach and CNFE/CSP developments take place

Both scenarios have been tested against a 'Do Minimum' transport network in order to identify the unmitigated transport impacts of the above developments through comparing one scenario with the other. The Do Minimum network includes all planned transport schemes in the modelled area with a likelihood status of 'certain' or 'near certain' (see Do Minimum Modelling report for more details).

It is also noted that all modelling results presented below are for the AM and PM weekday peak hours, which are:

- AM peak: 08:00-09:00
- PM peak: 17:00-18:00

4.2 Development Trip Details

4.2.1 Trip Levels

In this section, the impacts of the CNFE and CSP development sites in the Combined Scenario Do Minimum CSRM2 model are considered in terms of the transport parameters of total person trip generation, mode share, site internalisation levels and external trip generation and distributions. The level of development modelled at the sites is described above in Section 3.1.

In order to understand how travel demand for the CNFE and CSP development has been represented in the CSRM2 model, outputs from the CSRM2 demand model have been interrogated. The peak periods used in the demand model are as follows:

- AM Peak (07:00-10:00)
- PM Peak (16:00-19:00)

Conversion factors provided by Atkins have been applied to convert the 3-hour peaks to 1-hour peaks to keep the results consistent with the highway model outputs. Therefore, as outlined above, the peaks investigated are:

- AM Peak (08:00-09:00)
- PM Peak (17:00-18:00)

The level of all-mode person-trip generation calculated by the CSRM demand model for the CNFE and CSP development is shown in Table 12 and Table 13**.**

Table 12: CNFE development person trip generation

Parameter	AM (08:00-09:00)			PM (17:00-18:00)		
	Departures	Arrivals	Total Trips	Departures	Arrivals	Total Trips
External trips	2,231	1,631	3,862	2,190	1,841	4,031
Internal trips	289	289	289	268	268	268
All	**2,520**	**1,920**	**4,151**	**2,458**	**2,109**	**4,299**

Source: CSRM2

Table 13: CSP development person trip generation

Parameter	AM (08:00-09:00)			PM (17:00-18:00)		
	Departures	Arrivals	Total Trips	Departures	Arrivals	Total Trips
External trips	411	3,561	3,972	2,720	336	3,056
Internal trips	42	42	42	56	56	56
All	**453**	**3,603**	**4,014**	**2,776**	**393**	**3,112**

Source: CSRM2

The tables show that overall a higher number of person trips are expected to arrive at the development sites in the AM peak rather than depart, with the opposite being true in the PM peak. This tidal pattern is consistent with the predominantly employment development mix proposed. However, the fact that Scenario 3 Rebalanced includes a rebalanced mix of development is also illustrated in the above trip generation figures as, when looked at individually, the CNFE site has significantly more balanced flows than the CSP site.

Based on the above 'Total Trips' data in the above two tables, Table 14 below shows the overall level of trip internalisation at CNFE and CSP calculated by CSRM2. This shows a higher rate of internalisation for CNFE than for CSP, which reflects the greater balance of complementary land uses modelled for CNFE.

Table 14: Level of development trip internalisation

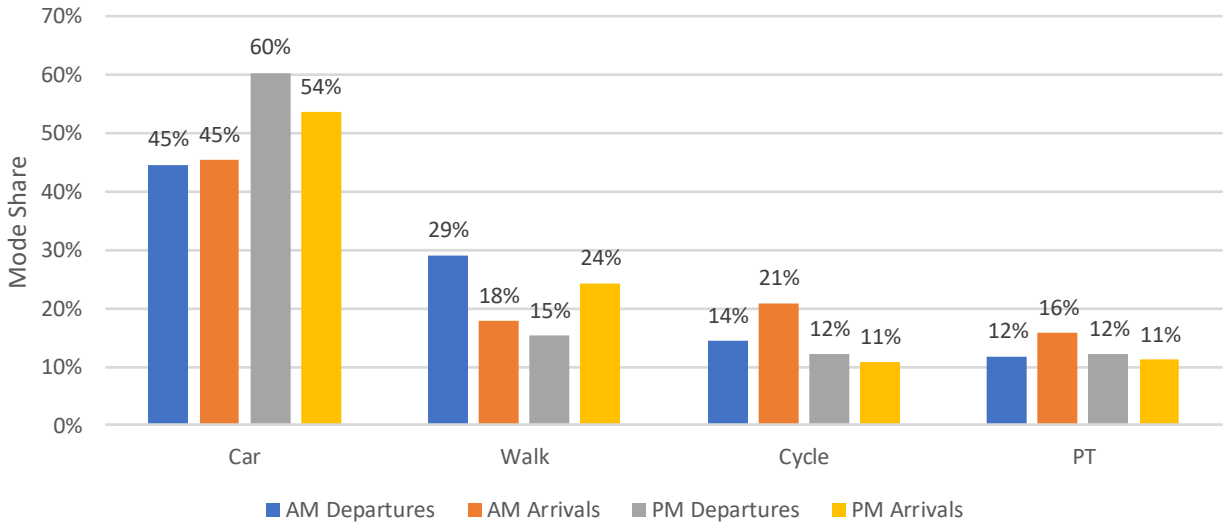
Site	AM Peak (08:00-09:00)		PM Peak (17:00-18:00)	
	Internal	External	Internal	External
CNFE	7%	93%	6%	94%
CSP	1%	99%	2%	98%

Source: CSRM2

4.2.2 Mode Share

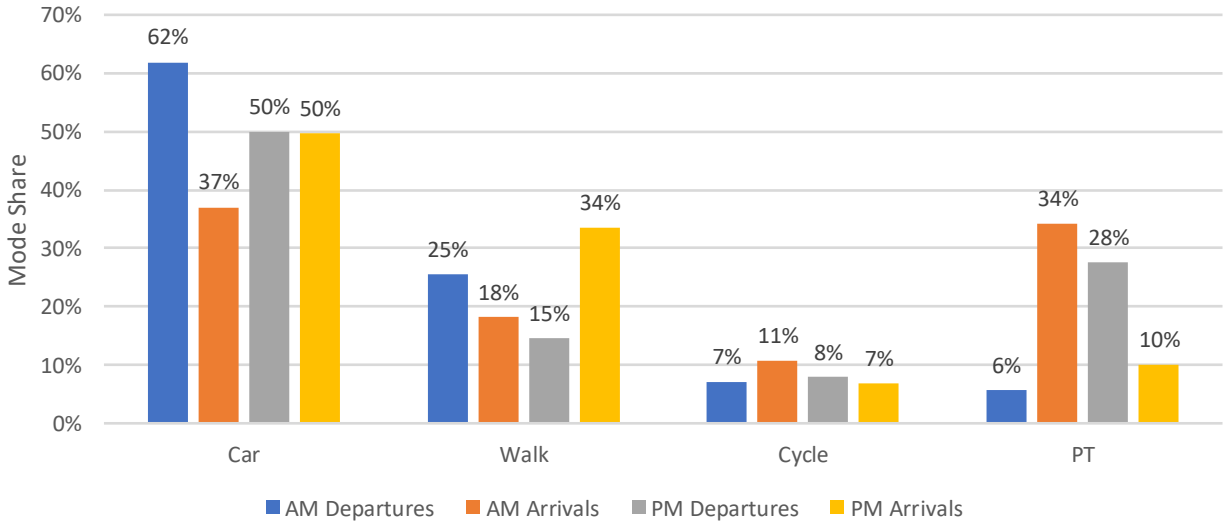
Figure 11 and Figure 12 show the mode share for the CNFE and CSP sites calculated by CSRM2. These are the trips which generate impact on the external transport network.

Figure 11: CNFE forecast mode share for external development trips



Source: CSRM2

Figure 12: CSP forecast mode share for external development trips



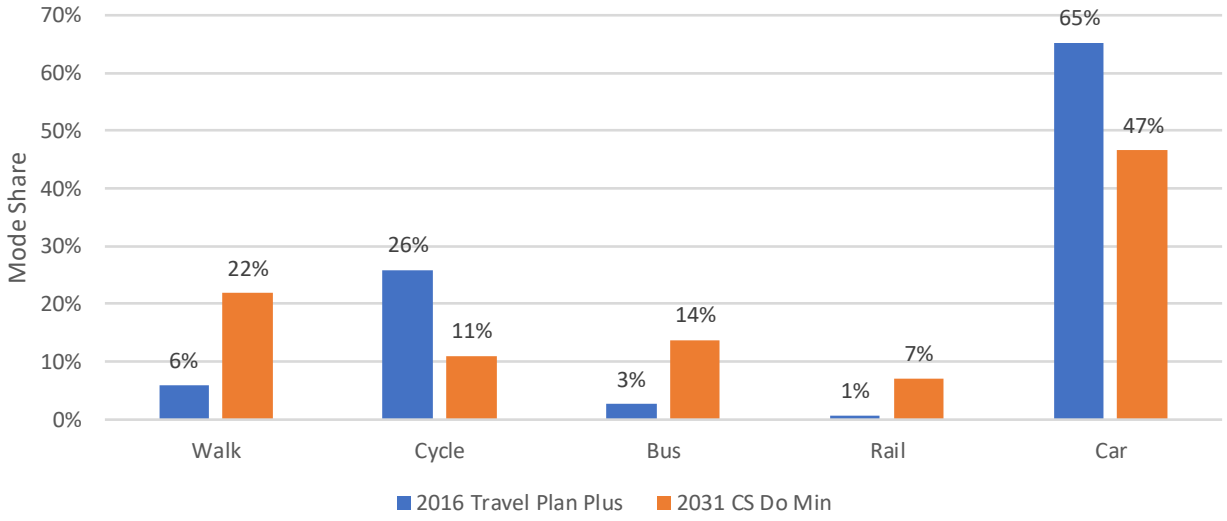
Source: CSRM

Overall, these charts show that car is predicted to be the most common mode for both sites. However, significant percentages are also predicted for walking (up to 34%), cycling (up to 21%) and public transport (up to 34%).

At CSP, there is a relatively high car mode share for departures in the AM. However, it is noted from Table 13 above that this mode share is based on only a small number of departure trips compared to the number of arrivals. There is less difference in actual trips between arrivals and departures at CNFE due to the mixed use of the site. Generally, the differences in mode share between the sites can be in part contributed to the different development mixes, with CNFE having more housing and with CSP being predominantly employment led.

To aid comparison with the mode share results from the 2016 Travel Plan Plus survey described in Section 2.2.2 above, the following chart combines the model mode share results for both sites and across all time periods (AM peak, inter-peak and PM peak) to generate a cross-site 12-hour average weekday mode share and disaggregates the public transport mode share to show rail and bus separately. This is also presented with the 2016 result to aid comparison.

Figure 13: Average full-weekday mode share for CNFE and CSP sites combined



Source: Travel for Cambridgeshire Partnership and CSRM2

This chart shows that, compared to existing mode shares for travel to and from these sites, the model predicts a significant shift towards walking, cycling and public transport modes. This can be attributed to the various improvements to these modes included in the Do Minimum scenario, combined with the greater relative attractiveness of these modes due to increased highway congestion.

4.2.3 Car Trips

Table 15 and Table 16 outline how the above analysis translates into car trips and actual vehicles using the external network in the model.

Table 15: CNFE external car trip generation

Parameter	AM Peak (08:00-09:00)			PM Peak (17:00-18:00)		
	Departures	Arrivals	Total Trips	Departures	Arrivals	Total Trips
Person trips by car	876	730	1,606	1,288	946	2,234
Number of cars	649	589	1,238	961	678	1,639

Source: CSRM2

Table 16: CSP external car trip generation

Parameter	AM Peak (08:00-09:00)			PM Peak (17:00-18:00)		
	Departures	Arrivals	Total Trips	Departures	Arrivals	Total Trips
Person trips by car	269	1,197	1,466	1,446	167	1,613
Number of cars	214	952	1,166	1,184	115	1,299

Source: CSRM2

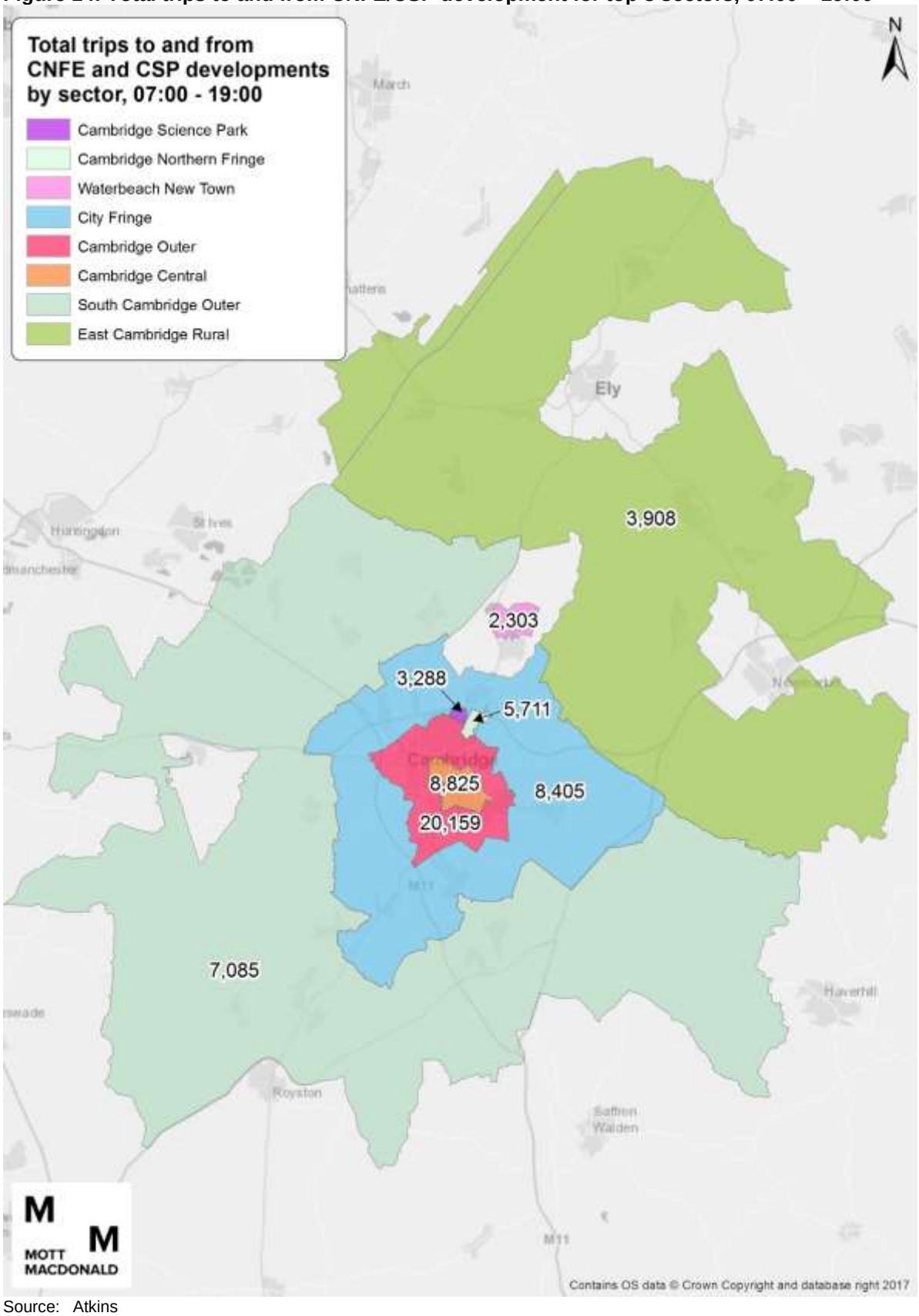
The tables show that the modelled development at both the CNFE and CSP sites combined are predicted to generate a total of around 2,400 external car trips in the AM peak hour and around 3,500 in the PM peak hour.

4.2.4 Highway Trip Distribution

Table 17 shows the top 8 sectors between which trips are generated by the proposed developments at the CNFE and CSP sites in 2031 and lists the actual 12-hour trip levels predicted to be undertaken by mode. Only the top 8 have been shown due to these sectors having over or close to 2,000 total trips during the time period. The remaining sectors have a far lower number of total trips, including Ely with 1,485 trips and a sector ranking of 10th.

These top 8 sectors are shown in Figure 14, and are derived from the CSRM model. A map showing all of the sectors can be found in Appendix C.

Figure 14: Total trips to and from CNFE/CSP development for top 8 sectors, 07:00 – 19:00



Source: Atkins

Table 17: Total trips to and from CNFE and CSP Development by sector, 07:00 – 19:00

Destination	Car	Walk	Cycle	Bus	Rail	GBus	P&R	Total
Cambridge Outer	5,545	7,461	4,021	2,809	142	101	79	20,159
Cambridge Central	2,189	1,934	1,842	2,682	57	0	121	8,825
City Fringe	4,404	2,053	708	1,022	193	25	0	8,405
South Cambs Outer	5,635	12	161	220	496	561	0	7,085
Cambridge Northern Fringe	830	4,382	499	0	0	0	0	5,711
East Cambs Rural	2,696	1	21	221	968	0	0	3,908
Cambridge Science Park	595	2,490	202	0	0	0	0	3,288
New town north of Waterbeach	1,575	46	310	358	14	0	0	2,303

Source: CSRM2

This table shows that the sectors generating the most external development trips are Cambridge Outer, Cambridge Central and the City Fringe.

Table 18 presents the above information in terms of mode share by sector.

Table 18: Total Trips to and from CNFE and CSP Development sector (%), 07:00-19:00

Destination	Car	Walk	Cycle	Bus	Rail	GBus	P&R
Cambridge Outer	28%	37%	20%	14%	1%	1%	0%
Cambridge Central	25%	22%	21%	30%	1%	0%	1%
City Fringe	52%	24%	8%	12%	2%	0%	0%
South Cambs Outer	80%	0%	2%	3%	7%	8%	0%
Cambridge Northern Fringe	15%	77%	9%	0%	0%	0%	0%
East Cambs Rural	69%	0%	1%	6%	25%	0%	0%
Cambridge Science Park	18%	76%	6%	0%	0%	0%	0%
New town north of Waterbeach	68%	2%	13%	16%	1%	0%	0%

Source: CSRM2

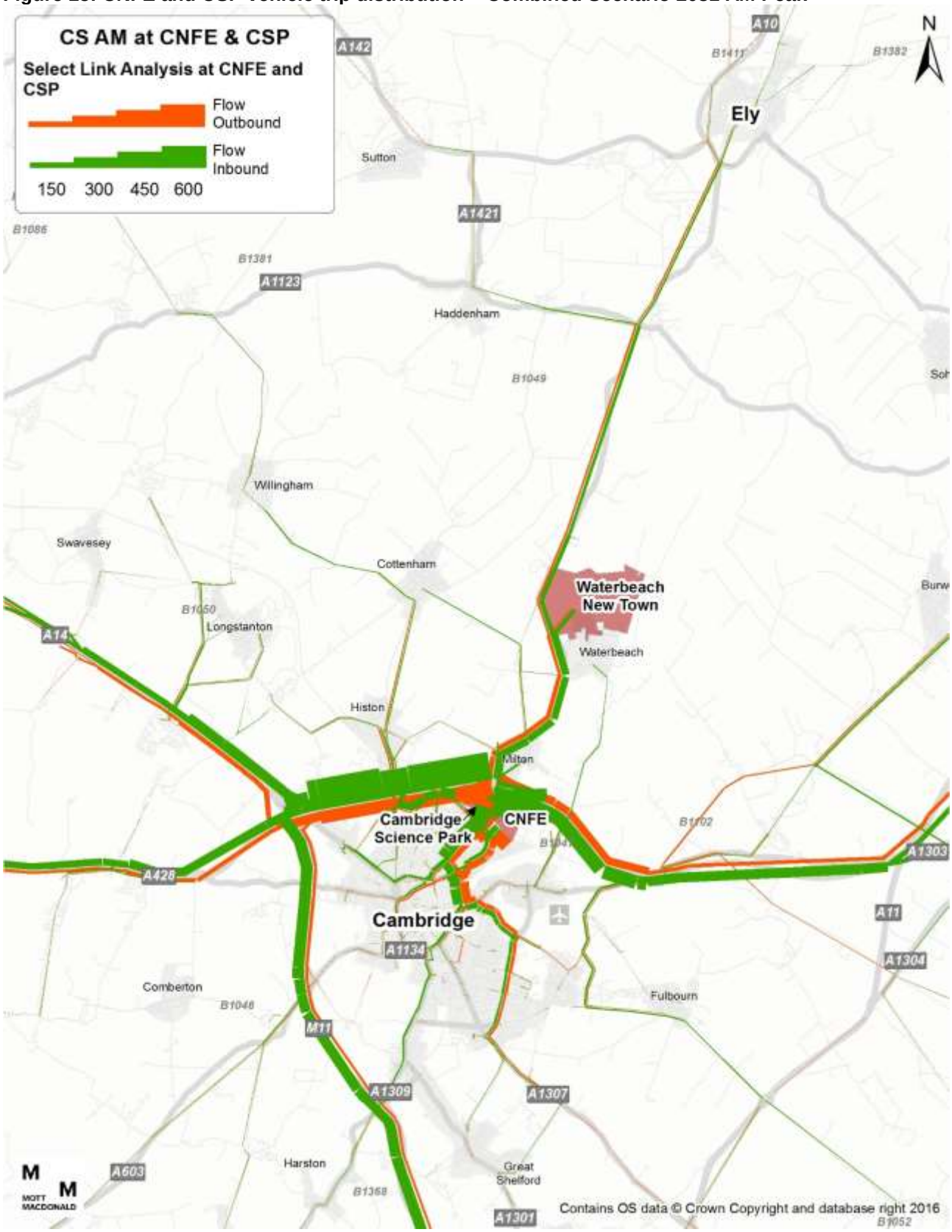
The table shows that there are significant differences in mode share proportions, depending on which sector is being travelled to/from by development related trips. As outlined previously, trips going to and from central Cambridge have a significantly lower car mode share (25%) compared to those going to and from areas such as South Cambridgeshire (80%). This reflects the distances travelled as well as the availability of more sustainable travel choices.

Figure 15 and Figure 16 show how the above distribution of car trips to and from the CNFE and CSP development sites impact the 2031 highway network in terms of development flow distribution during both the AM and PM peak periods respectively.

These figures show:

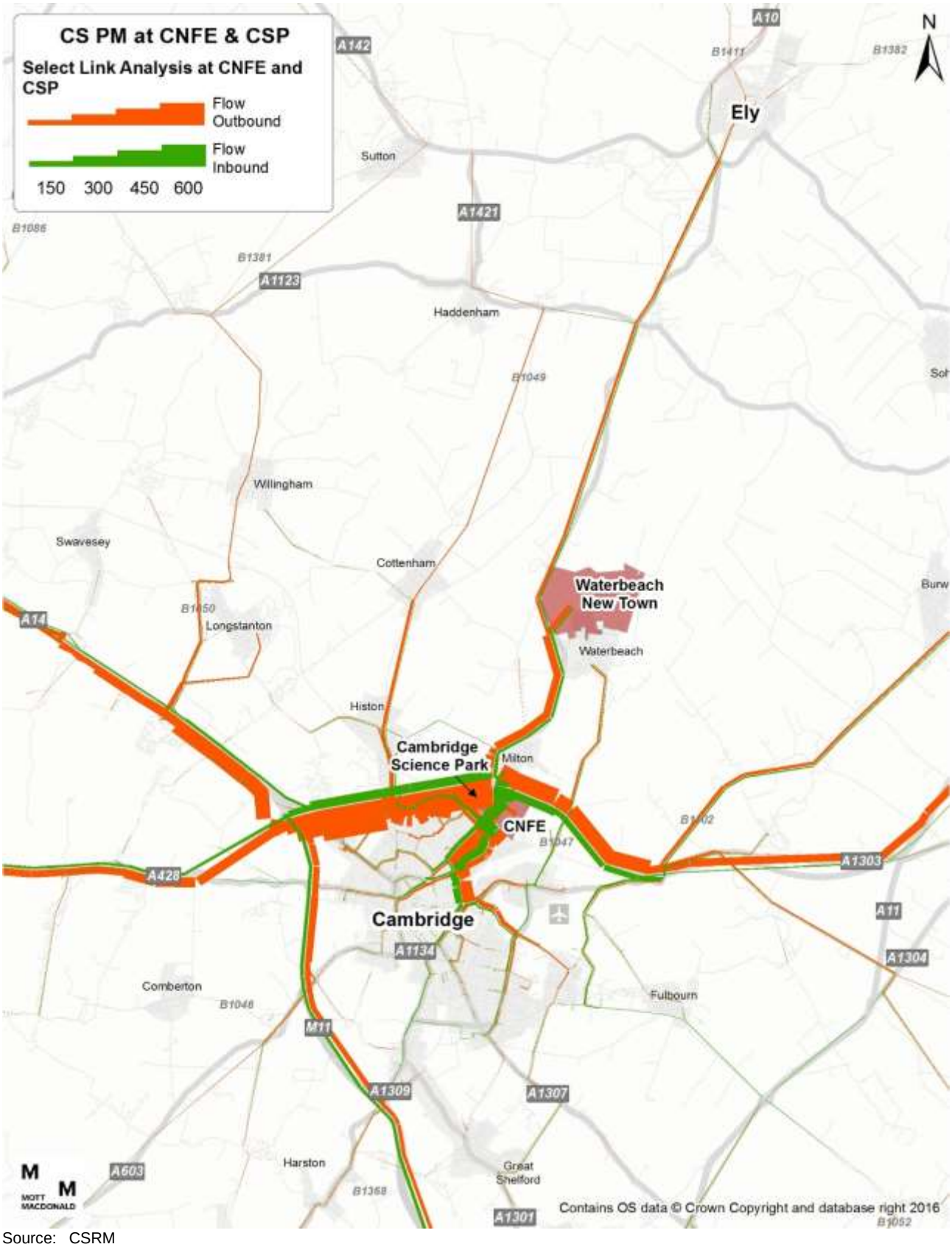
- Highest level of flow impact on the A14 between Milton Interchange and the M11
- Further significant flow on the A14 to the east of Milton Interchange
- A large proportion of A10 development flow coming from/to the new town north of Waterbeach
- High levels of flow from within Cambridge to the sites via Milton Road.

Figure 15: CNFE and CSP vehicle trip distribution – Combined Scenario 2031 AM Peak



Source: CSRM

Figure 16: CNFE and CSP vehicle trip distribution – Combined Scenario 2031 PM Peak



Source: CSRM

4.3 Network Performance

4.3.1 Traffic Flows and Delay

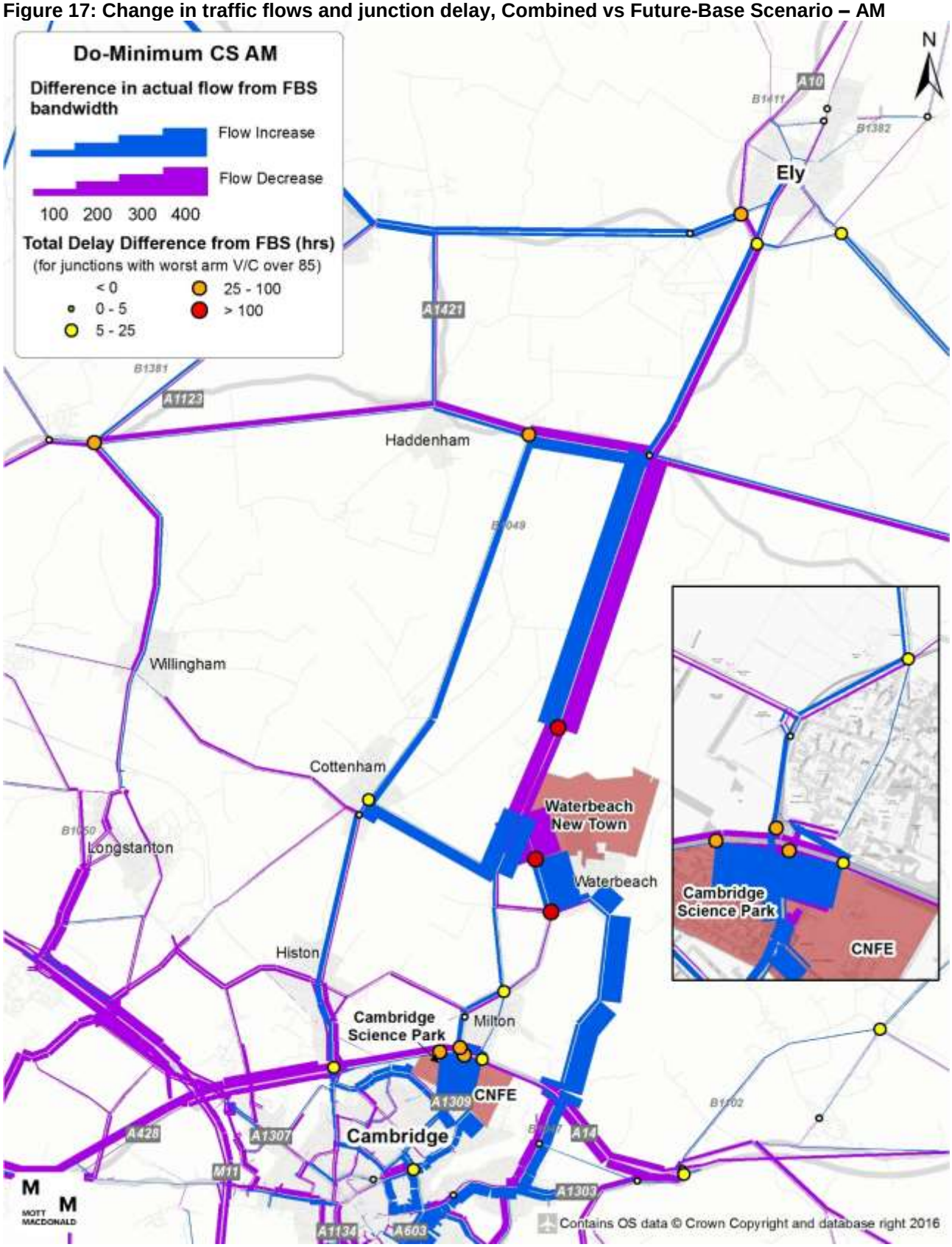
In order to estimate how proposed development is predicted to impact the performance of the highway network, the Figure 17 and Figure 18 below show the change in traffic flow and total junction delay between the 2031 Combined Scenario Do Minimum case (ie, the 'with-development-without-mitigation' scenario) and the 2031 Future-Base Do Minimum case (ie, the 'without-development-without-mitigation' scenario). This allows the changes resulting from the new development to be observed. In order to identify junctions which are impacted by the developments, only delay *increases* are shown, and only for junctions with a V/C[9] ratio in the Combined Scenario case over 85%.

These figures show:

- In the AM peak, the main increases in flow and junction delay are on the A10/A1309 route between Ely and Cambridge. Particular junction delay impacts are seen near the new town north of Waterbeach and at Milton Interchange. As a result, there is also an increase in flow on alternative routes, including the B1049 leading to King Hedges Road and impacting Histon Interchange, and on the B1047 leading to Newmarket Road.
- In the PM peak, substantial flow and delay increases are similarly evident on the A10/A1309 route between Ely and Cambridge and on the parallel B1047, but now also on parallel routes north of the A14 between Girton, Histon and Milton. This increase is both related and contributory to delays at Histon Interchange and Milton Interchange. Flow and delay increases are also seen on Kings Hedges Road and within central Cambridge, which are also partly a result of traffic seeking to avoid the delays at the A14 interchanges.

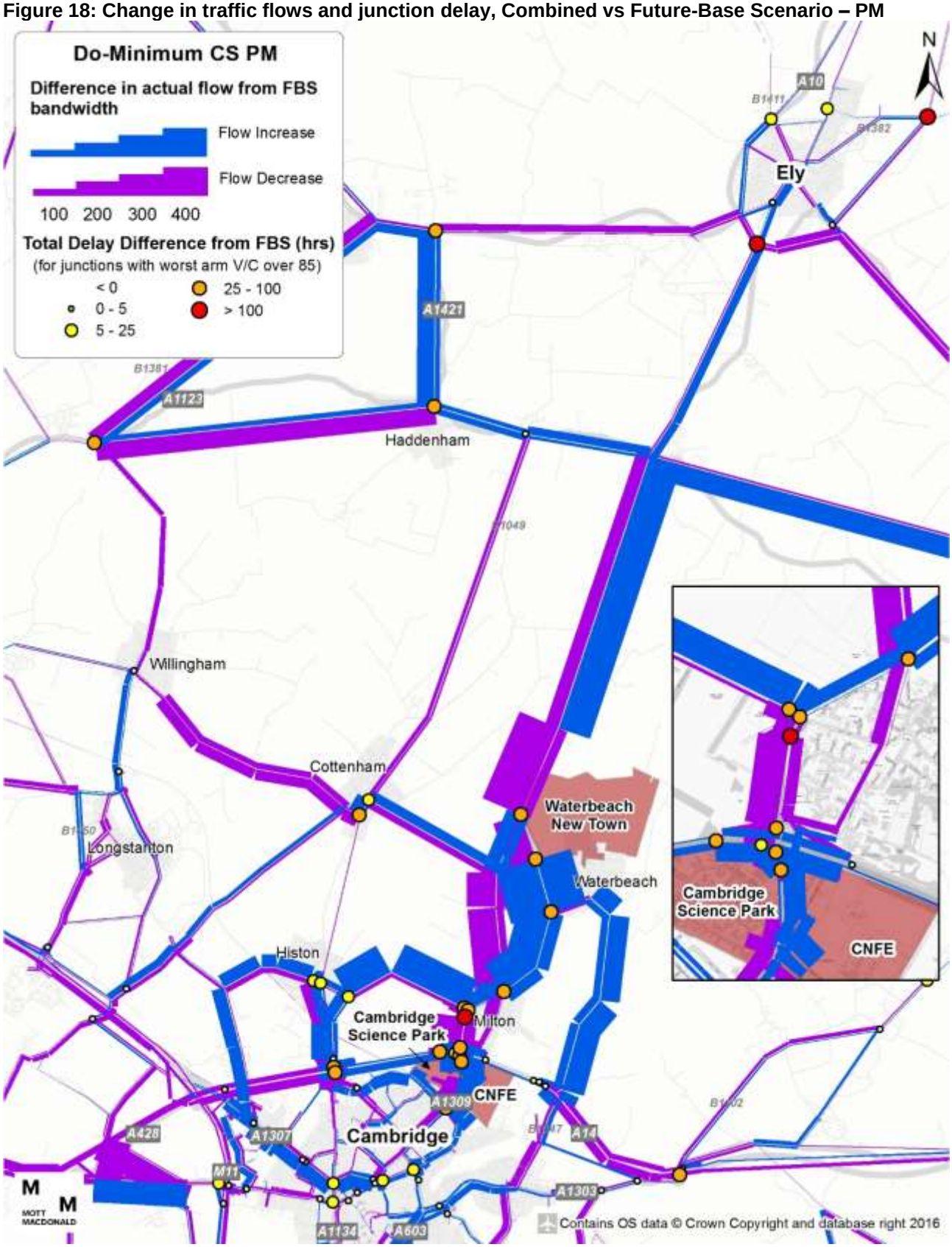
[9] V/C = ratio of traffic volume to junction capacity. This is a standard modelling measure of the operating level of a junction, where a V/C level above 85% is considered to mean a junction is operating above its effective capacity, and a level above 100% means it is operating above its absolute capacity.

Figure 17: Change in traffic flows and junction delay, Combined vs Future-Base Scenario – AM



Source: CSRM

Figure 18: Change in traffic flows and junction delay, Combined vs Future-Base Scenario – PM



Source: CSRM

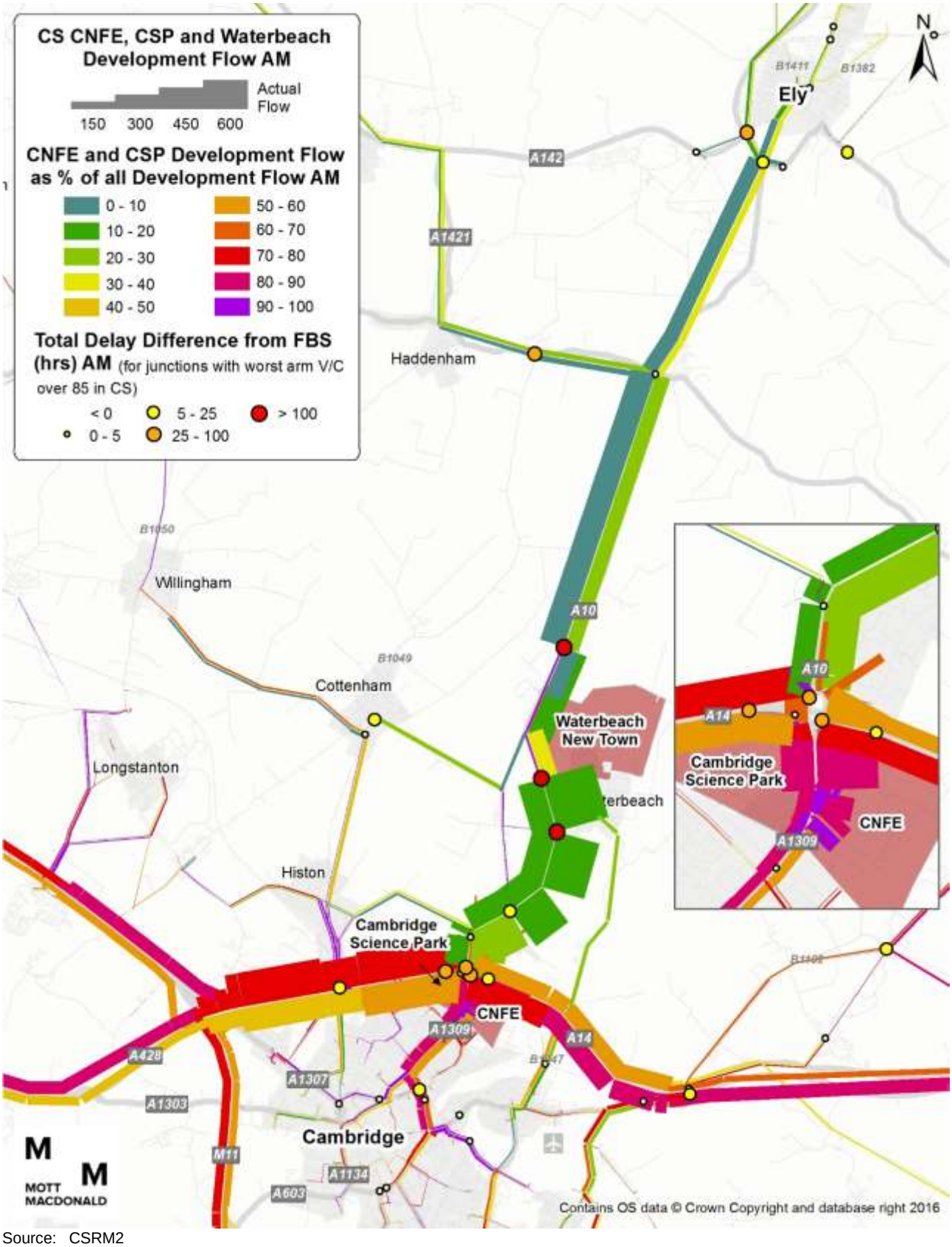
As noted, the above plots show flow changes and junction delay impacts as a result of the addition of new development traffic from both the CNFE and CSP sites and from the new town north of Waterbeach. In order to help identify to what degree the above junction impacts are attributable to the CNFE and CSP sites only, the Figure 19 and Figure 20 show for the AM and PM peak periods:

- The impacted junctions from the above figures
- The distribution of total new development flows in the Combined Scenario Do Minimum case
- The proportion of those flows which are generated by the CNFE and CSP sites combined (with the remaining proportion therefore being attributable to the new town north of Waterbeach)

These figures show:

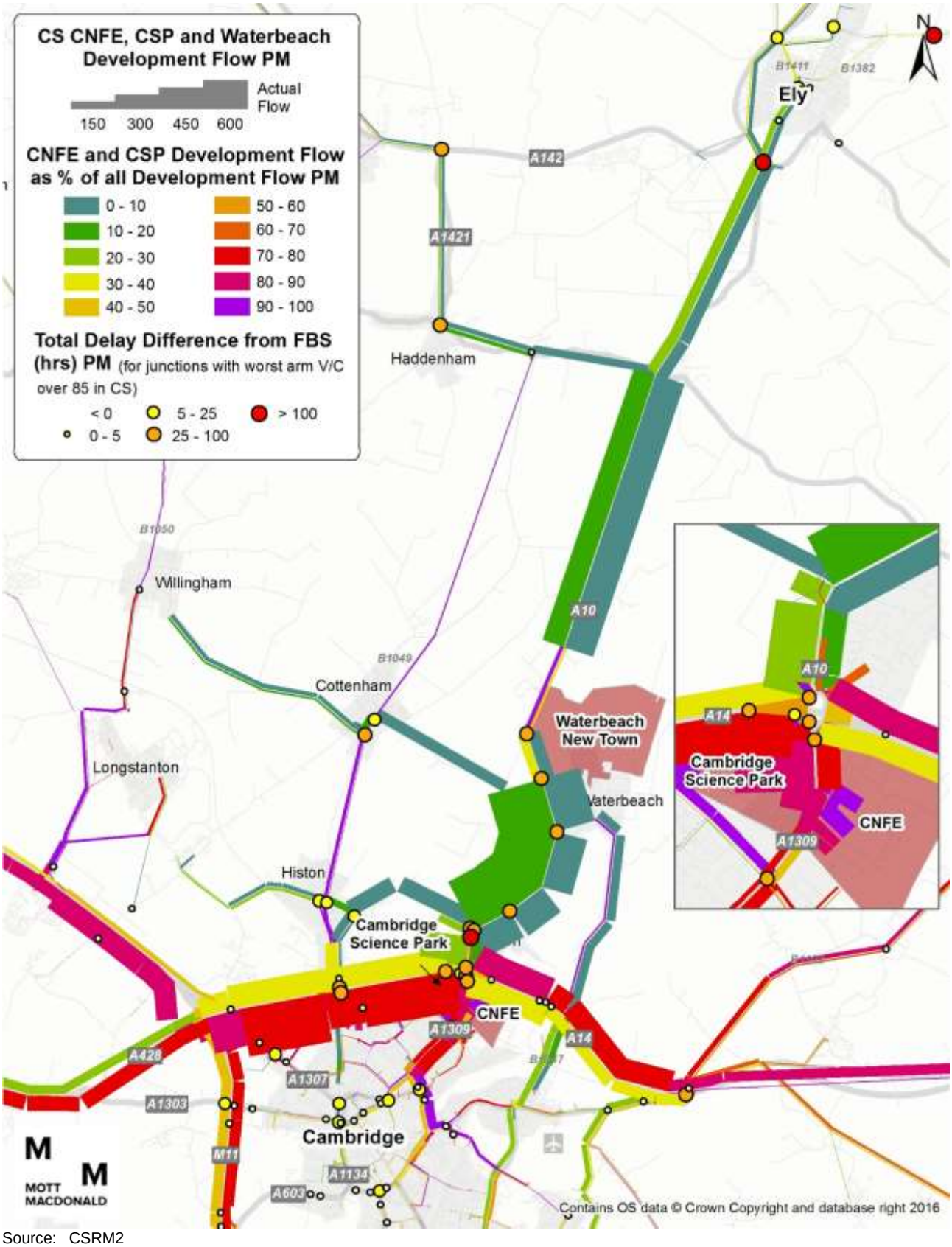
- In both peaks, a clear delineation between development flow contributions, with the CNFE and CSP flows representing the majority development flow contribution on the A14 and M11 and mostly within Cambridge, and the new town north of Waterbeach representing the majority development flow contribution on the A10 and connecting routes to the north. The connecting point between the two areas of impact is Milton Interchange which combines impacts from both developments.
- In the AM, junctions impacted by majority CNFE/CSP development flows are Milton Interchange, Histon Interchange, Quy Interchange and some junctions on or around the Cambridge inner ring road.
- In the PM, the same junctions are impacted by majority CNFE/CSP development flows, but with the addition of junctions on Huntingdon Road and Junction 13 of the M11

Figure 19: CNFE/CSP % of Combined Scenario DM total development flow and impacted junctions, AM



Source: CSRM2

Figure 20: CNFE/CSP % of Combined Scenario DM total development flow and impacted junctions, PM



Source: CSRM2

Lastly, in order to help identify to what degree the junctions impacted by CNFE/CSP traffic are impacted by each component site, the Figure 21 to Figure 24 below shows for the AM and PM peak periods:

- The impacted junctions from the above figures, where CNFE/CSP combined flows contribute at least 50%[10] of total new development flow on at least one arm
- The distribution of total new CNFE/CSP development flows in the Combined Scenario Do Minimum case
- The proportion of those flows which are generated by the CNFE site only or by the CSP site only

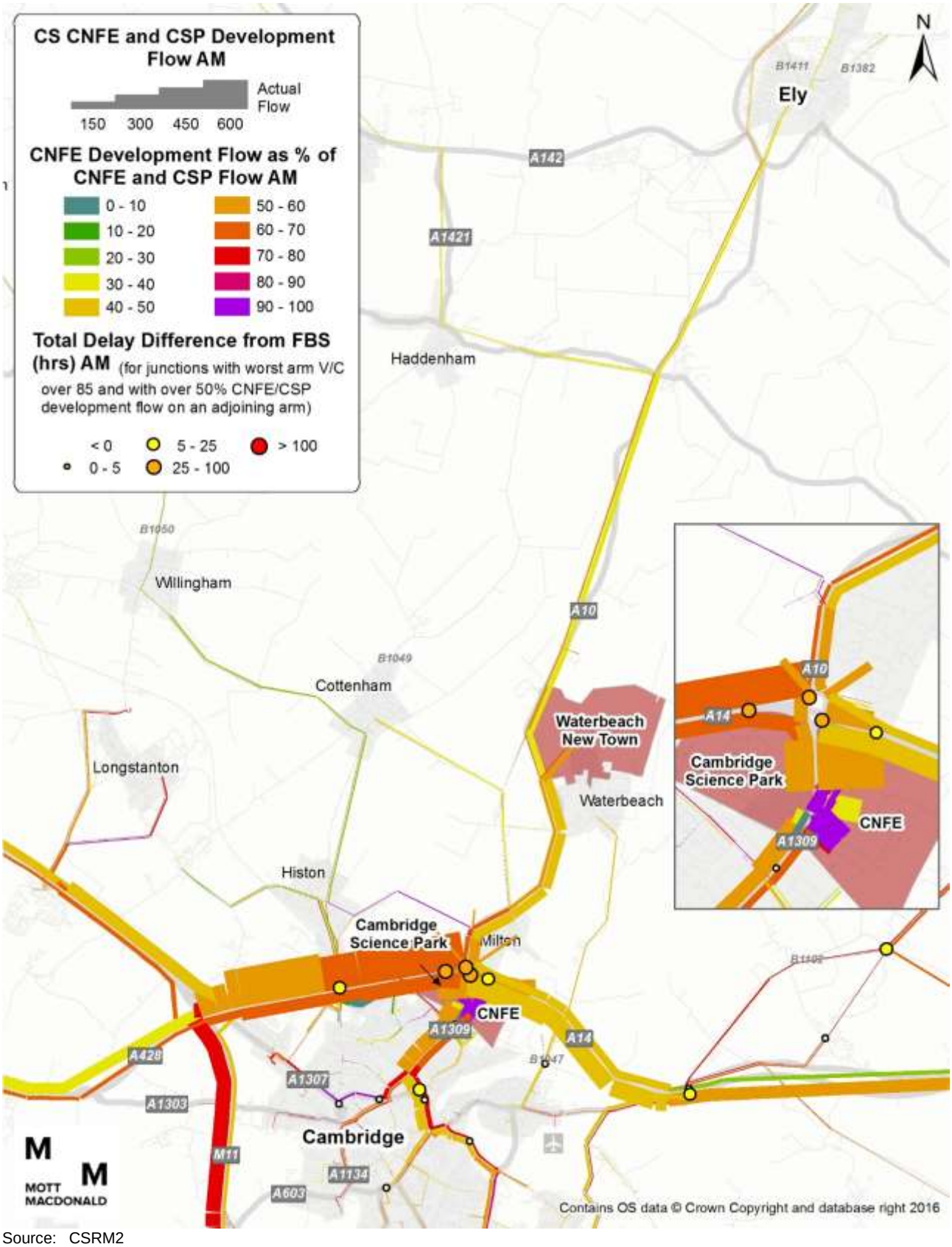
These figures show:

- In the AM peak, the junctions impacted by these developments are either on the A14 or in Cambridge. The same is true in the PM peak, with the addition of the B1102 in Swaffham Bulbeck.
- A leaning towards CNFE as the majority flow contributor of the two sites in both peak hours, but some distributional differences, such as more CSP trips on the A10 from the north and fewer on the M11 from the south in the AM, and more inbound trips to CNFE on the A14 in the PM due to the housing element of that development
- The PM peak also shows that much more CSP traffic is accessing the A14 westbound via Kings Hedges Road and Histon Interchange than via Milton Interchange. In both peaks, CNFE is the majority flow contributor to the impact of these two developments on the latter junction.

Overall, however, both developments make a significant contribution to the flows at most of the impacted junctions.

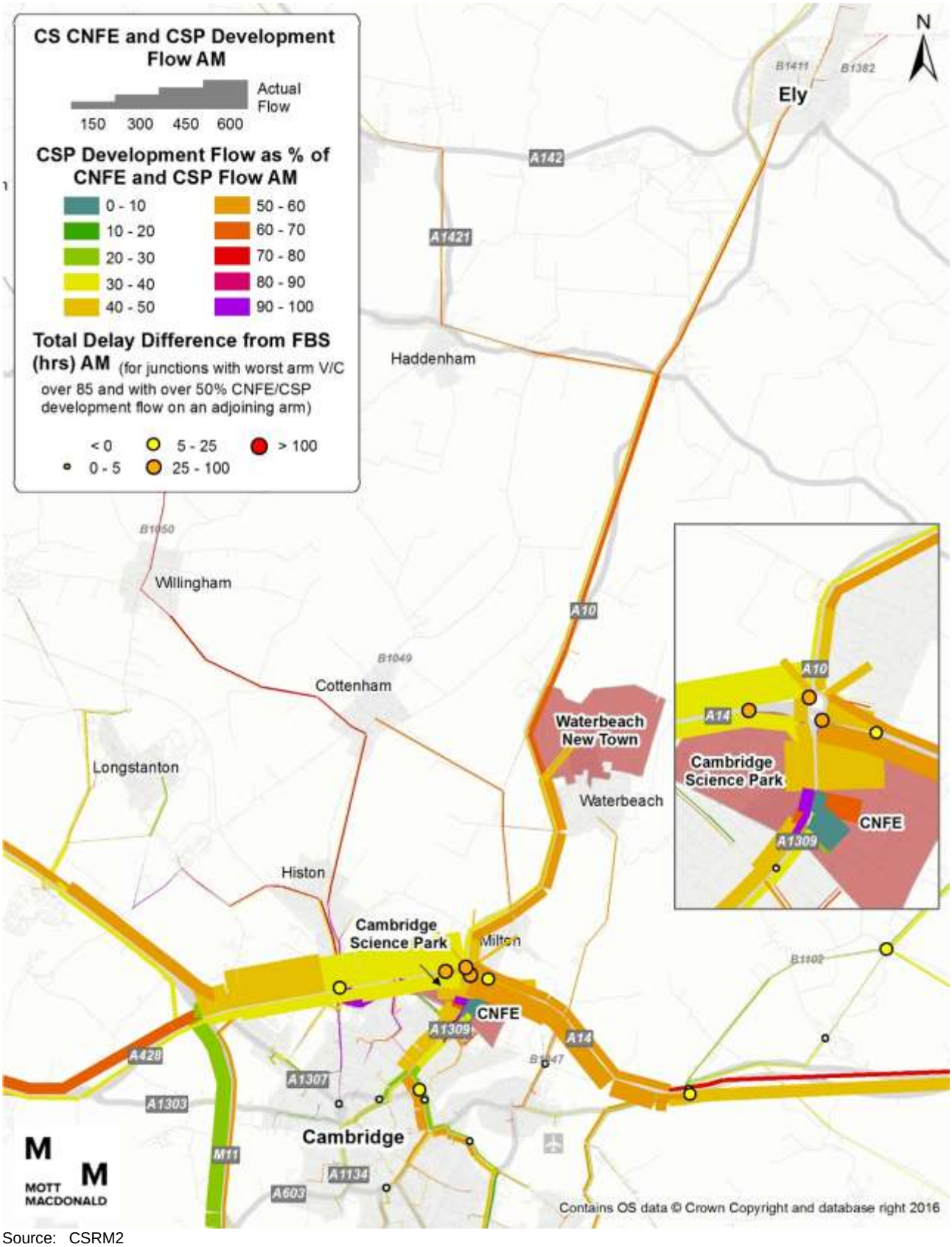
[10] Development flow proportions over 50% represent a majority impact, so this threshold provides a means of filtering the junctions by primary impact contributor. Where different developments contribute over 50% of flows on different arms, then the junction is impacted by more than one development.

Figure 21: CNFE % of Combined Scenario DM total CNFE/CSP flow and impacted jns – AM



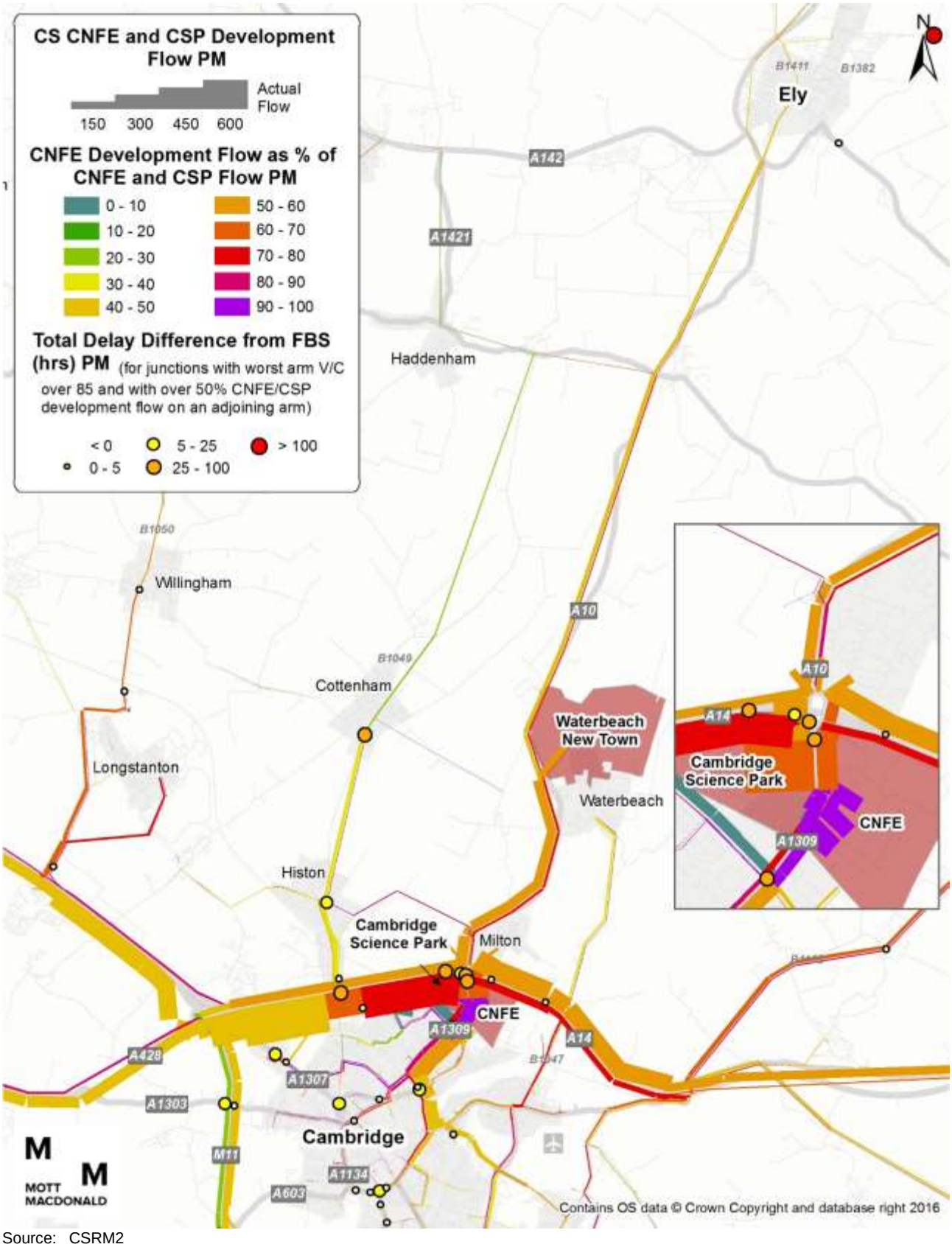
Source: CSRM2

Figure 22: CSP % of Combined Scenario DM total CNFE/CSP flow and impacted jns – AM



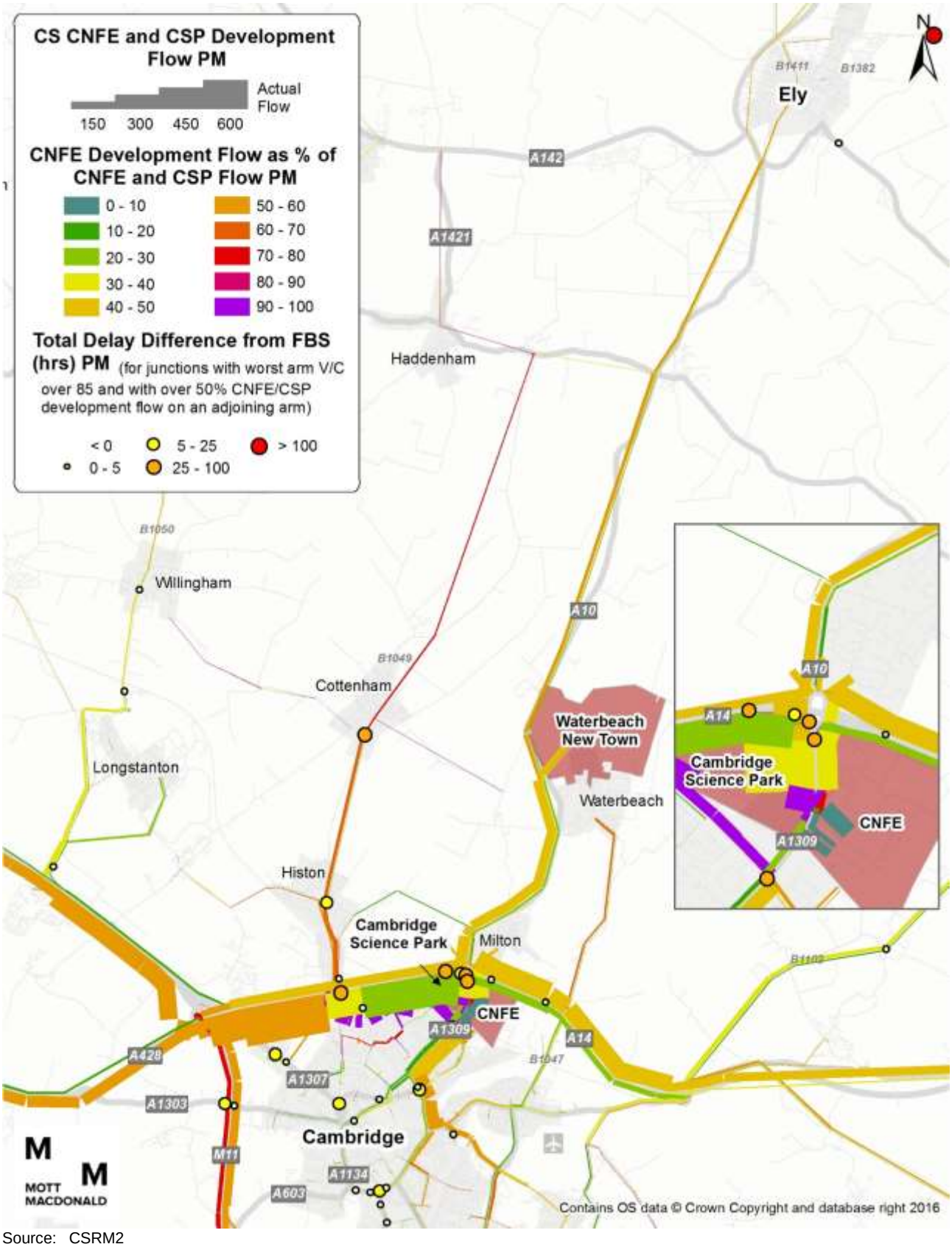
Source: CSRM2

Figure 23: CNFE % of Combined Scenario DM total CNFE/CSP flow and impacted jns – PM



Source: CSRM2

Figure 24: CSP % of Combined Scenario DM total CNFE/CSP flow and impacted jns – PM



Source: CSRM2

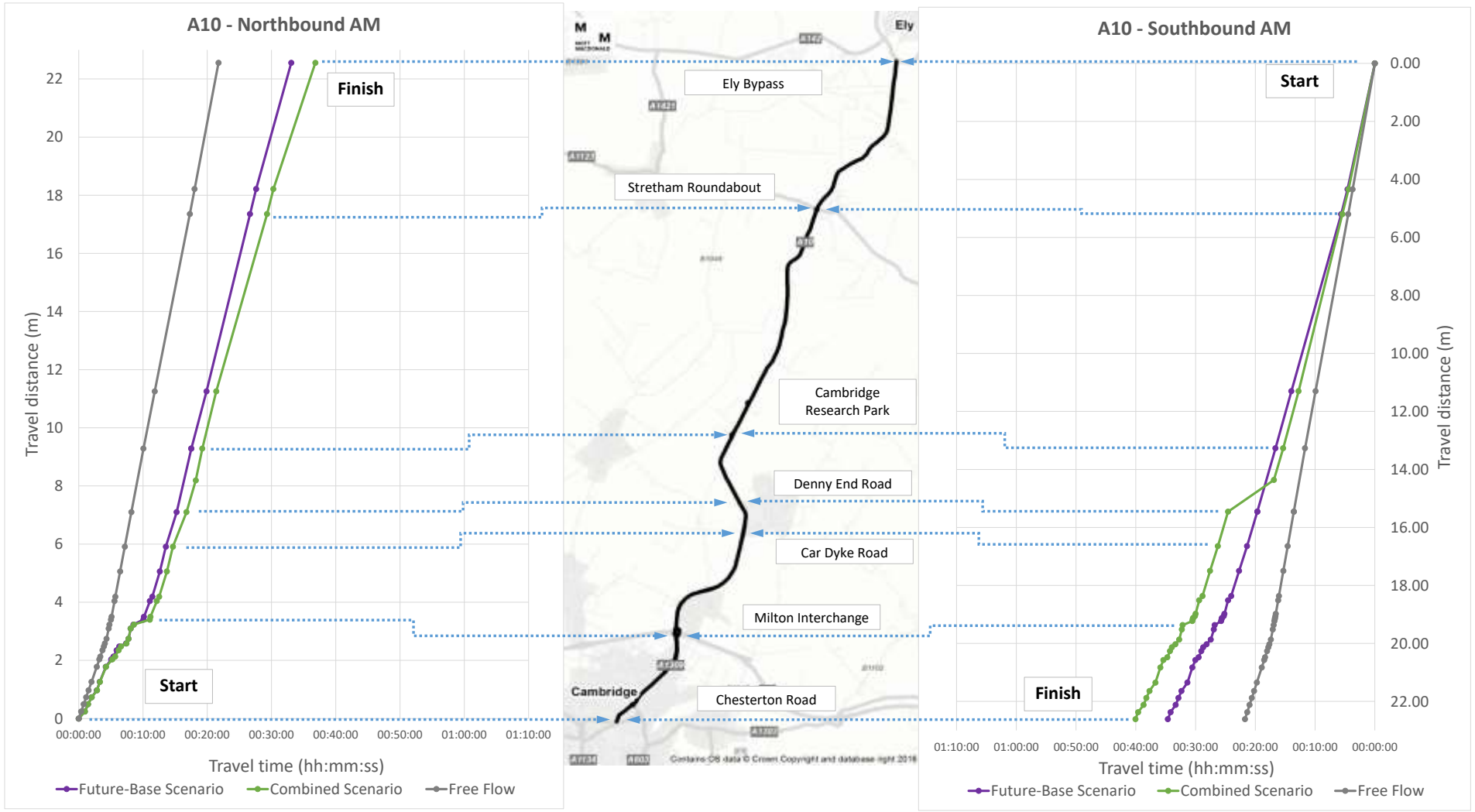
4.3.2 A10 Journey Times

As per the focus of this study, Figure 25 and Figure 26 below show modelled northbound and southbound journey times along the A10 between Chesterton Road in Central Cambridge and Ely during the AM and PM peaks. Results are illustrated for both the Future-Base and Combined Scenarios, with free flow time (taken from each link's 'Free Flow Time' parameter in the CSRM model) included for further comparison.

With particular focus on the difference between Combined Scenario and Future Base results, these figures show:

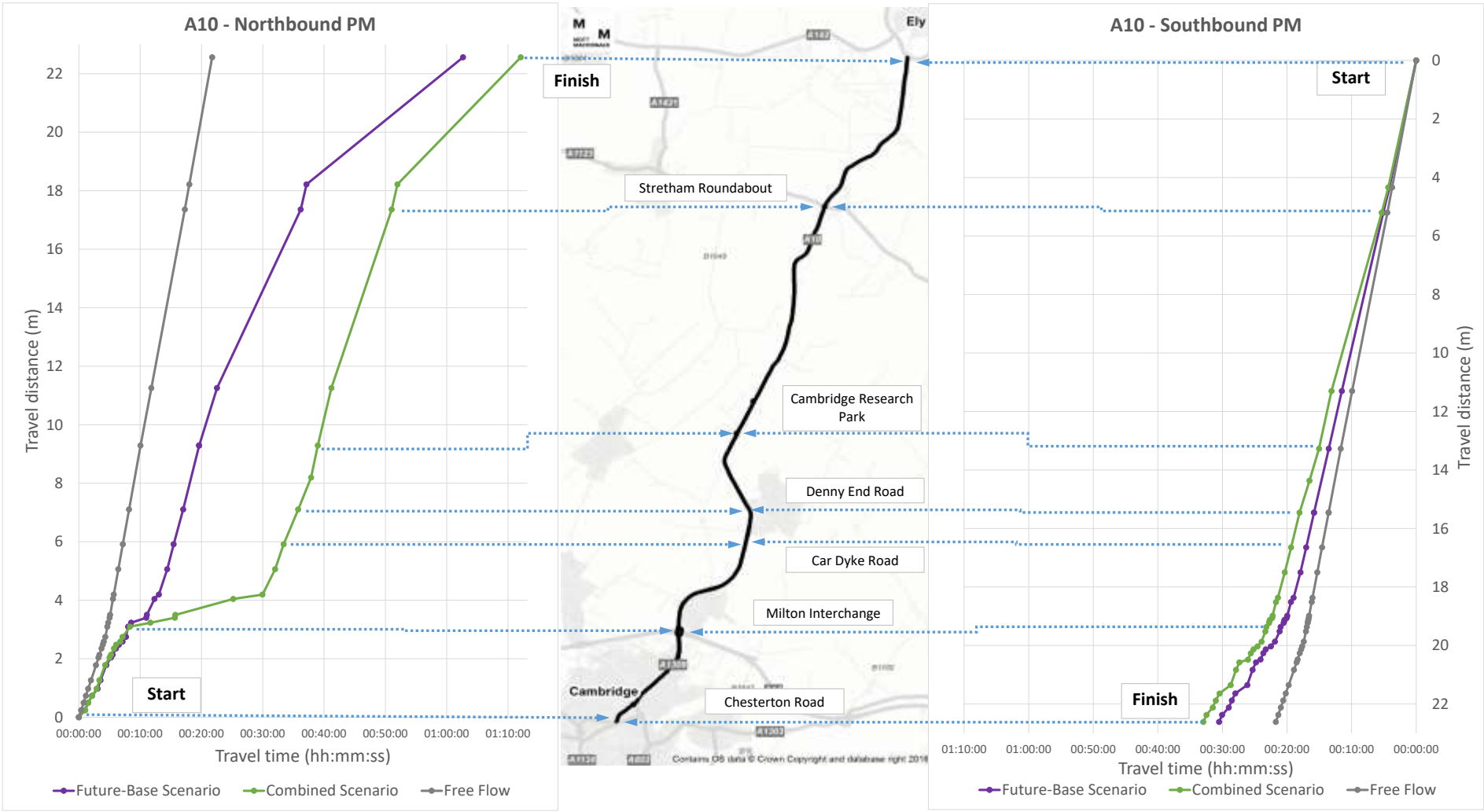
- Increased southbound journey times between the new town north of Waterbeach and Milton Interchange in the AM peak. As described above, the new Waterbeach development flows largely account for this impact, but CNFE/CSP flows contribute to delays experienced at Milton Interchange.
- Similarly, in the PM peak, the main delay increase in the northbound direction is between Milton Interchange and Landbeach Road, which is also largely due to the new town north of Waterbeach flows, though CNFE/CSP flows again contribute to delays experienced at Milton Interchange.
- On Milton Road between Milton Interchange and the city centre where CNFE/CSP flows comprise the majority development flow impact, little journey time impact is observed in either peak hour.

Figure 25: Journey time on the A10 between Ely and Cambridge – AM



Source: CSRM

Figure 26: Journey time on the A10 between Ely and Cambridge – PM



Source: CSRM

4.4 Summary

The assessment reveals that the proposed combined development is predicted to generate between 7,400 and 8,200 person trips during each peak hour. Due to the employment focussed development on the sites, the percentage of internal trips is predicted to be low (less than 3% for the CSP site). However, the increase in housing land use tested for the CNFE site has resulted in a slightly higher predicted internalisation proportion of around 7% in the AM peak and 6% in the PM peak.

For the external trips, demand is predicted from a number of locations, with varying levels of alternative transport provision. Whilst car is predicted to remain the predominant mode of travel to and from both sites, the planned improvements to public transport and cycling facilities, combined with the increased relative attractiveness of these modes due to greater highway congestion, are predicted to result in a significant increase in the use of these modes from those recorded by the 2016 Travel Plan Plus area survey. However, whilst public transport and active mode shares are predicted to increase, the developments are still predicted to generate around 2,400 car trips in the AM peak hour and about 3,500 car trips in the PM peak hour on the external road network.

The modelling results indicate that the primary flow impact of the CNFE and CSP developments on the surrounding highway network is predicted to be along the A14, M11, A428 and the southern section of A10. In terms of the delay impacts arising as a result of these predicted flows being added without mitigation, the modelling results for both peak hours show junction impacts at Milton Interchange, Histon Interchange, Quy Interchange, Junction 13 of the M11, and at junctions on or around the Cambridge inner ring road and along Huntingdon Road.

In terms of travel times on the A10/A1309 in the study area, the Combined Scenario Do Minimum modelling predicts significant increases in travel time compared to the Future Base scenario along the A10 between the new town north of Waterbeach and Milton Interchange, which is largely a result of the increase in new trips generated by the latter development, but CNFE/CSP flows also contribute to the significant increase in delays at Milton Interchange. These delays contribute to a displacement of traffic from primary routes, including the A10 and A14, onto less suitable routes including the B1049 and B1047 among others.

Further details on these modelling results can be found in the Do Minimum Modelling Report, but the overall conclusion for the proposed developments at the CNFE and CSP sites is that, though the various improvements included in the Do Minimum network will yield significant mode share improvements compared to existing levels, further mitigation measures will nonetheless be required to enable the development to function effectively without causing undue impact on surrounding transport networks.

5 Proposed Interventions

The purpose of this section is to review the transport interventions proposed to address the impact of the development proposals on the A10 highway corridor, and to review measures potentially required to address impacts on the wider network.

5.1 On-Site Measures

5.1.1 Parking Restraint Strategy

It is identified in Section 2.3.3 above that there is an overprovision of parking across both the CSP and CNFE sites, such that a 2016 survey revealed that only 52% of spaces are being used on average. Apart from highlighting an inefficient use of land, this result also indicates that parking is not currently acting as a restraint on car use to and from the sites. It can therefore be expected that the current provision levels are contributing to the current high car mode share level at the sites and that more stringent parking standards would assist in delivering a reduction in this mode share.

The following table lists car driver mode shares and parking ratios for:

- CNFE/CSP areas combined (Travel Plan Plus area)
- Cambridge Biomedical Campus
- CB1 Cambridge Station Area

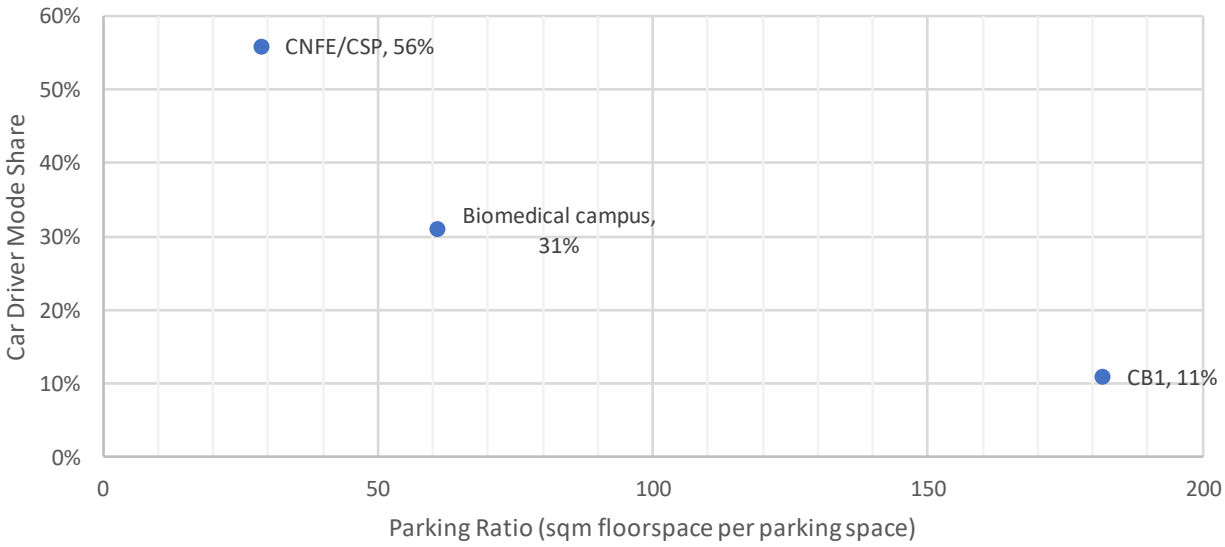
Table 19: Car driver mode shares (%) and parking ratios by location

Source/Location	Car Driver Mode Share (%)	Parking Ratio (sqm per space)
Travel Plan Plus Area (CSP, CNFE, CRC) – 2016	56	29*
Cambridge Biomedical Campus – staff only - 2015	31	61
CB1 Cambridge Station Area – TA agreed	11	156-208 (182 avg)

Sources: Travel Plan Plus annual survey (2016), Census (2011) excluding 'work from home', Cambridge Biomedical Campus Strategy and Travel Plan 2017-2022 (2017), Various CB1 Transport Assessment reports, Cambridge Parking Standards
* See Table 2 above for source of this value

It is evident from this table that there is a general relationship between car parking provision and car mode share, with the latter reducing as the relative level of provision reduces, as illustrated in the following chart. There will be other factors involved in this relationship, such as the relative availability, cost and effectiveness of alternative modes, but parking provision levels are clearly influential in sustaining a certain level of car driver mode share.

Figure 27: Scatter plot of car mode share and parking ratio results for three Cambridge sites



Source: See table above

It is described above in Section 3.1.1 and Section 3.1.2.3 that the CSP and CNFE options tested in the model are for 5,992 and 3,908 new jobs respectively, making 9,900 new jobs in total by 2031. By applying a typical conversion factor of 20 sqm per job for B1 development[11], this equates to additional potential employment floorspace of about 198,000 sqm, making a total floorspace over both sites of about 468,000 sqm.

The following table shows how different parking standards applied to this total floorspace would impact on the existing 9,581-space parking supply and 4,975-vehicle parking demand level at the two sites (see Table 1 above for source of these values). The scenarios are:

- 'Business-as-usual' – Applying existing parking supply-based ratio to full modelled development
- 'Utilisation-as-usual' – Applying existing parking utilisation-based ratio to full modelled development
- 'Biomed target mode share' – Applying the Biomedical Campus parking ratio to full modelled development to encourage a similar car mode-share of around 31%
- 'No demand increase' – Applying parking standard that matches supply to existing level of total demand
- 'CB1 target mode share' – Applying the CB1 parking ratio to full development to encourage a similar car mode-share of around 11%
- 'Car free zone' – Removing all standard car parking to deliver a 'car-free' site

Table 20: Parking standard scenarios for new CNFE/CSP development

Scenario	Ratio	Total spaces	Change from existing supply (spaces and %)	Change from existing demand (spaces and %)
Business as usual	29	16,138	+6,557 (+68%)	+11,163 (+224%)
Utilisation as usual	55	8,509	-1,072 (-11%)	+3,534 (+71%)
Biomed target mode share	61	7,672	-1,909 (-20%)	+2,697 (+54%)
No demand increase	94	4,975	-4,606 (-48%)	+0 (+0%)
CB1 target mode share	182	2,571	-7,010 (-73%)	-2,404 (-48%)
Car free zone	N/A	0	-9,581 (-100%)	-4,975 (-100%)

Source: MM

[11] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/484133/employment_density_guide_3rd_edition.pdf

This shows that, if the existing level of provision was to be extended to apply to all the estimated new floorspace on the sites, an additional 6,557 spaces would be required over existing. However, it also shows that there are currently already more than enough spaces across both sites to accommodate this level of floorspace if the spaces continue to be used at current utilisation levels and that, actually, some spaces would need to be removed. However, it is noted that this scenario would still result in about a 70% increase in car trips to the site as spaces currently unused become occupied. Given existing levels of congestion on the surrounding highway network, such increases would likely lead to severe impacts in the absence of significant mitigation.

For a more stretching future car mode share target, therefore, based on that achieved at the Biomedical Campus, it would be necessary to remove about 20% of the current provision of parking, though this would still result in levels of traffic generation that are around 50% greater than currently experienced if those spaces were to be fully utilised. Again, this could potentially result in a significant deterioration in network performance in the absence of appropriate mitigation

An even more stretching target inspired by the CB1 development would involve the removal of nearly three-quarters of current parking provision and potentially reduce traffic generation levels by around 50% compared to existing. The radical target of a ‘car free zone’ would of course require the removal of all parking.

An intermediate stretching target would be to set a parking standard such that the total number of future spaces across both sites is no greater than the associated current level of parking demand. Based on the current measured demand level of 4,975 vehicles and the above future floorspace estimates, this would require a B1 average parking standard of about 1 space per 94m^2 to be applied across the two sites.

It should be noted that each of these stretching options would in turn generate increasing levels of parking displacement impacts, and so would have to be implemented together with monitoring of parking levels in surrounding areas and potential management measures where impacts arise. It is also noted that, with each scenario above that requires a net reduction in car parking provision, the greater proportion of the reduction would have to be delivered by the CSP site as this currently provides the greatest proportion of existing capacity.

In conclusion, it is recommended that far more stretching parking standards are applied to future development at CNFE and CSP than is the current practice, which are proportionate to the future improved accessibility of the site by alternative modes, but which nonetheless act as an encouragement to maximise the use of these modes and minimise the incidence of unnecessary car travel.

As the CSRM2 model is not able to model parking restraint, this type of measure has, at least in part, been reflected in the CNFE ‘trip budget’ described in Section 3.1.2.3 above and included in the Do Minimum modelling described in the previous chapter. It is further recommended that a detailed review of appropriate parking standards, and their relationship with the proposed ‘trip budget’, is undertaken as a follow-on piece of work to ensure that significant further development does not result in severe cumulative highway impacts. Importantly this will need to establish in detail what the appropriate levels of car parking should be at the CSP to ensure that any intensified use of the site does not lead to a significant deterioration in highway network performance. The analysis set out above provides a useful start point for that assessment.

However, although parking restraint represents an essential component of transport strategy for the sites, the Do Minimum results confirm that this measure alone will not be sufficient to mitigate the impacts of new development, and so further measures will be required. These are described in the remainder of this section.

5.1.2 Trip Internalisation Measures

In addition to parking restraint measures, it is expected that both sites will be developed to include a number of measures to maximise the internalisation of trips and to encourage those trips by non-car modes,

including complementary land uses, travel planning and high quality, direct walking/cycle routes. For the CNFE site, the main measure proposed is a balance of both employment and residential uses, which will help internalisation, whereas internalisation on the CSP site can be improved by ensuring strong linkages between that site and complementary facilities provided on the CNFE site.

5.1.3 Site Access Considerations

One of the existing constraints at the CSP site is vehicular capacity for egressing the site in the PM peak hour, as noted in Section 2.3.2 above. This could potentially be alleviated to a degree if congestion on Milton Road is reduced. While the above measures to restrict car trip growth at CSP will help, further development at CSP plus significant development at the CNFE site on the other side of the A1309 Milton Road is likely to add extra pressure to the current site access arrangements.

The following figure shows the location of the existing highway access points to both development sites, together with the site boundary constraints of the A14 to the north, the guided busway to the south, and the railway to the east.

Figure 28: Site access constraints map

Source: MM

This plan shows that accesses are provided to both sites where they interface with accessible local roads. For CSP, this allows one access where the site meets Kings Hedges Road, and another access onto Milton Road. For CNFE, this means three main accesses from Milton Road, and one minor access from Nuffield Road.

5.1.3.1 A14 Access Options

In order to create a new highway access for both sites, we have explored the option of accessing the sites directly to and/or from the A14. The options considered and the outcomes for each are summarised in the following table.

Table 21: A14 new site access options considered

Option	Assessment	Outcome
Option 1: Access / egress from A14 westbound carriageway (east of the Milton Interchange) to CNFE site	An option to provide access and egress directly from the westbound carriageway on the A14 to CNFE has been assessed. This would include dedicated on and off slips to the CNFE site between the Milton Interchange (Junction 33) to the west and the A14 / B1047 Horningsea Road junction to the east. The A14 is a dual carriageway with a one metre hard strip and has national speed limit signs indicating a 70mph speed limit. The current distance between the end of the merge and start of diverge taper is 1 km (this has been designed in accordance with DMRB TD22/06 Paragraph 4.36). The document states, "For rural all-purpose roads the desirable minimum weaving length must be 1 km". This will allow time for motorists to have sufficient weaving length for their vehicles when moving between lanes, either going straight from the Junction 34 on-slip over onto lane 2 and motorists already in lane 2 wishing to exit at Junction 33 Milton Interchange having to get over into the nearside lane. Therefore, this form of access to the site cannot be accommodated within DMRB standards and significant changes and departures would need to be adopted. In addition, as the A14 is currently on an embankment, any proposed road alignment would need to ramp down to the proposed development site levels and, consequently, significant development land could be lost to accommodate this.	Due to the safety implications related to this proposed access strategy and the departures from standards, it is unlikely that this scheme would be permitted.
Option 2: Upgrade of Milton Interchange to provide a direct access off the junction to the CNFE site	An access and egress to the proposed CNFE site from Milton Interchange has been considered. To facilitate this, it would be necessary to increase the size of the roundabout gyratory significantly. The gyratory would have to be of an appropriate diameter to allow for spacing between the existing Milton Road arm (the southern arm of Milton Interchange) and a new access into the CNFE site. The spacing between these two arms would be dictated by entry and exit angles and may prove difficult to provide a suitable geometric alignment in accordance with DMRB requirements, and in particular, TD16/07 Geometric Design of Roundabouts and TD22/06 Layout of Grade separated junctions. The knock-on effect of the larger roundabout would reduce the spacing of the merge and diverge lanes between Junctions 33 and 34 by approximately 50m reducing the required weave length as discussed for Option 1 (above). Therefore, a departure would need to be agreed with the relevant highway authorities. The construction of the larger roundabout would certainly include the demolition and replacement of the eastern bridge over A14, and possibly, the western bridge too. It is likely that the existing land uses that are currently based on the north west quadrant of the CNFE site (St John's Innovation Park) would need to be demolished to facilitate the extra arm off the gyratory.	This option is unlikely to be viable due to its land take requirements and necessary departures from standards.
Option 3: Access only to CNFE site from the A14 westbound off slip to the CNFE site	This option would involve the Junction 33 west bound off slip being widened and realigned to provide an additional lane using a splitter island into the CNFE site. Consequently, this option would require the demolition a significant proportion of the existing land uses located in the northern part of the site. It would also only provide a new access for westbound A14 traffic and no increase in egress capacity or access capacity from other directions.	The limited benefits of this scheme are unlikely to justify the cost and disruption required to implement.
Option 4: Upgrade of the A14 / B1047 junction to enable access and egress to CNFE site	Another alternative option could be to upgrade the A14 / B1047 Horningsea Road junction (Junction 34) to a full grade-separated junction with gyratory and new A14 westbound off-slip and eastbound on-slip. Another arm could then be constructed west of the new gyratory which would run west, past Philips SL & Son land, over the River Cam and existing rail lane, and into the CNFE site.	This scheme would provide all movement access and egress between CNFE and the A14, but this benefit is unlikely to justify the costs and impacts arising from the amount of infrastructure and sensitive landtake required.

Option	Assessment	Outcome
Option 5: Access / egress from A14 into Cambridge Science Park	An option has been assessed to provide an access / egress from the westbound A14 carriageway between Milton Interchange (Junction 33) and the A14 / B1049 junction (Junction 32). Similar to Option 1, this would again be difficult due to traffic weaving distance requirements. The measured distance between the end of the merge and start of the diverge lanes for the two existing junctions gives a distance of approximately 1.4km, meaning that an additional 0.5km of carriageway would be required to provide an access to CSP within DMRB TD22/06 Paragraph 4.36 standards. The alignment of the busway would also make it difficult to accommodate the geometry of a new junction in this location without the requirement for extra overbridges and potential demolitions within the site.	This option is not likely to be feasible due to significant safety and geometric limitations.

Source: MM

These initial feasibility assessments suggest that securing new links between the A14 and either or both development sites is likely to be either non-feasible in engineering/safety terms and/or non-viable in Business Case terms.

5.1.3.2 Existing Site Access Enhancement

It is therefore expected that options for enhanced site access capacity will need to be focussed on where the sites interface with the Milton Road and Kings Hedges Road routes. Given the space available, this will mainly need to take the form of rationalising and enhancing the existing access points, where possible. Consideration of what is potentially deliverable at these existing accesses is summarised in the following table.

Table 22: Existing site access capacity enhancement considerations

Option	Assessment	Outcome
A1309 Milton Road / Cowley Road Junction		
Additional left slip lane from Milton Road (north) into Cowley Road	The addition of a left slip from the southbound carriageway of Milton Road to Cowley Road is achievable by widening the carriageway to the east (Option 1) or utilising the nearside ahead lane (Option 2). Option 1 would be constrained by level differences to the land to the east, which is at a lower level than Milton Road. The land to the east is currently hedgerow and there would be potential cost, infrastructure and environmental impacts to clear the space and raise the level to match the main carriageway. Alternatively, the existing carriageway could be lowered to match the levels of the land to the east. but total costs would be greater and could lead to disruption of existing users of Milton Road. Option 2 is that the nearside ahead lane of the southbound carriageway could be converted to an additional left turn lane into Cowley Road. This option would reduce southbound ahead capacity so, if taken forward as an option for further stages of this study, it is recommended that the impact of this option is assessed in more detail.	If an additional left slip lane is to be constructed to the east of the existing slip lane, then further assessment will need to be undertaken to understand level differences, the feasibility of doing so, and to determine the cost implications. Alternatively, the second option of converting an existing southbound lane into a left slip will have knock on effects of reducing the main carriageway capacity. Further assessment as to the impacts of doing this will be required for further stages of this study.
Additional right turn lane from Cowley Road onto Milton Road (north):	An additional right turn from Cowley Road onto Milton Rd may be required to cater for additional traffic demand egressing the proposed CNFE development site towards the A14. The length of the additional lane may be limited by surrounding infrastructure (including offices, existing road network). Therefore, this will have to be investigated further as the plans for the CNFE site are developed. There is the potential for right turn traffic to be alleviated by allowing traffic to turn right onto Milton Rd at the junction to the south (including the main access to the Cambridge Science Park off Milton Road). A feasibility assessment of this junction would be required and options would need to be modelled and assessed.	Further traffic flow distribution analysis is required and junction capacity needs to be assessed to ascertain whether an additional right turn lane is necessary and feasible in this location.

Option	Assessment	Outcome
Milton Road / Cambridge Science Park Road / Cowley Road Junction		
Potential need for widening access to CSP	As noted above, queues back-up from this junction to the roundabout within the CSP site. There is room on either side of the carriageway for widening: on the entrance for additional capacity on approach to the roundabout, and widening on the egress from the roundabout to provide additional lanes onto Milton Road (both would require widening of the existing roundabout and associated alterations to the other arms, as well as possibly requiring modifications to the existing Milton Road / Cambridge Science Park junction). This would require modifications to Milton Road (widening to the west) to accommodate the junction upgrade.	Further assessment as to the feasibility of the widening needs to be undertaken and proposed layouts with additional capacity should be assessed in terms of capacity to quantify the benefits and impacts on the wider network. The implications of any capacity improvements to the proposed redevelopment of CSP will also need to be investigated.
Addition of a right turn lane from Cowley Road (from the CNFE site) to Milton Road	As noted above, traffic travelling northwest on Cowley Road wishing to head north (A10 etc) must wind around Cowley Road to the northern junction with Milton Road. There is scope to add a right turn facility to this junction. It is not known at this stage if Cowley Road would remain in its current form.	Further assessment as to the feasibility of providing a right turn facility and the proposed layouts should be assessed in terms of capacity to quantify the benefits and impacts on the wider network. The impacts on the operation of Milton Road will also need to be assessed.
Milton Road / Cowley Park		
Extra egress lane On Cowley Park	In order to increase egress capacity from Cowley Park and reduce delays in the PM peak, an extra right turning lane could potentially be provided. The nearside lane would then operate for left and right turners, while the new offside lane would operate for right turners only. This would tie into the two existing northbound lanes on Milton Road, and therefore increase egress capacity for the heavier movement. Accommodating this extra lane would require some landtake from adjacent car parks and the relocation of the security lodge. Existing stop line and signal head positions on Milton Road would also need to be adjusted, though such a remodelling might also provide opportunity to rationalise or reallocate the use of space at this junction.	Further assessment as to the feasibility of the widening needs to be undertaken and proposed layouts with additional capacity should be assessed in terms of capacity to quantify the benefits and impacts on the wider network and adjacent properties.
Cambridge Science Park / Kings Hedges Road		
N/A	There is no clear option for increasing the capacity of this junction within the constraints of the existing single-land configuration of Kings Hedges Road, as dedicated signalised lanes already exist on all arms for each movement the junction permits. Dual egress lanes from the site could only be included if an extra exit lane in each direction were added to Kings Hedges Road for the requisite merge length, which would likely require a degree of landtake and property acquisition.	No improvement option suggested at this junction.
Nuffield Road Access		
N/A	Presently, Nuffield Road only provides access to the small portion of the site which lies to the south of the Guided Busway. Because the potential for development growth in this section is limited, no capacity enhancements are required for this access route. However, one option to consider for the future could be to provide a link into the main site from Nuffield Road over the Guided Busway. Depending on agreement with transport authorities, this could be potentially either grade-separated to avoid conflict with the busway or signalised at-grade. Further work would be required to determine both physical feasibility and wider third-party impacts.	No improvement option required for this access route due to small portion of site served. If route linked to main site in future, further work required to understand physical feasibility and third-party impacts.

Source: MM

5.1.3.3 Site Access Summary

In order to facilitate future vehicular access to and from the two sites, it is recommended that the following measures be pursued:

- Implementation of extensive measures to reduce need to travel to sites by private vehicle and promote use of alternative modes
- Rationalisation and capacity enhancement of existing site access junctions

In light of the constrained opportunities for providing physical access to these sites, it is recommended that future development of both sites is delivered within the framework of site-wide masterplans which are designed to optimise site access and internal circulation, rather than through uncoordinated piecemeal development which could lead to access and circulation inefficiencies.

For the purposes of this study, sufficient capacity enhancement of existing accesses has been assumed, so as to allow the full external impact of the development proposals to be simulated by the modelling process.

5.2 Study Area Measures

5.2.1 Outline of Package

As per the focus of this study, a number of potential mitigation packages have been developed and tested to specifically mitigate development-related impacts as far as they relate to the study area. The impact of CNFE/CSP development on this area is covered in Section 4 above and relates mainly to impacts on Milton Interchange, though wider impacts beyond the study area are also noted and these are considered further in Section 5.3 below.

The mitigation packages tested range from the non-highway intervention approach only to packages with an increasing level of complementary highway intervention. This range of packages is fully described in the accompanying Strand 1 Options Modelling report, but is also summarised in the following table.

Table 23: Core mitigation packages tested

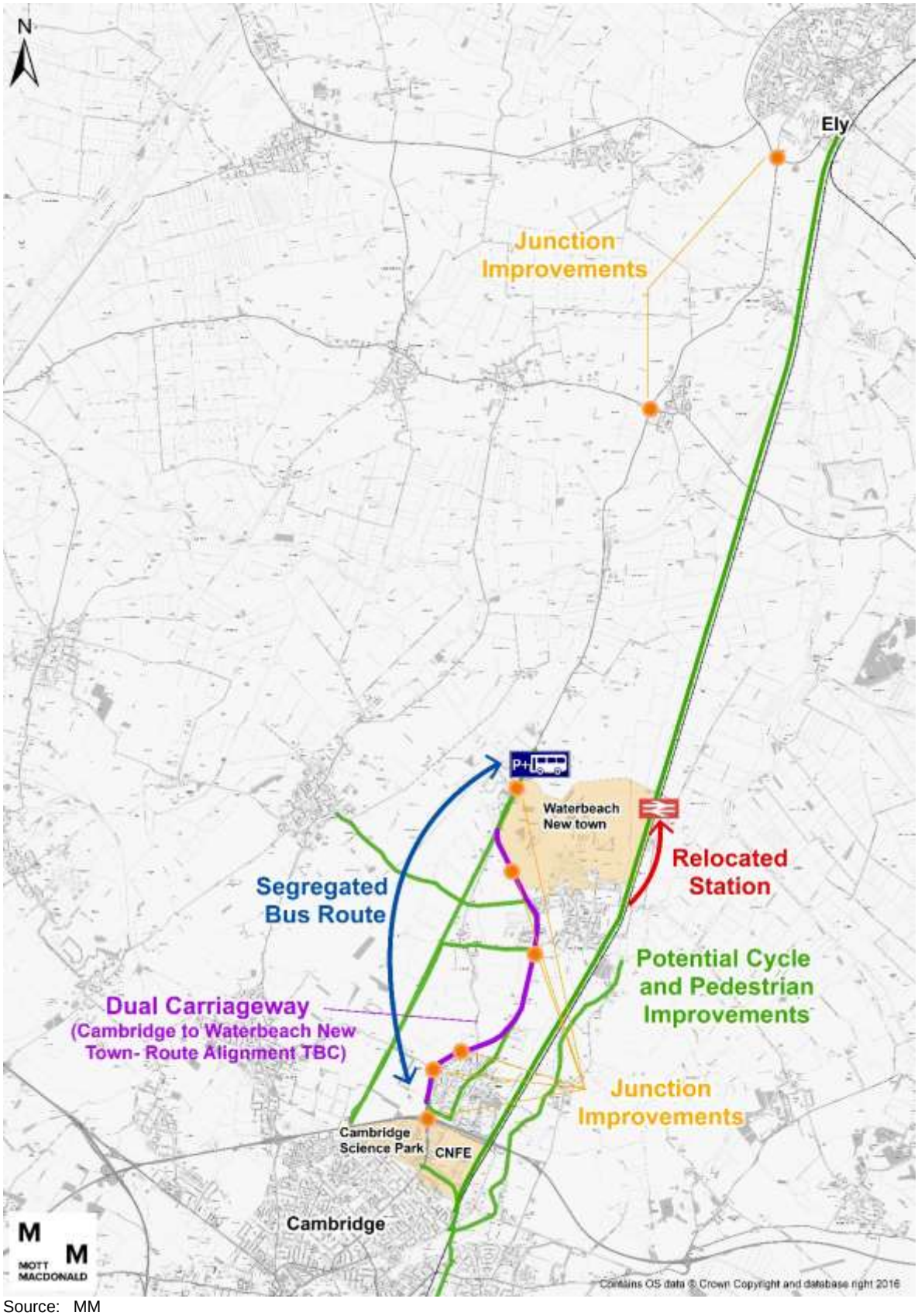
Package	Description	Rationale
Mode-shift	Do Minimum highway network, but new measures to encourage mode shift	To test the impact of non-highway interventions only
Junction+	Mode-shift option measures, but with additional junction improvements to A10 corridor	To test the impact of adding a first level of highway improvements
North-dual	Junction+ option, but with the A10 dualled from the north access of the new town north of Waterbeach to Ely	To test the impact of a further highway upgrade, which encourages use of Waterbeach P&R to Cambs
South-dual	Junction+ option, but with the A10 dualled from the south access of the new town Waterbeach to the A14	To test the impact of upgrading capacity on the south half of the corridor, where it is most needed
Full-dual	Junction+ option, but with the A10 dualled from the A14 to Ely	To test the impact of a full corridor upgrade

Source: MM

In addition, the implications for these mitigation packages of a potential new link between the A47 and the M11 were also assessed through sensitivity testing.

Full appraisal of these packages against the specific objectives of this study, wider policy objectives and considerations of value is described in the Strand 1 Preliminary SOBC report. Though no single package is recommended in that report as a preferred scheme at this stage, with all tested packages demonstrating high value-for-money scores, the INSET appraisal process scored the above ‘South-Dual’ package highest in terms of its overall balance of benefits and costs. The measures included in this package are summarised in the following figure.

Figure 29: South-Dual package measures



Source: MM

Though it is recognised that not all of the measures shown above would be required to mitigate the impacts of the CNFE and CSP development proposals if implemented without the new town north of Waterbeach, it is also noted that these developments would nonetheless directly benefit from some of the proposals, and particularly from the improvements to Milton Interchange and to public transport and active modes. For the purpose of assessing the impact of the CNFE/CSP developments on the study area in the context of a potential package of mitigation measures, therefore, the modelling results for this package are considered in this report.

The full measures are described in more detail in the following sections.

5.2.2 Active Mode Improvements

New or improved walking/cycling routes are proposed between Ely, Waterbeach and Cambridge including:

- A new route between the Waterbeach Park and Ride and the western end of the Cambridge Science Park located away from the A10, utilising Green End Road and the local road and walkway network
- Improvements to the existing off road footway/cycleway adjacent to the A10
- New cross connections between the two routes described above and connecting to Cottenham
- A new cycleway adjacent to the rail corridor between Cambridge and Ely, running adjacent to the eastern edge of the CNFE site, including a new connection through CNFE to the CSP site
- Improvements to the existing National Cycle Route between the existing Waterbeach Rail Station and Cambridge.

5.2.3 Bus Mode Improvements

A new segregated busway, or similar dedicated rapid transit link, is proposed between the new town north of Waterbeach and the CNFE and CSP sites. This will include the provision of a Park and Ride facility adjacent to the A10.

The exact route is yet to be determined, but the intention is to improve the attractiveness of bus travel by shortening the journey time through separating buses from general vehicle congestion and tying effectively into the existing bus and guided bus networks in Cambridge; taking into account proposals emerging from the ongoing GCP Milton Road Study.

5.2.4 Rail Mode Improvements

As outlined previously, the existing Waterbeach rail station is located to the south east of the existing Waterbeach village. It is proposed to relocate the rail station closer to Waterbeach new town and to provide an additional Park & Rail parking facility, separate to the bus based Park & Ride.

The Cambridge North Rail Station has recently opened adjacent to the CNFE site. No additional rail improvements are currently proposed in this area.

5.2.5 Highway Improvements

In addition to the improvements for non-car modes, this mitigation package involves the dualling of the southern and busiest section of the A10 corridor between the southern access of the new town north of Waterbeach and Milton Interchange and to upgrade the junctions within that section accordingly (including Milton Interchange). Whether the dualling would be applied along the existing route, along a new route, or a combination of both would be determined at the next stage of scheme development.

For the remainder of the study route to the north as far as Ely, this package includes moderate capacity improvements at junctions where the modelling shows such measures would be beneficial. The proposed junction improvements, for modelling purposes, are at the following junctions:

- A10 / Green End
- Northern Waterbeach Development Access
- Stretham Roundabout
- A10 / A142 / Cambridge Road

5.3 Potential Wider Network Measures

It is described in Section 4.3.1 above that the Combined Scenario Do Minimum modelling results predict that the main study area impact of the CNFE and CSP new development trips will be on Milton Interchange. However, the results also show that these sites will generate highway impacts outside the study area, and principally at Histon Interchange, Quy Interchange, Junction 13 of the M11, and at junctions on or around the Cambridge inner ring road and along Huntingdon Road.

The above results provide a number of pointers as to what wider mitigation measures might need to be explored as more detailed planning commences for development of the two sites. These measures include:

- From **the A14 to the east of Cambridge**, this could potentially be addressed by:
  - Intercepting trips at a park and ride facility to the east of the city, and providing segregated public transport / pedestrian cycle links into the area. This might be achieved by:
    - The Newmarket Road, Airport Way Park and Ride, and Eastern Orbital proposals set out in the GCP's initial programme.
    - Improved vehicular access to the Airport Way Park and Ride site from the A14, including improvements to the Quy Interchange between the A14, A1303 and B1102 which are being investigated by the Cambridgeshire and Peterborough Combined Authority.
    - The Chisholm Trail pedestrian and cycle route and bridge over the River Cam, which would allow for 'Park and Cycle' trips into the area from Newmarket Road / Airport Way.
  - Improvements to the frequency, capacity and journey times of rail links into Cambridge from the east. Trains from Norwich could directly serve Cambridge North. For trains from Ipswich this would involve changing at Cambridge and a three minute trip to Cambridge North.
- From **the M11 to the south of Cambridge**, this could potentially be addressed through:
  - Interception of trips at Trumpington or Hauxton for an onward public transport journey into the area using the GCP's Western Orbital route proposals and/or via the proposed park and ride site in the Cambourne to Cambridge area that is currently being investigated via the GCP scheme.
  - Additional rail services into Cambridge North station from the south, over and above those that are already planned to stop there. This would provide for trips by people living near to the railway, and would provide opportunity for longer trips to be intercepted at Meldreth, Shepreth, Foxton, Audley End, Great Chesterford, Whittlesford Parkway and Shelford. This could be achieved by:
    - Extending all stopping services between Royston and Cambridge and Stansted Airport, Audley End and Cambridge to Cambridge North.
    - Cross Country services from Birmingham to Stansted Airport serving Cambridge North.
- From **the A428 to the west of Cambridge**, this could potentially be provided by:
  - Bus services between St Neots, Cambourne or a Park and Ride facility on the A428, and the CNFE / CSP area. This could utilise:
    - The GCP's Cambourne to Cambridge Scheme.
    - The segregated bus links that are being provided through the Cambridge Northwest and NIAB developments between Madingley Road and Histon Road.
    - The existing Busway between Histon Road and Cambridge North Station.

- From **the A14 to the northwest of Cambridge**, this could be provided by:
  - Existing, and expanded, busway services between St Ives, Northstowe, the CSP and Cambridge North Station.

There is further scope to reduce pressure on the A14, A428, M11 and A10 for trips into the area by providing effective alternative provision for other trips that travel on these routes through the area rather than having the area as an origin or destination. Measures that could contribute to achieving this include:

- Cambridge South Station, providing for trips into the Cambridge Biomedical Campus from the north by rail, taking pressure off the A10, A14 and M11.
- Improved rail links into Cambridge from the east and west, taking pressure of the A14 and A428.
- Further development of the GCP Access to Cambridge suite of measures to improve conditions for pedestrians, cyclists, and public transport in the city more widely.

Many of the interventions noted above are already included in plans of, or being investigated by, the Greater Cambridge Partnership, the Cambridgeshire and Peterborough Combined Authority and Cambridgeshire County Council. Further, it is understood that a number of the rail interventions noted above are being investigated by Network Rail and local / regional partners. These include:

- Cambridge South Station
- A new rail link between Oxford and Cambridge (East West Rail western and central sections)
- Improved links between Cambridge, Norwich and Ipswich (East West Rail eastern section)
- Further development of the GCP City Access proposals that are seeking to help more people get into, out of and around the city by sustainable means, offer better alternatives to travel by car and boost economic growth and quality of life.

The overall capacity for current and new rail services in the Cambridge area to cater for growth and new travel demand is likely to need to be considered in detail, and the growth context in the CNFE / CSP area and the recommendations from this study should inform any such work.

It is recommended that opportunities to maximise rail travel are exploited through considering how improved linkages between Cambridge North and the two sites can be established. For the CNFE site, this should be focussed on masterplanning and on-site measures to ensure that safe, direct, and attractive pedestrian and cycle routes are provided across the site to and from the station. For CSP, which is more remote, delivery of walking and cycling facilities is key, but this should be accompanied by provision of a fast, frequent and reliable public transport connection between the station and the site (including key locations *within* the site). Innovative transport measures, such as the role of autonomous vehicles, should be considered.

It is also recommended that further work looks at the operation of the Milton Interchange between the A14, A10 and A1309 alongside the consideration of options for the dualling of the A10 recommended by the 'Ely to Cambridge Transport Study: Preliminary Strategic Outline Business Case'. This work would establish what additional highway capacity at the interchange could usefully be provided. It would also need to consider linkages with the work looking at extending the M11 to the A47, as it is possible that provision of this route could provide for many of the longer distance movements that a major improvement to the Milton Interchange might cater for.

5.4 Summary

To address the predicted external transport impacts on the study area of the modelled new development levels at the CNFE and CSP sites, a package of mitigation measures will be required. The package tested for this study includes a number of measures to maximise the internalisation of new development trips and to encourage use of non-car modes for the remaining trips, including:

- Complementary land uses at the CNFE site, including implementing a balance of residential and employment land uses
- High quality, direct walking/cycle routes
- Improvements to public transport, including a new segregated busway, or similar dedicated rapid transit provision, between the new town north of Waterbeach and the CNFE/CSP sites
- Stretching car parking standards at the CNFE and CSP sites accompanied by intensive travel planning activity

As the CSRM2 model is not able to directly model the latter measure, this has been reflected in the CNFE 'trip budget' described in Section 3.1.2.3 above and therefore included in the Do Minimum modelling described in the previous chapter. However, these results confirm that parking restraint alone will not be sufficient to mitigate the impacts of new development at these sites, so further measures will be required.

Consideration has therefore been given to the feasibility of providing new direct links between the A14 and either or both sites, but it is considered that any such scheme is likely to be either non-feasible in engineering/safety terms and/or non-viable in Business Case terms. This places extra importance on delivering capacity enhancements of the existing site access points off Milton Road, and potential ways of achieving this are summarised in Section 5.1.2 above. It also suggests that future development of the sites should be delivered within the framework of site-wide masterplans which are designed to optimise site access and internal circulation, rather than through uncoordinated piecemeal development which could lead to access and circulation inefficiencies.

Off-site highway network improvements will also be required, as outlined in the Strand 1 Preliminary Strategic Outline Business Case report. Though no single package is recommended in that report as a preferred scheme at this stage, with all tested packages demonstrating high value-for-money scores, the INSET appraisal process scored the above 'South-Dual' package highest in terms of its overall balance of benefits and costs. Though it is recognised that not all the measures included in this package would be required to mitigate the impacts of the CNFE and CSP development proposals if implemented without the new town north of Waterbeach, it is also noted that these developments would nonetheless directly benefit from some of the proposals, and particularly from the improvements to Milton Interchange and to public transport and active modes. For the purpose of assessing the impact of the CNFE/CSP developments on the study area in the context of a potential package of mitigation measures, therefore, the modelling results for this package are considered in this report.

Lastly, it is noted that the modelling results in Section 4 above show that the development proposals for CNFE/CSP are predicted to generate wider impacts than just in the study area, though many of these are a result of traffic being displaced to other routes to avoid the predicted delays at Milton Interchange. Wider rail, bus/rapid transit and active mode measures – together with stringent on-site parking restraint – are therefore essential for reducing this wider level of impact, but significant improvements to Milton Interchange will also be required to resolve these wider issues. Any residual wider impacts will then require further mitigation, to be considered via the transport assessment process.

6 Impact of Interventions

The purpose of this section is to review the predicted impact of the proposed interventions on development travel behaviour and surrounding network performance.

6.1 Modelling Method

Using the same method as described above in Section 4.1, the interventions outlined in Section 5 have been modelled by adding them to the Combined Scenario Do Minimum network to create a Combined Scenario 'Do Something' case. The results of this assessment are then compared with the equivalent Combined Scenario Do Minimum case ('Do Minimum') in order to establish the impacts of those interventions assessed via the Preliminary Strategic Outline Business Case

6.2 Development Trip Details

6.2.1 Trip Levels

As with the above Do Minimum assessment, the impacts of the CNFE and CSP developments on the proposed transport network in the CSRM model is considered in terms of the transport parameters of total person trip generation, mode share, site internalisation levels and external trip distributions.

The level of all-mode person trip generation calculated by the CSRM demand model for the CNFE and CSP developments are shown in Table 24 and Table 25. The table also shows the % difference between the results of the Do Something and Do Minimum Scenario described in Section 4.

Table 24: CNFE development person trip generation following interventions vs the Do Minimum

Parameter	AM (08:00-09:00)			PM (17:00-18:00)		
	Departures	Arrivals	Total Trips	Departures	Arrivals	Total Trips
External	2,234	1,670	3,904	2,235	1,851	4,086
% Diff vs Do Minimum	+0.1%	+2.4%	+1.1%	+2.1%	+0.6%	+1.4%
Internal	285	285	285	262	262	262
% Diff vs Do Minimum	-1.4%	-1.4%	-1.4%	-2.2%	-2.2%	-2.2%
All	**2,519**	**1,955**	**4,189**	**2,497**	**2,113**	**4,348**
% Diff vs CS	**+0.0%**	**+1.8%**	**+0.9%**	**+1.6%**	**+0.2%**	**+1.1%**

Source: CSRM2

Table 25: CSP development person trip generation following interventions vs the Do Minimum

Parameter	AM (08:00-09:00)			PM (17:00-18:00)		
	Departures	Arrivals	Total Trips	Departures	Arrivals	Total Trips
External	410	3,617	4,027	2,757	335	3,092
% Diff vs Do Minimum	-0.2%	1.6%	1.4%	1.3%	-0.5%	1.2%
Internal	41	41	41	55	55	55
% Diff vs Do Minimum	-2.4%	-2.4%	-2.4%	-1.8%	-1.8%	-1.8%
All	**451**	**3,658**	**4,068**	**2,811**	**390**	**3,147**
% Diff vs CS	**-0.5%**	**1.6%**	**1.3%**	**1.3%**	**-0.8%**	**1.1%**

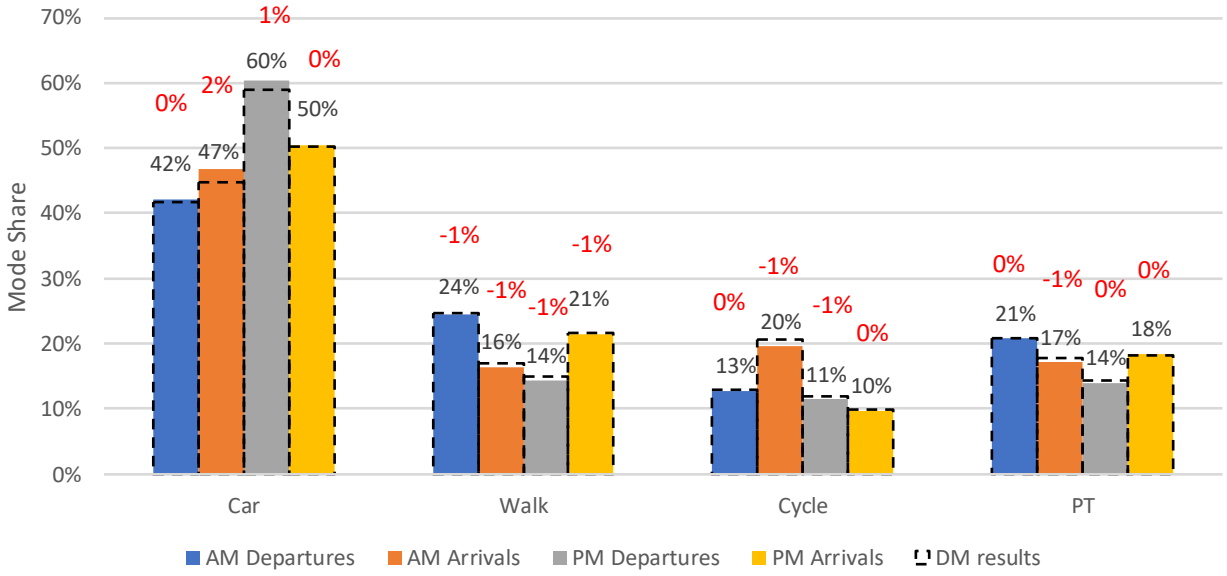
Source: CSRM2

The tables show that, overall, there is predicted to be a small percentage increase in the number of total person trips travelling to and from the CNFE and CSP sites as a result of the proposed interventions. This increase is due to the greater accessibility to the sites which the interventions will promote within the study corridor. There is a corresponding small drop in internal trips, but this is negligible in terms of trip numbers.

6.2.2 Mode Share

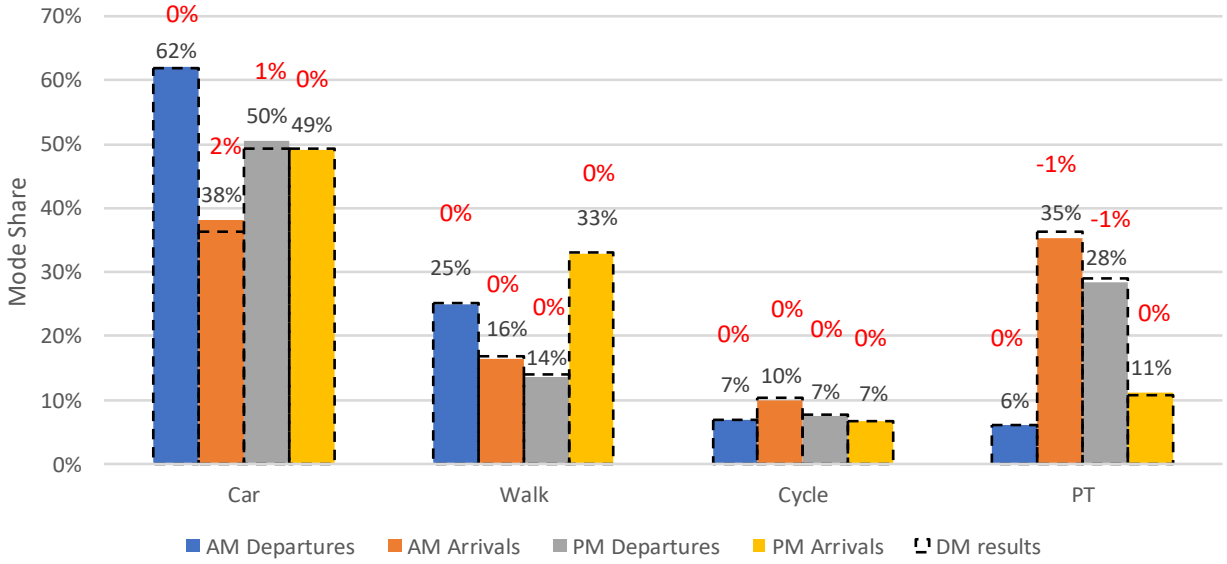
Figure 30 below shows the mode share for the CNFE and CSP development external trips calculated by the CSRM for the Do Something case. The equivalent Do Minimum result is also shown for reference.

Figure 30: CNFE forecast mode share for external development trips – Do Something versus Do Min



Source: CSRM

Figure 31: CSP forecast mode share for external development trips – Do Something versus Do Min



Source: CSRM

The results show that little difference in mode share is predicted between the Do Minimum and Do Something scenarios, but that the differences shown are a slight increase in car mode share and associated decreases in walking, cycling and public transport mode shares. This is likely in response to the fact that the dualling of the A10 makes car trips more attractive from the north, which reinforces the importance of car parking management measures at these sites to encourage use of more sustainable modes. However, it is noted that the resulting car mode shares shown are still significantly lower than the existing car mode shares recorded by the 2016 Travel Plan Plus survey (see Section 2.2.2 above).

6.2.3 Car Trips

Table 26 and Table 27 outline how the above analysis translates into car trips and actual vehicles and compares the results to the Do Minimum scenario.

Table 26: CNFE External car trip generation – Do Something vs Do Minimum Scenario

Parameter	AM Peak (08:00-09:00)			PM Peak (17:00-18:00)		
	Departures	Arrivals	Total Trips	Departures	Arrivals	Total Trips
Person trips by car	883	783	1,666	1,347	956	2,303
% Diff vs Do Minimum	+0.8%	+7.3%	+3.7%	+4.6%	+1.1%	+3.1%
Number of cars	655	633	1,288	1,005	685	1,690
% Diff vs Do Minimum	+0.9%	+7.5%	+4.0%	+4.6%	+1.0%	+3.1%

Source: CSRM2

Table 27: CSP External car trip generation – Do Something vs Do Minimum Scenario

Parameter	AM Peak (08:00-09:00)			PM Peak (17:00-18:00)		
	Departures	Arrivals	Total Trips	Departures	Arrivals	Total Trips
Person trips by car	269	1,280	1,549	1,500	166	1,666
% Diff vs Do Minimum	+0.0%	+6.9%	+5.7%	+3.7%	-0.6%	+3.3%
Number of cars	214	1,021	1,235	1,229	115	1,344
% Diff vs Do Minimum	+0.0%	+7.2%	+5.9%	+3.8%	+0.0%	+3.5%

Source: CSRM

The results indicate that the combination of a small increase in overall person trips combined with the small predicted increase in car mode share (around 1-2%) results in an increase in vehicle trips generated by the sites of 4-6% in the AM peak and 3-4% in the PM peak. This is equivalent to an increase of about 124 vehicle trips in the AM peak hour and about 100 in the PM peak hour.

As outlined above, this result highlights the importance of car parking management measures to encourage use of other modes and to restrain car trip growth as a result of enhanced highway capacity measures.

6.2.4 Highway Trip Distribution

In Section 4.2.4 above, trip levels by mode between the CNFE and CSP sites and the top eight trip generating sectors are tabulated for the Combined-Scenario Do Minimum case. The following table shows how these trip levels are predicted to change as a result of the Do Something package of interventions.

Table 28: Change in total trips to and from CNFE and CSP developments by sector, 07:00 – 19:00, Do Something vs Do Minimum

Destination	Car	Walk	Cycle	Bus	Rail	GBus	P&R	Total
Cambridge Outer	-169	-65	-48	-30	-1	9	7	-297
Cambridge Central	-127	-13	-23	-66	-1	57	404	232
City Fringe	-12	-24	-18	-21	-5	14	0	-66
South Cambs Outer	29	0	-7	-24	-3	20	0	16
Cambridge Northern Fringe	-52	-43	-8	0	0	0	0	-103
East Cambs Rural	208	0	-3	-18	-39	21	0	170
Cambridge Science Park	-48	-12	-3	0	0	0	0	-63
New town north of Waterbeach	336	7	-29	-321	488	22	0	504

Source: CSRM

This table shows an overall reduction in person trips between the CNFE/CSP sites and outer Cambridge areas, and from within the sites themselves. Conversely, trips between the sites and Central Cambridge, South Cambridgeshire Outer, East Cambridgeshire Rural and the new town north of Waterbeach show overall person trips increases. In the case of the latter three sectors, this will be due to an increase in transport capacity on the southern section of the study corridor, which also translates to an increase in car trips. In the case of the new town north of Waterbeach, it also translates into a significant increase in the use of rail and guided bus, though some of this is offset by a reduction in bus use.

In Section 4.2.4 above, the mode share for trips by sector is also tabulated for the Combined-Scenario Do Minimum case. The following table shows how these mode shares are predicted to change as a result of the Do Something package of interventions.

Table 29: Change in mode shares to and from CNFE and CSP developments by sector, 07:00 – 19:00, Do Something vs Do Minimum

Destination	Car	Walk	Cycle	Bus	Rail	GBus	P&R
Cambridge Outer	0%	0%	0%	0%	0%	0%	0%
Cambridge Central	-2%	-1%	-1%	-2%	0%	+1%	+4%
City Fringe	0%	0%	0%	0%	0%	0%	0%
South Cambs Outer	0%	0%	0%	0%	0%	0%	0%
Cambridge Northern Fringe	-1%	+1%	0%	0%	0%	0%	0%
East Cambs Rural	2%	0%	0%	-1%	-2%	+1%	0%
Cambridge Science Park	-1%	+1%	0%	0%	0%	0%	0%
New town north of Waterbeach	0%	0%	-3%	-14%	+17%	+1%	0%

Source: CSRM

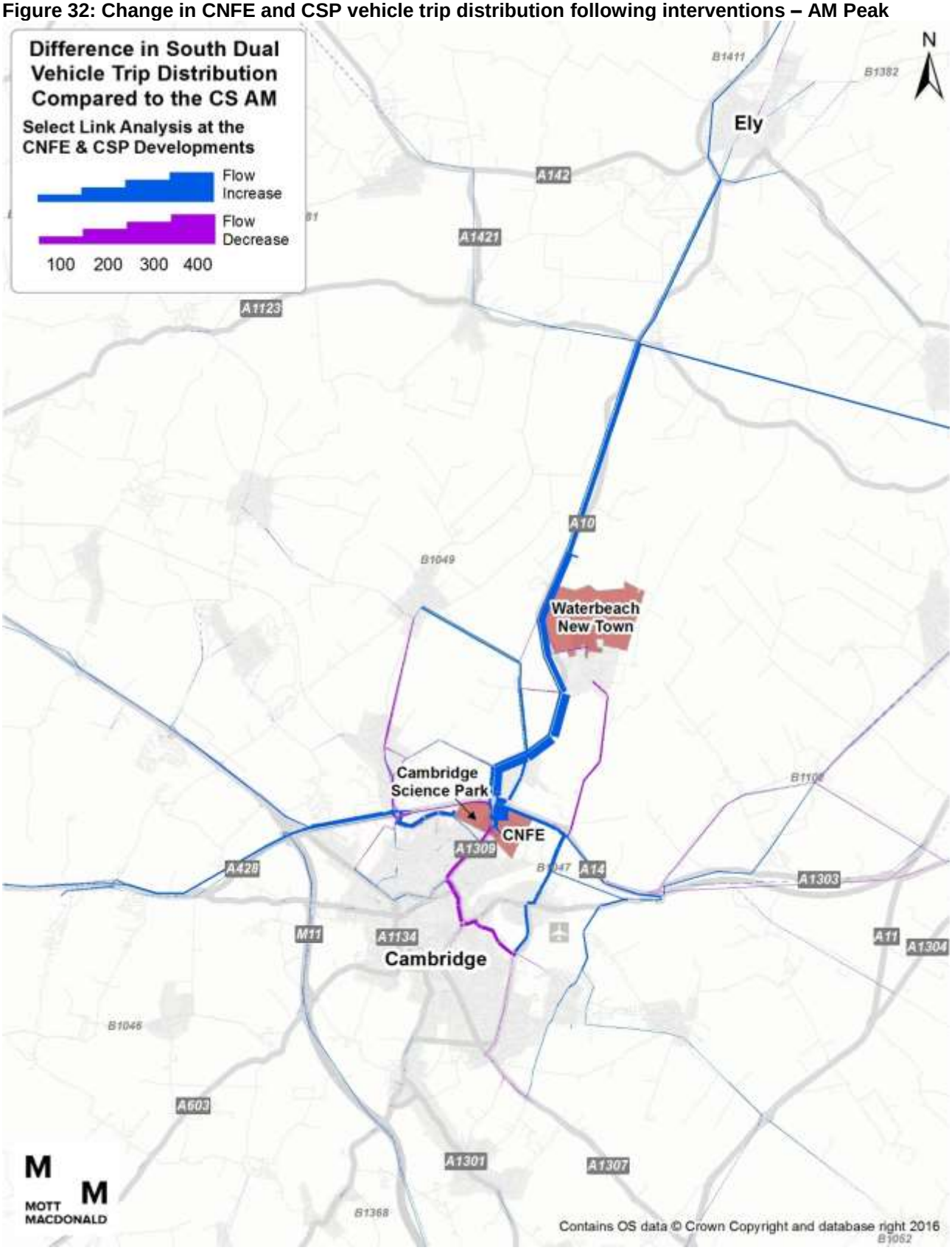
The results reveal that car mode shares are predicted to either stay the same or reduce for all sectors with the exception of East Cambridgeshire Rural, where the car mode share is predicted to increase. It is noted that even though the model predicts an increase in vehicle trips between the new town north of Waterbeach and the CNFE and CSP sites, the overall car mode share is predicted to stay the same for these trips.

Section 4.2.4 above shows the highway network distribution of the resulting car trips to and from the CNFE and CSP sites for both the AM and PM peak periods in the Combined-Scenario Do Minimum case. The following figures show how these distributions change as a result of the Do Something package of interventions.

The main change in trip distribution between the two scenarios is a predicted increase in vehicle trips on the A10 between the CNFE and CSP sites and the new town north of Waterbeach during both the AM and PM peaks, and a significant transfer of vehicle trips from King Hedges Road to the A14 during the PM peak.

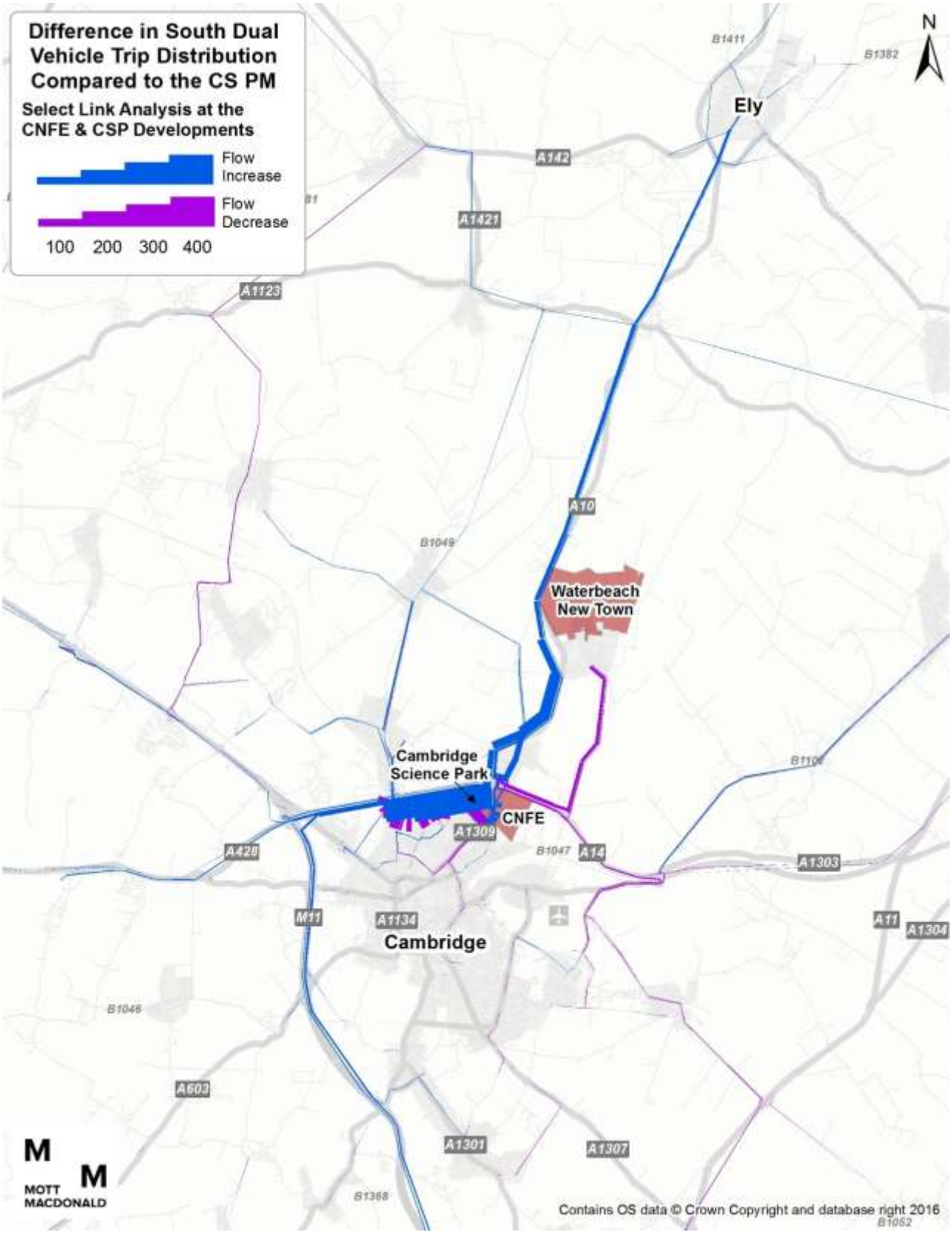
The increase in vehicle trips on the A10 is a direct result of the proposed increase in capacity on this section. There is an associated decrease in vehicle trips on alternative adjacent north south routes. The predicted increase on the A14 during the PM peak is in response to improvements to Milton Interchange drawing more A14 trips via that junction.

Figure 32: Change in CNFE and CSP vehicle trip distribution following interventions – AM Peak



Source: CSRM

Figure 33: Change in CNFE and CSP vehicle trip distribution following interventions – PM Peak



Source: CSRM

6.3 Network Performance

6.3.1 Traffic Flows and Delay

In order to show how the mitigation package is predicted to impact the performance of the highway network, Figure 34 and Figure 35 show the change in traffic flow and total junction delay between the 2031 Combined Scenario South-Dual Do Something case (ie, the 'with-development-with-mitigation' scenario) and the 2031 Combined Scenario Do Minimum case (ie, the 'with-development-without-mitigation' scenario). This allows the changes resulting from the mitigation measures to be observed. The changes in junction delay are only shown for the junctions shown as impacted by development flows in Figure 17 and Figure 18, and for any other junctions which experience an increase in delay and a V/C[12] ratio over 85% as a result of the mitigation measures.

It is noted in Section 4.3.1 above that the main impacts generated by CNFE/CSP development traffic in the Do Minimum scenario are at Milton Interchange, Histon Interchange, Quy Interchange, Junction 13 of the M11, and at junctions on or around the Cambridge inner ring road and along Huntingdon Road.

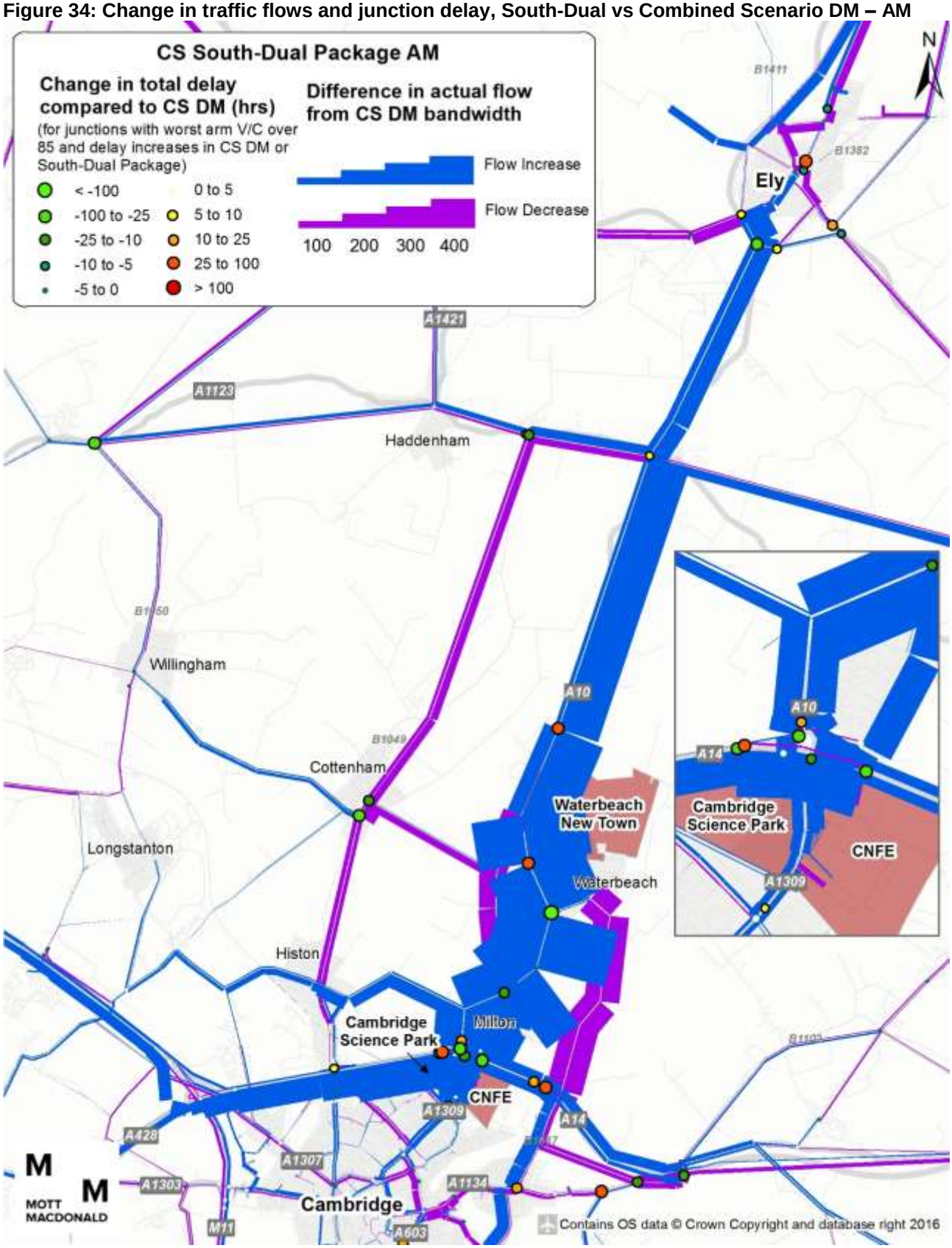
Taking this context into consideration, therefore, the following figures show:

- Significant delay improvements at Milton Interchange in both peak hours. In the evening, this yields delay improvements on Kings Hedges Road and at Histon Interchange as more development traffic is routed via Milton Interchange instead. The increase in A14 traffic results in a small delay increase at Histon Interchange in the morning, however.
- Some delay increases at Junctions 34 of the A14 in both peak hours and at Junction 31 in the PM peak
- Some small delay increases on Milton Road as development traffic from central Cambridge increases slightly, but improvements on Huntingdon Road in the PM as traffic no longer seeks to avoid Milton Interchange.

Overall, the results suggest that the tested study-area-focussed Do Something package of interventions will help to mitigate the main local impacts of increased development at the CNFE and CSP sites. The greatest benefits for the development are seen in the upgrading of Milton Interchange, which helps to reduce pressure on Kings Hedges Road, Histon Interchange and on routes via the city centre. Measures to resolve the wider residual impacts are discussed above in Section 5.3.

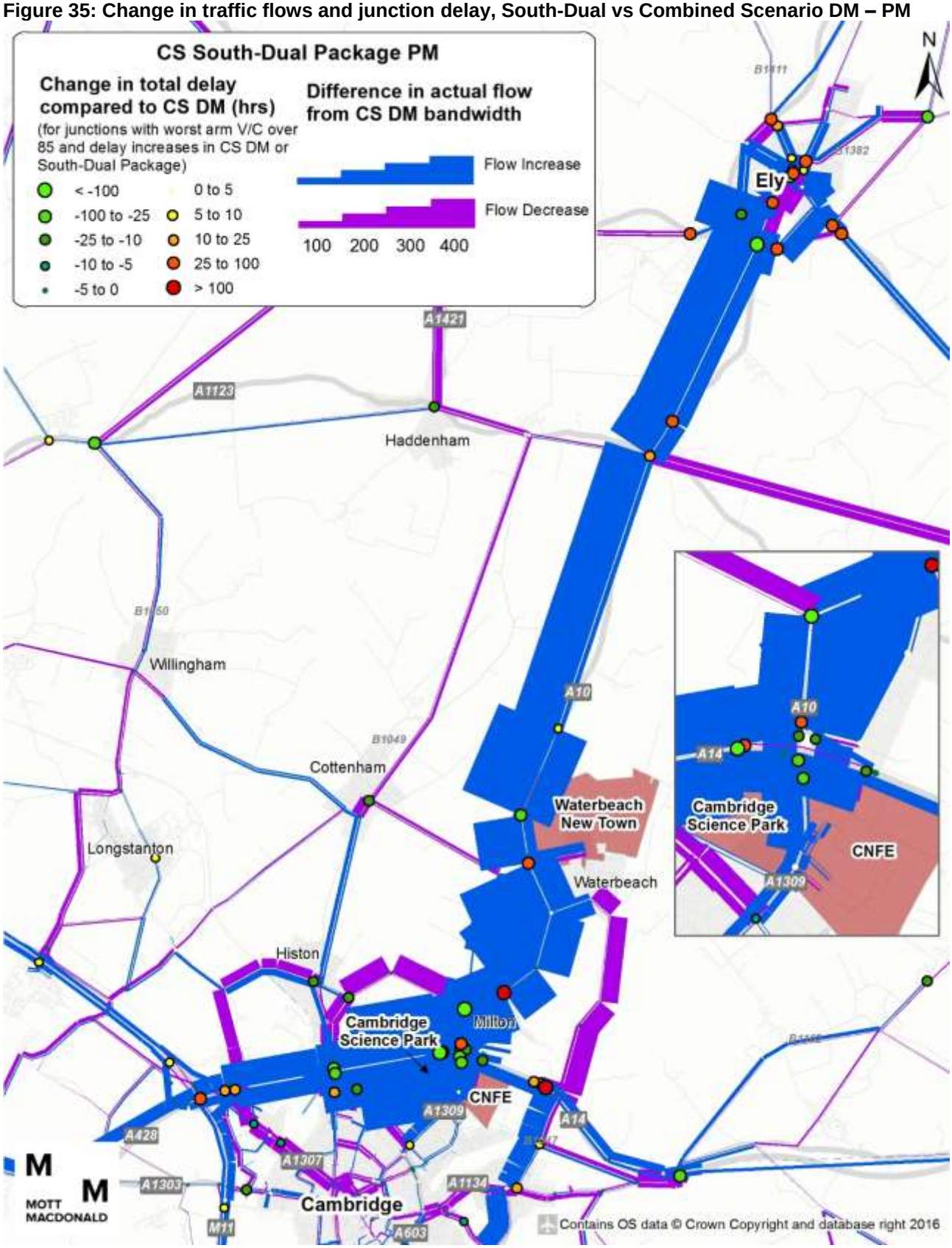
[12] V/C = ratio of traffic volume to junction capacity. This is a standard modelling measure of the operating level of a junction, where a V/C level above 85% is considered to mean a junction is operating above its effective capacity, and a level above 100% means it is operating above its absolute capacity.

Figure 34: Change in traffic flows and junction delay, South-Dual vs Combined Scenario DM – AM



Source: CSRM

Figure 35: Change in traffic flows and junction delay, South-Dual vs Combined Scenario DM – PM



Source: CSRM

6.3.2 A10 Journey Times

As per the focus of this study, Figure 36 and Figure 37 show modelled northbound and southbound journey times along the A10 between Chesterton Road in Central Cambridge and Ely during the AM and PM peaks. Results are illustrated for the:

- Combined-Scenario Do Something case (ie mitigated with-development case)
- Combined-Scenario Do Minimum case (ie unmitigated with-development case)
- Future-Base Do Minimum case (ie without-development case)
- Free-flow case (taken from each link's 'Free Flow Time' parameter in the CSRM model)

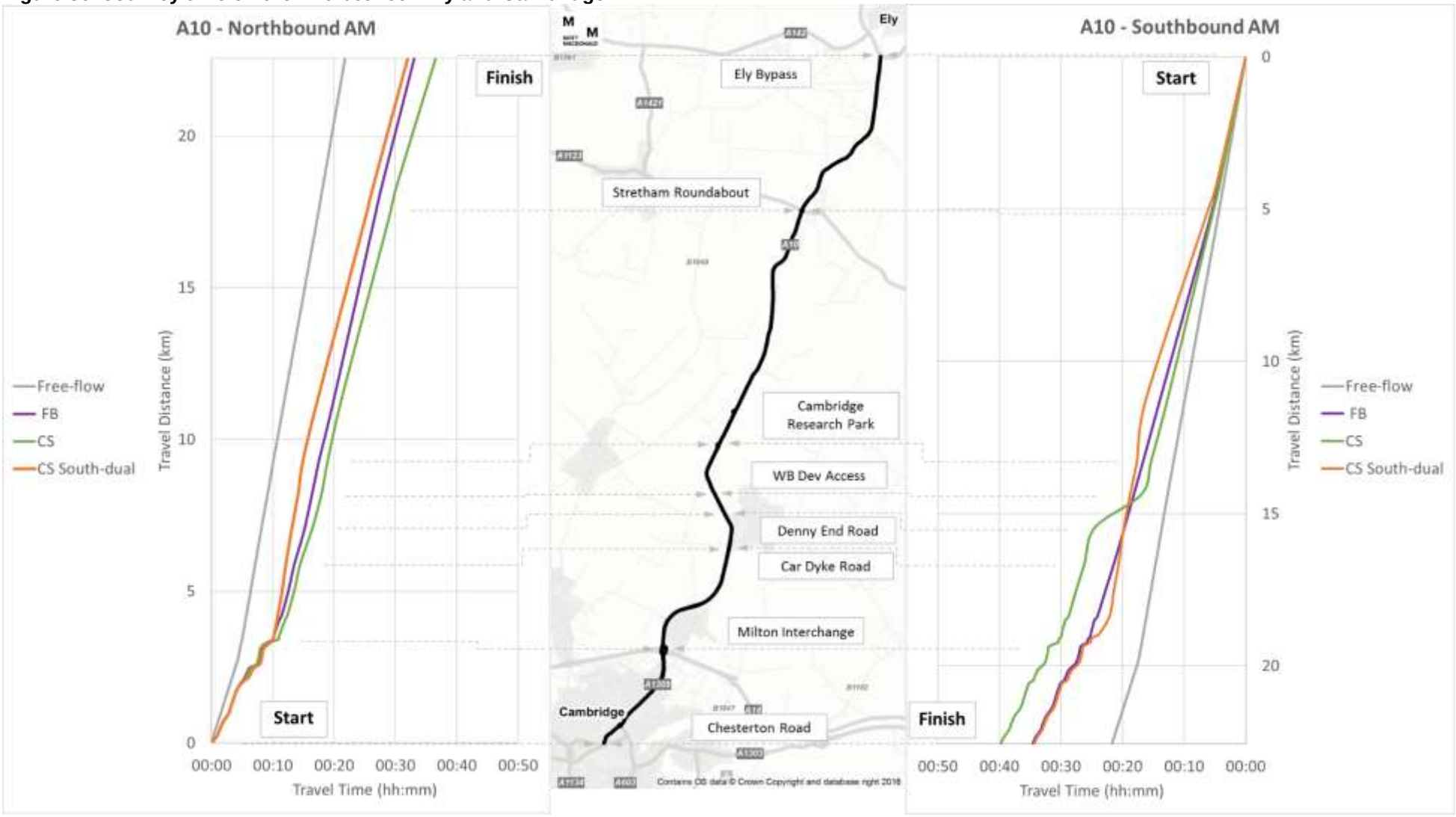
With particular focus on the impacts of the CNFE and CSP developments with mitigation in place, the results show:

- Over the full route distance, the South-Dual journey times are lower than both those of the Combined Scenario Do Minimum and the Future Base Do Minimum in all cases except southbound in the PM peak, where it is a little greater than the others.
- Particular improvements are seen on the southern section of A10 between the new town north of Waterbeach and Milton Interchange, where CNFE/CSP flows contribute to impacts at the latter.
- On Milton Road between Milton Interchange and the city centre where CNFE/CSP flows comprise the majority development flow impact, little journey time impact is observed in either peak hour.

Overall, it can be seen from these results that the package of transport interventions tested for the study area is predicted to deliver A10 journey time performance which is generally better than the equivalent 'without development' case. The measures are therefore predicted to provide effective development impact mitigation on highway corridor performance.

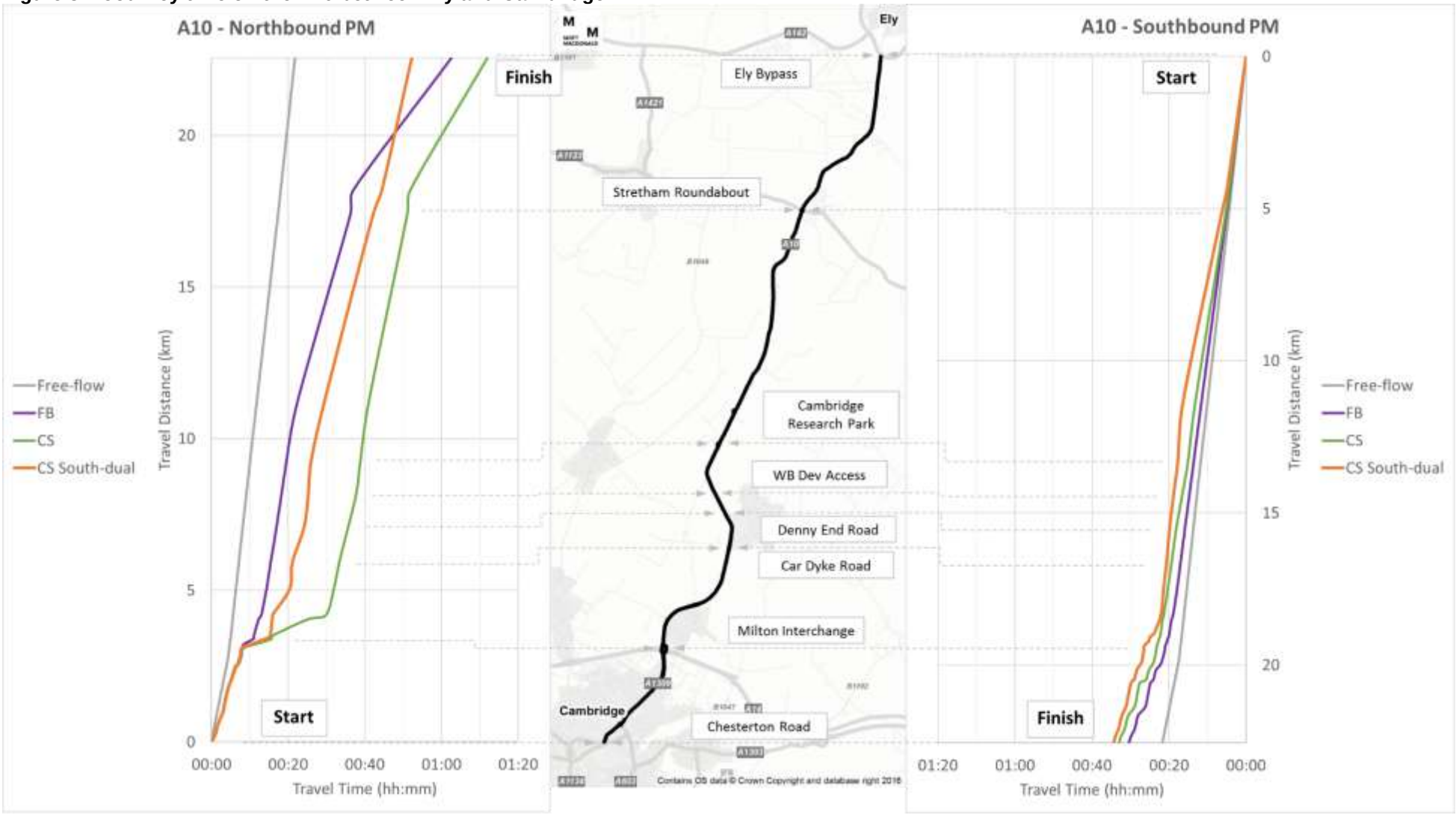
It is also likely that these measures will generate performance benefits on other routes impacted by these developments, such as on King Hedges Road and at Histon Interchange, while the potential wider measures noted in Section 5.3 above will also yield further benefits.

Figure 36: Journey time on the A10 between Ely and Cambridge – AM



Source: CSRM

Figure 37: Journey time on the A10 between Ely and Cambridge – PM



Source: CSRM

6.4 Summary

As a result of the interventions tested for the study corridor, the total person trips generated by the CNFE and CSP sites is predicted to increase by around 1% as wider network accessibility is increased. The increase in highway capacity – particularly at Milton Interchange – also results in a small increase in the mode share of car travel to and from the sites, though this is still significantly improved over existing levels. Overall, this amounts to an extra 100-124 vehicles generated by both sites in each peak hour as a result of the interventions which, though minor in percentage terms, highlights the importance of car parking management measures to encourage use of other modes and to restrain car trip growth at the sites.

In terms of development trip distribution, the main change resulting from the interventions is a predicted increase in vehicle trips on the A10 between the CNFE and CSP sites and the new town north of Waterbeach during both the AM and PM peaks, and a significant transfer of vehicle trips from King Hedges Road to the A14 during the PM peak. The increase in vehicle trips on the A10 is a direct result of the proposed increase in capacity on this section, while there is also an associated decrease in vehicle trips on alternative adjacent north south routes. The predicted increase on the A14 during the PM peak is in response to improvements to Milton Interchange drawing more A14 trips via that junction instead of via Histon Interchange and less appropriate local routes.

In highway performance terms, the interventions combined with the flow reassignments result in delay improvements at Milton Interchange in both peak hours. In the evening, the reassignment of flows to this junction also produces delay benefits to Kings Hedges Road and Histon Interchange, though a small increase in delay is seen at this interchange in the AM peak. Delay reductions are also seen on Huntingdon Road and in the city centre, though some delay increases are predicted at Junctions 31 and 34 of the A14. Measures to resolve the wider residual impacts are discussed above in Section 5.3.

In terms of how these changes affect journey times in the study corridor, however, the results show that the package of transport interventions tested for the study area is predicted to deliver A10 journey time performance which is generally better than the equivalent ‘without development’ case. The measures are therefore predicted to provide effective development impact mitigation on study area highway performance.

It is also likely that these measures will generate journey time benefits on, and reduce traffic from, other routes impacted by the CNFE and CSP developments, such as on King Hedges Road and at Histon Interchange, while the potential wider measures noted in Section 5.3 above will also yield further benefits.

7 Implementation Considerations

The purpose of this section is to review issues relating to development implementation.

7.1 Costs and Funding

7.1.1 Scheme Costs

An outline cost estimate for the 'South-Dual' package of interventions is outlined in Table 30 below.

Table 30: South-Dual package estimated costs

Intervention	Estimated Cost (£million)
Guided Busway	£90m
Waterbeach Park and Ride	£10m
New Waterbeach Station	£30m
Pedestrian and Cycle Improvements	£20m
Milton Road Improvements	£5m
Highway Works (dualling and junction improvements)	£155m
Total	**£310m**

Source: MM

This estimate is based on the following assumptions and exclusions:

- General assumptions**:**
  - The estimate is based at 4Q17 (no inflation has been allowed for beyond this time)
  - Works can be carried out under half road closure wherever possible
  - Existing ground level approximately same as finished construction levels
  - The A10 is not a Highways England maintained asset therefore no allowances have been included for roadside technology signs for NRTS
  - All signage to be unlit
  - All street lighting for the (non-rail) dedicated public transport route, ped/cycle and junction improvements is at 20m intervals
  - New Waterbeach Park and Ride site allowance for 1,000 spaces as per the Waterbeach Transport Assessment document
  - The generic layout of the relocated railway station platform uses assumptions taken from the Waterbeach Transport Assessment which is considered a reasonable basis for estimates at the early stage in the process
  - If existing lane configurations not clear then a minimum of 100m allowed on the approach to major junctions where the lane configuration changes
  - Roundabout inscribed circle diameter assumed as 30m unless existing roundabout is larger
  - Assume (non-rail) dedicated public transport route is through a greenfield site
  - Assume cycle/ped way is through a greenfield site
  - The crossing over the River Great Ouse will be widened, not demolished and rebuilt
  - Replacement of pedestrian bridge for Milton Park and Ride for the South and Full Dual Options

  - Site compounds included in the prelims except for the Guided Busway which needs site compound for a batching plant
  - Where possible, budget quotations have been used from specialist subcontractors
- Exclusions**:**
  - VAT
  - 3rd party compensation costs
  - Planning and approval charges
  - Costs associated with Statutory Fees (e.g. HMRI, Local Authority, etc.)
  - Costs associated with taxes, levies and licences
  - Costs associated with changes in legislation and any form of applicable standards
  - Christmas, Easter and Bank Holiday working
  - Environmental mitigation works
  - Archaeological digs
  - Inflation beyond the base date
  - Land deemed relatively flat - minimising the use of safety barrier in the verges allowed for 50% barrier
  - Re-location of affected businesses
  - Road diversions
  - Landscaping
  - Retaining walls
  - Footpaths for the full length of the dual carriageway
  - Any works to the existing A14
  - Tactile paving
  - Procurement of new vehicles for the (non-rail) dedicated public transport route
  - New depot for vehicles for the (non-rail) dedicated public transport route

It is common practice when schemes and measures are in the early stages of their assessment for there to be a number of exclusions such as those noted above. For the purposes of assessing the economic performance of the package in the Strand 1 Preliminary Strategic Outline Business Case report, however, factors reflecting optimism bias, risk and other elements, including an assumed uplift for land costs, have been applied in addition to the above inclusions.

7.1.2 Funding Considerations

This study is not a substitute for detailed development-related transport assessments (TAs) which will need to accompany planning applications for development at the CSP and CNFE sites. These TAs will be expected to consider the transport implications of the development proposals, to set out measures to address the transport needs of development, and to mitigate the identified impacts. The TAs, and any accompanying transport proposals, will need to be agreed with the transport authorities in the usual way.

This study has, however, identified a number of potential strategic interventions for the corridor which are either directly related to development, or from which development will benefit, and therefore should be funded (at least in part) by development.

At the time of writing, any cost-sharing mechanism seeking to secure funds via Planning Obligations ('Section 106') would need to comply with Regulation 122 of the Community Infrastructure Levy Regulations which state that an obligation should be:

- Necessary to make the development acceptable in planning terms

- Directly related to the development
- Fairly and reasonably related in scale and kind to the development

In the case of the bus and rail-based measures, these are directly related to development and there is an expectation that these would be funded in full by development. Where multiple developments benefit from such investments, then a cost-sharing arrangement should be explored. This should be based on the relative levels of demand from each development predicted to make use of that investment and will need to be subject to further, more detailed, assessment work.

In the case of strategic highway schemes, there will be multiple beneficiaries including specific developments, but also general background growth. Should these be taken forward by the relevant delivery bodies then it is recommended that, as a start-point for discussions, the transport authorities undertake further, more detailed, model-based assessment work to:

- Finalise the package of measures proposed
- Determine more refined cost estimates for each element
- Assess the relative use made of each element for each strategic development site (Waterbeach, CNFE, CSP, and others identified as relevant), together with background growth
- Calculate appropriate developer contributions based on those proportions
- Assume that the residual funding requirement (ie: that related to general background growth that is less easily attributed to specific sites) is met from public sector funding sources. These might include from the GCP, from the CA, from DfT, and from other opportunistic public funding opportunities should these materialise (historic examples include Growth Area Funding and the Community Infrastructure Fund)

Such an approach would appear to be in line with the requirement for obligations to be fair and reasonable.

Specifically for the developments considered by this report, it is noted from the analysis in Section 4.3.1 above that CNFE/CSP development trips are predicted to generate delay impacts at Milton Interchange, Histon Interchange, Quy Interchange, Junction 13 of the M11, and at junctions on or around the Cambridge inner ring road and along Huntingdon Road, whereas Section 6.3.1 above shows that improvements to Milton Interchange resolve many of these wider impacts. These developments will therefore be required to contribute to the cost of upgrading that junction, and to resolving the wider residual highway impacts noted in the previous chapter.

In further developing the details of funding packages, the planning and transport authorities will also need to be mindful of restrictions on the number of developer contributions that can be pooled (currently limited to five) towards any single project. This will need to be borne in mind as details, based on the above principles if they are adopted, are developed.

If, of course, the strategic highway measures identified are not taken forward by the public bodies then development would be expected to mitigate its highway impact directly. Similarly, highway impacts away from the A10 corridor but directly attributable to development at Waterbeach would also need to be identified and addressed independent of any A10-related measures.

7.2 Development and Scheme Phasing

In terms of development phasing, whether this is delivered through one developer or multiple parties, it is recommended that all development at these sites be brought forward according to an agreed site masterplan which provides a coordinated approach to site access and circulation. Given the constrained site access opportunities, this will allow for the use of available space and network capacity to be optimised.

Regarding the phasing of transport schemes, a full scheme phasing plan is recommended at a following stage of works. However, at this stage, we recommend the following with respect to the phased implementation of the South-Dual package of interventions to support development at CNFE/CSP:

- With the exception of road improvements required to enable the development (such as site access), short term measures should include works associated with encouraging non-vehicle travel, including a wholesale review of parking provision, walking and cycling improvements, rail station improvements/relocation and bus measures. Providing these interventions, along with the initial stages of the development, will encourage use of non-car modes from the beginning before trip behaviours are set
- Medium term improvements to support these developments should include single carriageway junction improvements on the south section of the A10, including at Milton Interchange
- Proposals for a dual-carriageway in the A10 corridor should be developed and implemented in parallel with the above.

7.3 Delivery Risks

The following provides a list of potential risks to the delivery of the proposed interventions which should be considered:

- The need for consents. We anticipate that the proposed interventions, in particular the guided busway / rapid transit route and the dualling of the A10 are likely to require planning consent as a major project and supporting environmental studies. This will need to be factored into the programme and increases the risk of delay.
- Potential environmental effects which could affect the ability to obtain consents are ecology, landscape, air quality, noise and vibration, historic environment, flood risk. A high level review of government environmental data (www.magic.defra.gov.uk) does not reveal any major designations in the area of the proposed interventions, although a thorough assessment will be required. This can affect the cost of the project, particularly if significant potential effects are envisaged.
- Land-take requirements are predicted to be required for the guided busway and dualling. This will require consultation with landowners which can result in increased timeframes
- Objections from local interest groups or communities. Statutory public consultation is required as part of a major application.
- Funding (as outlined above)
- Cost increases due to unforeseen circumstances such as ground conditions, archaeological issues etc.

7.4 Summary

The outline cost estimate for the ‘South-Dual’ package of interventions is around £310m at present values. However, it should be noted that this is an indicative cost at this stage, is not based on either specific or detailed scheme designs, and excludes the optimism bias which has been added on as part of the Preliminary Strategic Outline Business Case transport appraisal.

With regards the funding of this package, this study has identified a number of potential strategic interventions for the A10 corridor which are either directly related to development, or from which development will benefit, and therefore should be funded – at least in part – by development. In the case of the bus/rapid transit and rail-based measures, these are directly related to development and there is an expectation that these would be funded in full by development. In the case of strategic highway schemes, however, there will be multiple beneficiaries including specific developments, but also general background growth, so transport authorities will need to identify the degree to which the different implicated parties contribute to the funding of these measures.

Specifically for the developments considered by this report, it is noted from the analysis in Section 4.3.1 above that CNFE/CSP development trips are predicted to generate delay impacts at Milton Interchange, Histon Interchange, Quy Interchange, Junction 13 of the M11, and at junctions on or around the Cambridge inner ring road and along Huntingdon Road, whereas Section 6.3.1 above shows that improvements to

Milton Interchange resolve many of these wider impacts. These developments will therefore be required to contribute to the cost of upgrading that junction, and to resolving the wider residual highway impacts noted in the previous chapter.

In terms of development phasing, whether this is delivered through one developer or multiple parties, it is recommended that all development at these sites be brought forward according to an agreed site masterplan which provides a coordinated approach to site access and circulation. Given the constrained site access opportunities, this will allow for the use of available space and network capacity to be optimised.

Regarding the phasing of transport schemes, a full scheme phasing plan is recommended at a following stage of works. However, at this stage, we recommend the following with respect to the phased implementation of the South-Dual package of interventions to support development at CNFE/CSP:

- With the exception of road improvements required to enable the development (such as site access), short term measures should include works associated with encouraging non-vehicle travel, including a wholesale review of parking provision, walking and cycling improvements, rail station improvements/relocation and bus measures. Providing these interventions, along with the initial stages of the development, will encourage use of non-car modes from the beginning before trip behaviours are set
- Medium term improvements to support these developments should include single carriageway junction improvements on the south section of the A10, including at Milton Interchange
- Proposals for a dual-carriageway in the A10 corridor should be developed and implemented in parallel with the above.

Finally, it is noted that there are many potential risks to the delivery of the proposed interventions, including the need for consents, environmental issues, land-take requirements, funding, objections from interest groups or communities and cost increases due to unforeseen circumstances. The management and effective mitigation of these risks will need to be built into the delivery programme for all schemes to maximise the chances of effective delivery.

8 Conclusion and Recommendations

8.1 Study Background and Report Purpose

Mott MacDonald has been commissioned by Cambridgeshire County Council (CCC) to deliver the Ely to Cambridge Transport Study. The indicative study area includes the rail route and the A10 route between Cambridge and Ely, the B1049 between Wilburton and the A14 at Histon Interchange, and the B1047 though Horningsea and Clayhithe to the A14.

As specified in the study brief, the outputs of the study will be:

- Strand 1 – An Options Study and Strategic Outline Business Case for the overall package of interventions in the Ely to Cambridge study area, including development of principles/mechanisms for securing appropriate developer contributions.
- Strand 2 – A Transport Study to identify the specific transport requirements, access options and measures, their costs, acceptability and any implications for the phasing of development of a new town north of Waterbeach.
- Strand 3 – A Transport Study to identify the specific transport requirements, access options and measures, their costs, acceptability and any implications for the levels of development and phasing of, a significant parcel of land in the north-east of Cambridge, known as Cambridge Northern Fringe East (CNFE) and Cambridge Science Park (CSP).

This report outlines the findings of the Strand 3 Transport Study. The CNFE and the CSP sites are key trip attractors at the south end of the study corridor and locations of significant potential future development as allocated in the submission South Cambridgeshire and Cambridge City Local Plans[13].

8.2 Existing Conditions

The sites are well located with respect to the strategic highway network and to Cambridge city centre, but this advantage is constrained at peak times by significant levels of delay on these routes. The sites also provide significantly more parking than is actually used, meaning that parking provision does not currently place a restraint on car use to and from the sites.

The sites are served by a number of bus routes, including along the adjacent busway, which results in a combined frequency of around nine services per hour during weekday peak hours. However, around a third of the CSP site and around half of the CNFE site lie beyond 400m of a high frequency bus stop, while the furthest distance from a bus stop within each site is about 700m and 1km respectively. Similarly, about 60% of the sites' employee catchment lies beyond a 45 minute travel time by public transport, though the nearby Cambridge North rail station, which opened in May 2017, should provide some improvement to this situation. The proximity of the sites to the extensive Cambridge cycle network also encourages use of this mode.

The outcome of these various factors is that the predominant mode for travel to these sites is the car, at an average mode share of 65%[14], while the active mode share (primarily cycling) accounts for 32%, but public transport (primarily bus) accounts for only 3%.

Overall, the challenge for increasing development at the CNFE and CSP sites is to deliver growth without also delivering a significant increase in car use to the sites and resulting traffic congestion. The current significant delays on the strategic routes around the site, the over-provision of on-site car parking, the under-

[13] South Cambridgeshire Local Plan, Proposed Submission, July 2013

[14] 2016 Travel Plan Plus

utilisation of the Milton Park and Ride site, and the lack of bus penetration to the site will place a significant constraint on the potential for sustainable growth unless addressed.

8.3 Development Proposals

For modelling purposes, the intensification of the CSP site is proposed to result in about 6,000 new jobs by 2031.

For the CNFE site, various development scale and mix options have been put forward for the site to support the emerging Local Plan, which are primarily employment-led. Modelling of a scenario based on these proposals showed that the scale and tidal nature of trips generated in the peak hours resulted in significant impact on the surrounding local and strategic highway networks.

It was therefore agreed with the client group to develop a further refined CNFE land use mix which offers greater levels of internalisation and better balanced access and egress flows in order to reduce potential impact on the external network. This suggests that a more residential-led development mix for the site, which increases trip internalisation and reduces trip tidality and scale, would provide better transport outcomes. The level of trips generated by this suggested development mix is discussed in Section 4.2.1 above. This level of trip generation forms the basis for deriving a trip budget for the area, but it does not place a ceiling on *development* levels on the sites; the level and mix of development will need to be agreed with the local planning authorities. From a transport perspective, higher levels of development could be accepted provided it could be demonstrated that the highway trip budget is not breached and that other trips can satisfactorily be accommodated by non-car means.

The Do Minimum CSRM2 modelling forecast for 2031 includes a number of future transport measures which will provide transport benefits to the two sites. These include improvements to the A14, and various improvements for bus, Park & Ride, rail and cycle modes. In addition, it is anticipated for modelling purposes that the CNFE and CSP sites will continue to be accessed in future via the existing highway accesses, with capacity enhanced where deliverable.

8.4 Future Conditions

An assessment of future transport conditions with full build-out of development in 2031 but no transport mitigation measures has been carried out using the CSRM2 model. The purpose of this ‘Do Minimum’ assessment is to identify future development transport impacts which would require mitigation.

The assessment reveals that the proposed combined development is predicted to generate between 7,400 and 8,200 person trips during each peak hour. Due to the employment focussed development on the sites, the percentage of internal trips is predicted to be low (less than 3% for the CSP site). However, the increase in housing land use tested for the CNFE site has resulted in a slightly higher predicted internalisation proportion of around 7% in the AM peak and 6% in the PM peak.

For the external trips, demand is predicted from a number of locations, with varying levels of alternative transport provision. Whilst car is predicted to remain the predominant mode of travel to and from both sites, the planned improvements to public transport and cycling facilities, combined with the increased relative attractiveness of these modes due to greater highway congestion, are predicted to result in a significant increase in the use of these modes from those recorded by the 2016 Travel Plan Plus area survey. However, whilst public transport and active mode shares are predicted to increase, the developments are still predicted to generate around 2,400 car trips in the AM peak hour and about 3,500 car trips in the PM peak hour on the external road network.

The modelling results indicate that the primary flow impact of the CNFE and CSP developments on the surrounding highway network is predicted to be along the A14, M11, A428 and the southern section of A10. In terms of the delay impacts arising as a result of these predicted flows being added without mitigation, the

modelling results for both peak hours show junction impacts at Milton Interchange, Histon Interchange, Quy Interchange, Junction 13 of the M11, and at junctions on or around the Cambridge inner ring road and along Huntingdon Road.

In terms of travel times on the A10/A1309 in the study area, the Combined Scenario Do Minimum modelling predicts significant increases in travel time compared to the Future Base scenario along the A10 between the new town north of Waterbeach and Milton Interchange, which is largely a result of the increase in new trips generated by the latter development, but CNFE/CSP flows also contribute to the significant increase in delays at Milton Interchange. These delays contribute to a displacement of traffic from primary routes, including the A10 and A14, onto less suitable routes including the B1049 and B1047 among others.

Further details on these modelling results can be found in the Do Minimum Modelling Report, but the overall conclusion for the proposed developments at the CNFE and CSP sites is that, though the various improvements included in the Do Minimum network will yield significant mode share improvements compared to existing levels, further mitigation measures will nonetheless be required to enable the development to function effectively without causing undue impact on surrounding transport networks.

8.5 Proposed Interventions

To address the predicted external transport impacts on the study area of the modelled new development levels at the CNFE and CSP sites, a package of mitigation measures will be required. The package tested for this study includes a number of measures to maximise the internalisation of new development trips and to encourage use of non-car modes for the remaining trips, including:

- Complementary land uses at the CNFE site, including implementing a balance of residential and employment land uses
- High quality, direct walking/cycle routes
- Improvements to public transport, including a new segregated busway between the new town north of Waterbeach and the CNFE/CSP sites
- Stretching car parking standards at the CNFE and CSP sites together with active travel-planning to encourage take-up of on-car modes.

As the CSRM2 model is not able to directly model the latter measure, this has been reflected in the CNFE ‘trip budget’ described in Section 3.1.2.3 above and therefore included in the Do Minimum modelling described in the previous chapter. However, these results confirm that parking restraint alone will not be sufficient to mitigate the impacts of new development at these sites, so further measures will be required.

Consideration has therefore been given to the feasibility of providing new direct links between the A14 and either or both sites, but it is considered that any such scheme is likely to be either non-feasible in engineering/safety terms and/or non-viable in Business Case terms. This places extra importance on delivering capacity enhancements of the existing site access points off Milton Road, and potential ways of achieving this are summarised in Section 5.1.2 above. It also suggests that future development of the sites should be delivered within the framework of site-wide masterplans which are designed to optimise site access and internal circulation, rather than through uncoordinated piecemeal development which could lead to access and circulation inefficiencies.

Off-site highway network improvements will also be required, as outlined in the Strand 1 Preliminary Strategic Outline Business Case report. Though no single package is recommended in that report as a preferred scheme at this stage, with all tested packages demonstrating high value-for-money scores, the INSET appraisal process scored the above ‘South-Dual’ package highest in terms of its overall balance of benefits and costs. Though it is recognised that not all the measures included in this package would be required to mitigate the impacts of the CNFE and CSP development proposals if implemented without the new town north of Waterbeach, it is also noted that these developments would nonetheless directly benefit

from some of the proposals, and particularly from the improvements to Milton Interchange and to public transport and active modes. For the purpose of assessing the impact of the CNFE/CSP developments on the study area in the context of a potential package of mitigation measures, therefore, the modelling results for this package are considered in this report.

Lastly, it is noted that the modelling results in Section 4 above show that the development proposals for CNFE/CSP are predicted to generate wider impacts than just in the study area, though many of these are a result of traffic being displaced to other routes to avoid the predicted delays at Milton Interchange. Wider rail, bus and active mode measures – together with stringent on-site parking restraint – are therefore essential for reducing this wider level of impact, but significant improvements to Milton Interchange will also be required to resolve these wider issues. Any residual wider impacts will then require further mitigation, to be considered via the transport assessment process.

8.6 Impact of Interventions

As a result of the interventions tested for the study corridor, the total person trips generated by the CNFE and CSP sites is predicted to increase by around 1% as wider network accessibility is increased. The increase in highway capacity – particularly at Milton Interchange – also results in a small increase in the mode share of car travel to and from the sites, though this is still significantly improved over existing levels. Overall, this amounts to an extra 100-124 vehicles generated by both sites in each peak hour as a result of the interventions which, though minor in percentage terms, highlights the importance of car parking management measures to encourage use of other modes and to restrain car trip growth at the sites.

In terms of development trip distribution, the main change resulting from the interventions is a predicted increase in vehicle trips on the A10 between the CNFE and CSP sites and the new town north of Waterbeach during both the AM and PM peaks, and a significant transfer of vehicle trips from King Hedges Road to the A14 during the PM peak. The increase in vehicle trips on the A10 is a direct result of the proposed increase in capacity on this section, while there is also an associated decrease in vehicle trips on alternative adjacent north south routes. The predicted increase on the A14 during the PM peak is in response to improvements to Milton Interchange drawing more A14 trips via that junction instead of via Histon Interchange and less appropriate local routes.

In highway performance terms, the interventions combined with the flow reassignments result in delay improvements at Milton Interchange in both peak hours. In the evening, the reassignment of flows to this junction also produces delay benefits to Kings Hedges Road and Histon Interchange and a reassignment of traffic from these less suitable routes, though a small increase in delay is seen at this interchange in the AM peak. Delay reductions are also seen on Huntingdon Road and in the city centre, though some delay increases are predicted at Junctions 31 and 34 of the A14. Measures to resolve the wider residual impacts are discussed above in Section 5.3.

In terms of how these changes affect journey times in the study corridor, however, the results show that the package of transport interventions tested for the study area is predicted to deliver A10 journey time performance which is generally better than the equivalent ‘without development’ case. The measures are therefore predicted to provide effective development impact mitigation on study area highway performance.

It is also likely that these measures will generate journey time benefits on, and reduce traffic from, other routes impacted by the CNFE and CSP developments, such as on King Hedges Road and at Histon Interchange as traffic reroutes back on to the A14 mainline, while the potential wider measures noted in Section 5.3 above will also yield further benefits in terms of addressing off-corridor impacts..

8.7 Implementation Considerations

The outline cost estimate for the ‘South-Dual’ package of interventions is around £310m at present values. However, it should be noted that this is an indicative cost at this stage, is not based on either specific or

detailed scheme designs, and excludes the optimism bias which has been added on as part of the Preliminary Strategic Outline Business Case transport appraisal.

With regards the funding of this package, this study has identified a number of potential strategic interventions for the A10 corridor which are either directly related to development, or from which development will benefit, and therefore should be funded – at least in part – by development. In the case of the bus/rapid transit and rail-based measures, these are directly related to development and there is an expectation that these would be funded in full by development. In the case of strategic highway schemes, however, there will be multiple beneficiaries including specific developments, but also general background growth, so transport authorities will need to identify the degree to which the different implicated parties contribute to the funding of these measures.

Specifically for the developments considered by this report, it is noted from the analysis in Section 4.3.1 above that CNFE/CSP development trips are predicted to generate delay impacts at Milton Interchange, Histon Interchange, Quy Interchange, Junction 13 of the M11, and at junctions on or around the Cambridge inner ring road and along Huntingdon Road, whereas Section 6.3.1 above shows that improvements to Milton Interchange resolve many of these wider impacts. These developments will therefore be required to contribute to the cost of upgrading that junction, and to resolving the wider residual highway impacts noted in the previous chapter.

In terms of development phasing, whether this is delivered through one developer or multiple parties, it is recommended that all development at these sites be brought forward according to an agreed site masterplan which provides a coordinated approach to site access and circulation. Given the constrained site access opportunities, this will allow for the use of available space and network capacity to be optimised.

Regarding the phasing of transport schemes, a full scheme phasing plan is recommended at a following stage of works. However, at this stage, we recommend the following with respect to the phased implementation of the South-Dual package of interventions to support development at CNFE/CSP:

- With the exception of road improvements required to enable the development (such as site access), short term measures should include works associated with encouraging non-vehicle travel, including a wholesale review of parking provision, walking and cycling improvements, rail station improvements/relocation and bus measures. Providing these interventions, along with the initial stages of the development, will encourage use of non-car modes from the beginning before trip behaviours are set
- Medium term improvements to support these developments should include single carriageway junction improvements on the south section of the A10, including at Milton Interchange
- Proposals for a dual-carriageway in the A10 corridor should be developed and implemented in parallel with the above.

Finally, it is noted that there are many potential risks to the delivery of the proposed interventions, including the need for consents, environmental issues, land-take requirements, funding, objections from interest groups or communities and cost increases due to unforeseen circumstances. The management and effective mitigation of these risks will need to be built into the delivery programme for all schemes to maximise the chances of effective delivery.

8.8 Study Conclusions

An assessment of existing transport conditions relating to the CNFE and CSP sites illustrates how – at the time of the 2011 Census – these sites had good strategic highway access but relatively poor public transport accessibility, leading to quite a high car mode share at 65%. Without the 32% mode share of active modes facilitated by the sites' location in Cambridge, this level of car dependency would be higher still.

However, the Do Minimum modelling of the future expanded levels of development at CNFE and CSP predict a drop in this car mode share level to around 47%. The difference between the network modelled in

this scenario and the network in 2011 is a package of future measures which clearly generate a positive impact on travel patterns to and from these two sites, especially in the context of increased highway congestion which further enhances the relative attractiveness of these modes. These include a number of initiatives affecting the city, such as the potential expansion of the Core Scheme, the new Cambridge North rail station, improved rail services, radial route bus improvements, a new western orbital bus link and new cycle routes, such as the Chisolm Trail, all of which affect the sites in beneficial ways.

It is therefore noted that a significant element of the works required to deliver increased development at the CNFE and CSP sites is already included in the Do Minimum package of proposed schemes, and so it is important that these schemes are delivered before or as the sites are built out.

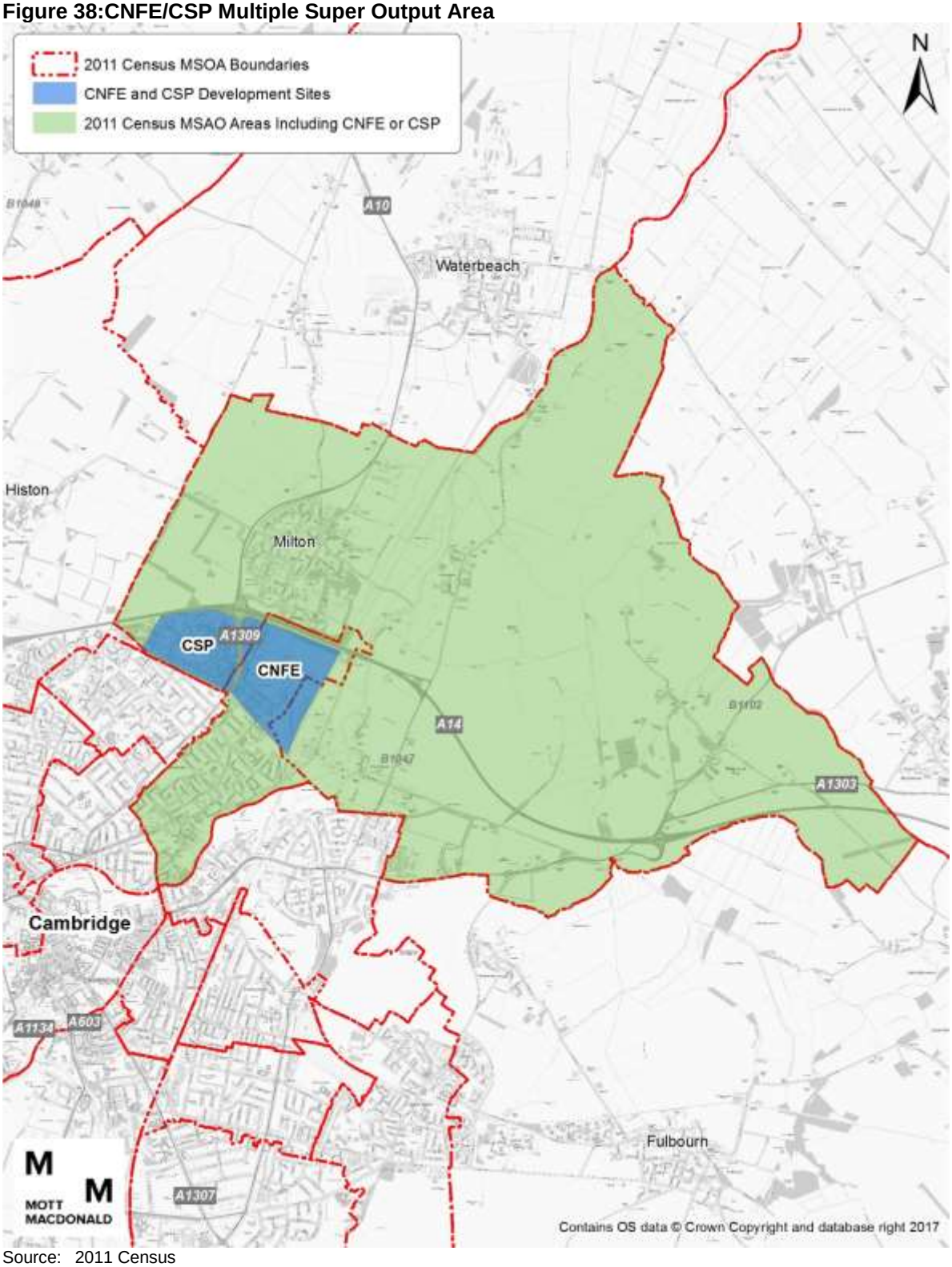
Despite the mode share improvements delivered by the Do Minimum schemes, however, the results of this modelling still show development-related impacts on the surrounding highway network which require mitigation. The study-area focussed Do Something modelling exercise shows that selected highway capacity improvements – particularly at Milton Interchange – help to address these impacts, but that unless they are delivered in combination with significant on-site parking restraint (represented in the model by a stretching site 'trip-budget') and further active mode and public transport improvements, the increase in car trips to and from the sites would neutralise many of the highway benefits gained. The complementary delivery of these non-highway measures is therefore essential to locking in the benefits of any development-related highway improvements.

Lastly, it is noted that, even with car growth restrictions in place, the highway access – and particularly egress – capacity of both sites will need to be addressed as development comes forward. Options are outlined and assessed in this document as to how to deliver these, but it is recommended in the light of the sites' limited highway access points and proximity to the strategic network that further detailed work and stakeholder liaison will be required to identify and agree a suitable and proportionate highway access strategy for the sites.

Appendices

A. CNFE/CSP 2011 Census MSOA Area

Figure 38:CNFE/CSP Multiple Super Output Area



Source: 2011 Census

B. ‘Scenario 3 Rebalanced’ Report

Mott MacDonald
35 Newhall Street
Birmingham B3 3PU
United Kingdom

T +44 (0)121 234 1500
F 44 (0)121 200 3295
mottmac.com

Cambridgeshire County Council

A10 Corridor Transport Study

CNFE Alternative Land Use Options ('Scenario 3 Rebalanced')

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Contents

1 Introduction

1.1 Document Background

Mott MacDonald has been commissioned by Cambridgeshire County Council (CCC) to deliver the Ely to Cambridge Corridor (A10(N)) transport study. In particular, the aim of the study is to consider the overall transport capacity requirements of the corridor due to the strategic nature of the A10 between Ely and Cambridge and the levels of growth proposed at Waterbeach New Town, Cambridge Northern Fringe East (CNFE) and Cambridge Science Park (CSP) located at the southern end of the A10.

The strategy for modelling the impacts of these proposed developments on the study corridor is outlined in our separate 'Proposed Do Minimum Modelling Strategy' note, dated 23 November 2016. This defines a set of 2031 development scenarios which, when modelled using the Cambridge Sub-Regional Model (CSRM2), allows the impacts of the proposed developments to be identified. The proposed scenarios are:

- Scenario 1 – 'Without Development' scenario
  - This is the future hypothetical scenario where the sub-region's population and employment growth targets are met but not through development at Waterbeach, CNFE or CSP. It does not represent any future proposed or envisaged planning scenario, but is simply a hypothetical future baseline which serves only to allow development impacts to be predicted.
- Scenario 2 – 'With Waterbeach New Town development' scenario
  - This is the future scenario where the sub-region's population and employment growth targets are met, including through development at Waterbeach New Town, but not through development at either CNFE or CSP. Through comparison with Scenario 1, this scenario therefore allows the specific transport impacts of Waterbeach New Town to be identified.
- Scenario 3 – 'With CNFE and CSP development' scenario
  - This is the future scenario where the sub-region's population and employment growth targets are met, including through development at CNFE and CSP, but not through development at Waterbeach. Through comparison with Scenario 1, this scenario therefore allows the specific transport impacts of CNFE and CSP development to be identified.
- Scenario 4 – 'With Waterbeach New Town, CNFE and CSP development' scenario
  - This is the future scenario where the sub-region's population and employment growth targets are met, including through development at Waterbeach New Town, CNFE and CSP. Through comparison with Scenario 1, this scenario therefore allows the combined transport impacts of Waterbeach New Town, CNFE and CSP development to be identified.

At the time of writing, the development proposals for the Waterbeach New Town are more advanced and better defined than the proposals for the CNFE and CSP sites. Therefore, in order to model the potential transport implications of development at CNFE and CSP, it was necessary to make a number of initial assumptions about the development mix on those sites (it is important to note that these assumptions were made for transport modelling purposes only and do not necessarily represent either a viable or desired development mix for the site).

An employment-biased land use mix for CNFE was modelled initially to reflect Scenario 3. This created an unbalanced (tidal) and largely externally-focussed pattern of transport demand.

This document therefore explores an approach to transport modelling that seeks to provide a higher level of internal trip-making, and a more balanced pattern of demand. The resultant scenario has been labelled 'Scenario 3 Rebalanced'.

1.2 Document Structure

The document is structured as follows:

- The methodology, assumptions and parameters used to derive Scenario 3 Rebalanced are described in Section 2
- Possible Scenario 3 Rebalanced results based on Option 2a+ are calculated and presented in Section 3
- Possible Scenario 3 Rebalanced results based on Option 4a+ are calculated and presented in Section 3
- A recommended Scenario 3 Rebalanced result is presented in the final section
- Supporting material is attached in Appendix A.

2 Current CNFE Development Options

2.1 Introduction

The purpose of this section is to review the current status of potential CNFE development options, including the option already modelled to form the current Scenario 3.

2.2 Council Coordinated Options

There are currently two options being considered by local authorities as part of the local plan process for the development of the CNFE site: Option 2a+ and Option 4a+[1].

The main difference between the options is that Option 2a+ assumes a rationalisation of the existing waste-water treatment works on the site so that it effectively takes up less area and so allows more land for redevelopment, whereas Option 4a+ assumes that these works will be relocated off the site so as to allow the full site area to be redeveloped. The levels of development included in the two pervious local plan tests are outlined in the Table 1below.

Table 1: Option 2a+ – CNFE Lower Level Developer option

Option 2a+ as amended by CB4	Units / Floorspace	Jobs	GFA per Job (m^2)
Chesterton Partnership And Nuffield Road Dwellings (no)	1,062	-	-
Chesterton Partnership - B1(a/b) Offices (GFA sqm)	248,932	20,919	12
Chesterton Partnership Retail (GFA sqm)	1,600	91	18
Chesterton Partnership Hotel (GFA sqm)	6,500	33	195
St.John's Innovation Park Office (GFA sqm)	25,000	2,101	12
Option 2a B1c/B2/B8 Industrial (GFA sqm)	50,180	1,416	35
Ancillary Facilities	To be agreed	To be calculated	-
Total Jobs	-	**24,560**	-
Total new jobs (assuming 3,800 existing[2])	-	**20,760**	-

Source: CCC

Table 2: Option 4a+ – CNFE Higher Level Developer option

Option 4a+ as amended by Grosvenor Estates	Units / Floorspace	Jobs	GFA per Job (m^2)
Grosvenor, Chesterton Partnership And Nuffield Rd Dwellings (no)	7,692	-	-
Grosvenor, Chesterton Partnership - B1(a/b) Offices (GFA sqm)	261,910	22,009	12
Grosvenor and Chesterton Partnership Retail (GFA sqm)	9,500	543	18
Grosvenor Leisure (GFA sqm)	18,000	277	65
Chesterton Partnership Hotel (GFA sqm)	6,500	33	195
St.John's Innovation Park Office (GFA sqm)	25,000	2,101	12
Option 4a+ B1c/B2/B8 Industrial (GFA sqm)	No space left	1,416	35
Ancillary Facilities	To be agreed	To be calculated	-
Total Jobs	-	**24,963**	-
Total new jobs (assuming 3,800 existing[2])	-	**21,263**	-

Source: CCC

[1] The designations '2a+' and '4a+' reflect that the land use numbers have been refined since those in the Land Use Figures paper dated 19th May 2016

[2] As per CSRM1 existing jobs provision for CNFE (source: CCC)

2.3 Modelled Scenario 3 Option

When modelling the impacts of differing development strategies, it is necessary to ensure that the total population and employment across Cambridgeshire should be the same in all future scenarios. This reflects the fact that the future scenarios being modelled are differentiated not by the level of socio-economic growth which will take place in the sub-region, but by the distribution of that growth through the Local Plan allocations.

As can be seen from the information set out above, the existing scenarios have assumed that the proposed CNFE/CSP developments would be primarily employment led. To this end it was agreed with the client group that the best way to enable the testing of increased development at CNFE/CSP was to relocate all the allocated employment sites in the Local Plan which do not currently have either planning permission or a live planning application to the CNFE/CSP area. As has been previously stated, this scenario was purely for the purposes of transport modelling and in no way reflects a proposed or desired future planning scenario for the area. This approach identified 19,100 jobs that could be reallocated to the CNFE/CSP Area. These jobs have been split with 80% at the CNFE and 20% at the CSP, giving a total of 15,280 reallocated new jobs at CNFE, giving a total of 19,080 jobs including the assumed 3,800 existing jobs on the site. 1,062 dwellings are also proposed for CNFE, as per Option 2a+.

2.4 Summary

Table 3 summarises the above CNFE development scenarios in terms of:

- Total number of dwellings
- Total number of jobs
- Number of new jobs

Table 3: CNFE development option land use mix

Development Option	Total Dwellings	Total Jobs	New Jobs
Option 2a+	1,062	24,560	20,760
Option 4a+	7,692	24,963	21,263
Scenario 3	1,062	19,080	15,280

Source: CCC and Motts

It can be seen that the modelled Scenario 3 included about 76-78% of the jobs of the other two options, but the same level of housing as Option 2a+. Again it is important to note that this scenario was derived purely to enable the modelling of increased levels of development at CNFE/ CSP, and does not represent a proposed or necessarily desirable future planning scenario.

The results of the Scenario 3 tests suggested that the largely external and tidal nature of the trips generated by CNFE and CSP in the peak hours as a result of the employment-led development assumptions resulted in significant impact on the surrounding local and strategic road networks. The costs of addressing these impacts would also likely be significant. Therefore, in the absence of clearly defined development aspirations from the developers of the CNFE site, it was agreed with the client team that an approach to deriving a more balanced set of trip demands, with greater levels of internal trips, would be explored.

It is recognised that this exercise is, by necessity, based on a number of assumptions. However, as agreed with the client team, it is considered that this approach provides a reasonable basis for deriving an alternative set of land use assumptions for initial modelling of CNFE/CSP. It is important to note that these assumptions are for the purposes of the initial transport modelling and do not necessarily represent either a viable or desired development mix for the site.

The purpose of the remainder of this document is to explore and propose a more mixed-use development for CNFE/CSP that maximises potential for internalised trips and which generates a better balance of flows in and out of the site during the peak periods so as to make best use of available network capacity. The revised scenario arising from this document is therefore labelled as ‘Scenario 3 Rebalanced’.

3 Methodology, Assumptions and Parameters

3.1 Introduction

The purpose of this section is to set out the methodology, assumptions and parameters used to allow a rebalancing exercise of the land use distributions for the CNFE site in order that a 'Scenario 3 Rebalanced' can be derived which seeks to minimise the vehicular traffic impacts generated by new development at the site.

3.2 Methodology Overview

The aim of the rebalancing exercise is to understand the impact on development vehicle-trip generation when the land-use mix of residential and employment uses is altered.

To do this, the first exercise is to estimate the total developable site area for each option and how that is proposed to be distributed between residential and employment uses, as set out in Table 3 above. This step is necessary because the published details about the existing Options 2a+ and 4a+ do not disclose the assumed total developed area or how that is distributed between the differing land uses proposed.

Once the land-use mix on the sites have been defined, it is possible to estimate the associated weekday peak-hour vehicle-trip generation by using location-tailored trip rates from the TRICS database. These trip rates are then discounted to reflect the likely level of trip internalisation for differing development mixes, which results from the provision of complementary land uses on the same site.

Finally, once the trip generation of the land use mixes are understood, the ratio of residential to employment can be amended to understand the impact that the land use mix has on the vehicle trip generation of the site. The aim of this exercise is to establish what development mix could be considered to provide the best opportunities for minimised impacts from vehicular traffic on the external road network.

3.3 Step 1 – Establishing the Developable Area and Land Use Mix Ratio

The land use distribution tables for Options 2a and 4a+ above present residential and employment uses in terms of numbers of dwellings and Gross Floor Areas respectively.

In order to convert these to an implied total developable site area for each Option, including all external infrastructure and landscaping, it is necessary to apply appropriate Floor Area Ratios. The following table shows the evidence-based Floor Area Ratios used in this exercise, and the sources of this information.

Table 4: Applied Floor Area Ratios

Land Use	Floor Area Ratio			Unit	Source
	Lower Density	Mid Value	Higher Density		
Residential	25	35	80	Dwellings per ha	Wikipedia[3]
B1	3,282	-	6,809	GFA per ha	Employment Land Review 2012[4]
B2	-	4,200	-	GFA per ha	Employment Land Review 2012[2]

It is important to note that the above do not include any ratios for the other minor employment uses that might be present on the site, as it is anticipated that these will be largely ancillary to the main uses. Education provision has also been excluded at this stage as this has yet to be defined by the local authorities. However, B1 and B2 uses form the majority of the proposed land uses and also generate the

[3] https://en.wikipedia.org/wiki/Medium-density_housing

[4] https://www.scambs.gov.uk/sites/default/files/documents/Employment%20Land%20Review.pdf

highest number of trips, so are considered suitable to represent a reasonable assessment of the potential internalisation and external vehicle trip generation of the site at this stage in the business case process.

By applying the appropriate parameter to the number of dwellings and GFA data, the implied area of land occupied by each land use can be calculated, giving both a total developable area and the land use mix for each option.

As a guide, the estimated maximum developable site area available is 100 hectares. The total implied developable area for each option should not therefore exceed this value.

3.4 Step 2 – Calculating Vehicle Trip Rates per Hectare

To calculate the number of vehicle trips that would be generated by each land use, standard trip rate data from the TRICS database has been applied. Vehicle trip rates have been used in the analysis as opposed to person trip rates, because it is external vehicles trips which are the key focus of this exercise.

The use of TRICS is the industry standard method for deriving the likely number of trips generated by proposed developments. Full selection parameters and results for each land use are attached in Appendix A. It is noted from the following table that the average employment-use mode shares on which the TRICS data is based provides a close match with the 2011 Census mode share for the CNFE site (assuming a 50:50 split between B1 and B2 uses for the existing site). It is therefore considered that the TRICS trip rates are reasonably applicable to the CNFE site.

Table 5: Comparison between TRICS and Census 2011 car driver mode share for CNFE site

Source	Category	Car Driver Mode Share
TRICS	B1	58.2%
	B2	84.2%
	Average	**71.2%**
Census 2011	**Average**	**71.1%**

A summary of the arising vehicle trip rates relevant to this analysis is provided below:

Table 6: Vehicle trip rates by land use type

Land Use	AM		PM		Daily		Unit	Trics Category
	Arr	Dep	Arr	Dep	Arr	Dep		
Residential	0.106	0.307	0.266	0.124	1.708	1.770	Per Dwelling	M – 'Mixed Private / Affordable Housing'
B1	1.694	0.291	0.219	1.499	7.930	7.383	Per 100m^2 GFA	A – Office
B2	0.414	0.078	0.063	0.373	2.236	2.189	Per 100 m^2 GFA	C – Industrial

Source: TRICS 7.4.1

These trip rates can then be converted to 'vehicle trip rates per hectare' by application of the appropriate Floor Area Ratio.

3.5 Step 3 – Calculating Pre-Discounted Vehicle Trip Totals

Pre-discounted vehicle trip totals are calculated by multiplying the 'vehicle trip rates per hectare' calculated in Step 2 by the site area for each land use calculated in Step 1.

It is noted that this step could be arrived at quicker by directly multiplying the trip rates in Table 6 above by the number of dwellings and GFA data already provided for Options 2a+ and 4a+ in Section 2.2 above.

However, the reason the 'trip rate per hectare' step is included instead is because it is required to enable the rebalancing calculation in the final step below.

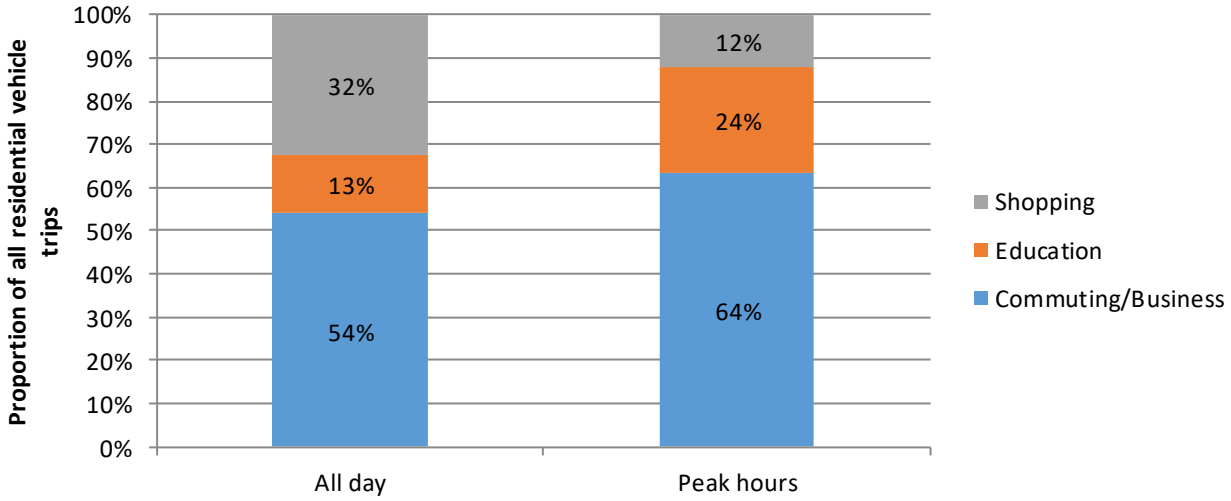
3.6 Step 4 – Calculating Site Internalisation Trip Discount Factor

Where multiple land uses are found on the same site, a degree of trip internalisation can be assumed. Where all the main essential services required by residents are found on-site, i.e. employment, education, food retail and health facilities, a trip internalisation factor of between 14% and 18% can be expected[5]. A mid-range internalisation factor of 16% has therefore been assumed initially for this analysis.

However, of the above essential services for residents, the development mix for CNFE currently only includes employment land uses. The proportion of the above internalisation factor which can be assumed for CNFE, therefore, is equal to the proportion of residential trips to essential services which are work related. This adjusted internalisation factor results in a robust assessment of the likely external trip generation of the different proposed development mixes.

Figure 1 below shows the average distribution of residential car trips across the essential services of commuting/business, education and shopping trips, based on the National Travel Survey.

Figure 1: Distribution of residential vehicle trips by 'essential service' trip purpose



Source: National Travel Survey 2009-2013 results

This shows that commuting/business trips account for 64% of car trips in the weekday peak hours and 55% of car trips over the course of the whole day.

The following table therefore summarises the maximum vehicle trip discount which can be applied to the CNFE development mix to reflect site internalisation. This is applied to the lower of the total number of trips generated by on-site residential or attracted by on-site employment.

Table 7: Vehicle trip discount factors by time period to reflect internalised commuting

Period	Discount Factor
Peak period	10.2%
All day	8.8%

Source: MM calculation

[5] Source: Cambridgeshire County Council, based on empirical evidence

3.7 Step 5 – Calculating Post-Discounted Vehicle Trip Totals

Applying the internalisation discount to the vehicle trip totals calculated in Step 2 provides a final vehicle trip total calculation.

3.8 Step 6 – Calculating Rebalanced Vehicle Trip Totals

Once all the above information is known, altering the ratio of residential to employment uses within the developable area of the site results in a change in predicted vehicle trips. This can therefore be varied to test the impact of different transport-related scenarios. The scenarios explored in the sections below are:

1. Maximum trip internalisation scenario
2. Balanced external flow scenario
3. Minimum trip generation scenario

4 'Scenario 3 Rebalanced' Calculation Based on Option 2a+

4.1 Introduction

The purpose of this section is to explore the definition of 'Scenario 3 Rebalanced' by applying the above 6-step methodology to the Option 2a+ land use mix.

4.2 Step 1 – Establishing the Developable Area and Land Use Mix Ratio

Based on Table 1 above, the land use data proposed for Option 2a+ is as follows:

Table 8: Option 2a+ land use data summary

Land Use	Units / Floorspace
Residential	1,062 dwellings
B1	273,932 sqm GFA
B2	50,180 sqm GFA

It is important to note that this land use mix *includes* the existing uses within the CNFE site, which are assumed from the CSRM1 model to comprise zero dwellings but employment uses providing 3,800 jobs.

Applying the lower density and mid-value Floor Area Ratios from Table 4 above converts the above data to the following implied site areas per land use.

Table 9: Option 2a+ site area implied by lower density Floor Area Ratios

Land Use	Units / Floorspace	Floor Area Ratio Applied	Site Area Implied	Land Use Mix
Residential	1,062 dwellings	25 dwellings per ha	42 ha	31%
B1	273,932 sqm GFA	3,282 sqm GFA per ha	83 ha	61%
B2	50,180 sqm GFA	4,200 sqm GFA per ha	12 ha	9%
Total site area			**138 ha**	**100%**

This calculation implies a total developed site area of 138 hectares, which is 38 hectares greater than the assumed maximum developable area of the whole site (see Section 3.3 above). Furthermore, as Option 2a+ only assumes a rationalisation of the area currently occupied by the waste-water treatment works and not a complete removal, the total developable site area for this option should be less than 100 ha, and intuitively no more than about 70ha.

The following table therefore shows the implied site areas based on the higher density and mid-value Floor Area Ratios from Table 4 above.

Table 10: Option 2a+ site area implied by higher density Floor Area Ratios

Land Use	Units / Floorspace	Floor Area Ratio Applied	Site Area Implied	Land Use Mix
Residential	1,062 dwellings	80 dwellings per ha	13 ha	20%
B1	273,932 sqm GFA	6,809 sqm GFA per ha	40 ha	61%
B2	50,180 sqm GFA	4,200 sqm GFA per ha	12 ha	18%
Total site area			**65 ha**	**100%**

This produces a more likely developable site area of 65 hectares, being about two-thirds of the theoretical estimated maximum area available.

4.3 Step 2 – Calculating Vehicle Trip Rates per Hectare

Applying the applied Floor Area Ratios detailed in Table 10 above to the vehicle trip rates of Table 6 above generates the following vehicle trip rates per hectare.

Table 11: Option 2a+ vehicle trip rates per hectare by land use type

Land Use	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Residential	8	25	21	10	137	142
B1	115	20	15	102	540	503
B2	17	3	3	16	94	92

Source: TRICS 7.4.1

It is noted from this table that, on a per hectare basis, B1 office uses generate considerably more trips than both the residential and B2 uses, being about 4 to 6 times greater respectively. In transport terms, therefore, B1 uses represent the most intensive use of the site.

4.4 Step 3 – Calculating Pre-Discounted Vehicle Trip Totals

Multiplying the above 'vehicle trip rates per hectare' by each land-use's site area detailed in Table 10 above produces a pre-discounted estimate of the total vehicle trips generated by Option 2a+, as follows:

Table 12: Option 2a+ total pre-discounted vehicle trips by land use type

Land Use	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Residential	113	326	282	132	1,814	1,880
B1	4,640	797	600	4,106	21,723	20,224
B2	208	39	32	187	1,122	1,098
Total	**4,961**	**1,162**	**914**	**4,425**	**24,659**	**23,203**

Source: TRICS 7.4.1

It is noted that these trips include the existing trips generated by the site and does not take into account any internalisation.

4.5 Step 4 – Calculating Site Internalisation Trip Discount Factor

To calculate the trip discount level for Option 2a+'s land use mix, the internalisation discount factors shown in Table 7 above are applied to the lower of the total number of trips generated by on-site residential or attracted by on-site employment. It can be seen from Table 12 that, for Option 2a+, the discount factor should be applied to the residential trips. The same number of trips can then also be deducted from the employment trips to reflect that fewer residential departures becomes correspondingly fewer employment arrivals, and vice versa.

The result of this calculation is shown in the following table. The discounted residential trips have been applied pro-rata to the employment uses.

Table 13: Option 2a+ vehicle trips discounted due to internalisation

Land Use	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Residential	-11	-33	-29	-13	-157	-163
B1	-32	-11	-13	-27	-155	-149
B2	-1	-1	-1	-1	-8	-8
Average	**-22**	**-22**	**-21**	**-21**	**-160**	**-160**

Source: MM calculation

As can be seen, the land use mix assumed by Option 2a+ does not lead to high levels of internalised trips.

4.6 Step 5 – Calculating Post-Discounted Vehicle Trip Totals

The post-discounted vehicle trip totals for Option 2a+ are calculated simply by deducting the above discounted vehicle trips from the pre-discounted vehicle trip totals shown above in Table 12. The results of this calculation are shown in the following table.

Table 14: Option 2a+ total post-discounted vehicle trips by land use type

Land Use	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Residential	101	293	254	118	1,657	1,717
B1	4,609	786	587	4,079	21,568	20,075
B2	206	39	31	186	1,114	1,090
Total	**4,916**	**1,118**	**872**	**4,383**	**24,339**	**22,883**

It is noted that these trips include existing trips generated by the site.

This table suggests that Option 2a+, as currently proposed, will:

- Produce highly tidal flows in the morning and evening peak hours. This is due to the current development mix bias towards employment uses.
- Produce high levels of flows in both peak hours, with potentially up to 5,000 vehicle trips being attracted to the site in a single peak hour. This is due to the high proportion of B1 uses which, as noted above, results in the most intensive use of the site in terms of vehicle trip generation.

By increasing the ratio of residential to employment uses on the site, the above two problems of imbalanced flows and high flow levels should be reduced. This is explored in the next step.

4.7 Step 6 – Calculating Rebalanced Vehicle Trip Totals

As described in Section 3.8 above, the ratio of residential to employment uses within the developable area of the site can be altered to deliver certain target transport scenarios. The three transport scenarios explored in the sections below are:

1. Maximum trip internalisation scenario
2. Balanced external flow scenario
3. Minimum trip generation scenario

4.7.1 Rebalanced Option 2a+ – Maximum Trip Internalisation Scenario

Trip internalisation is maximised if the residential uses on the site produce approximately the same number of trips as are attracted by the site's employment uses.

Table 10 above suggests that the residential component of Option 2a+ would occupy about 20% (13ha) of the estimated developable site area (65ha). Analysis suggests that trip internalisation would be maximised if this component were increased to 75% (49ha).

The following table shows the suggested rebalanced land use mix, which would result in a little more residents than jobs, and a net increase in jobs over existing levels of 3,905:

Table 15: Suggested rebalanced land use mix for maximising internalised trips

Land Use	Hectares	Proportion	Dwellings/GFA	Residents/Jobs	
				Total	New
Residential	49	75%	3,920	9,016[6]	+9,016
B1	13	19%	86,379	7,259[7]	+3,679
B2	4	6%	15,823	447[5]	+229
Total	**65**	**100%**			

Source: MM calculation

This revised land use mix results in the pre-discounted vehicle trip levels, discounted trips levels and final post-discounted vehicle trip levels shown in the following three tables respectively. These tables are based on total site trip generation and therefore include existing trips generated by the site.

Table 16: Maximised internalised trips scenario – total pre-discounted vehicle trips by land use type

Land Use	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Residential	416	1,203	1,043	486	6,695	6,938
B1	1,463	251	189	1,295	6,850	6,377
B2	66	12	10	59	354	346
Total	**1,944**	**1,467**	**1,242**	**1,840**	**13,899**	**13,662**

Source: TRICS 7.4.1

Table 17: Maximised internalised trips scenario – vehicle trips discounted due to internalisation

Land Use	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Residential	-42	-122	-106	-49	-580	-601
B1	-117	-40	-47	-101	-572	-550
B2	-5	-2	-2	-5	-30	-30
Average	**-82**	**-82**	**-78**	**-78**	**-591**	**-591**

Source: MM calculation

[6] Based on a national average of 2.3 persons per household, as per 2011 Census

[7] Based on GFA per job values shown in Table 1 above

Table 18: Maximised internalised trips scenario – total post-discounted vehicle trips by land use type

Land Use	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Residential	373	1,081	937	437	6,115	6,337
B1	1,346	211	142	1,193	6,278	5,827
B2	60	10	7	54	324	316
Total	**1,780**	**1,303**	**1,086**	**1,685**	**12,718**	**12,481**

As can be seen by comparing Table 17 with Table 13 above, this suggested land use mix would result in over three and a half times as many internalised trips as for the Option 2a+ mix. Table 18 also shows that this option would result in more balanced flows in and out of the site in the peak hours. Comparison with Table 14 shows that this land use mix would nearly halve the total level of vehicle trips generated across the day. For the AM arrivals and PM departures, this reduction is more like two thirds.

4.7.2 Rebalanced Option 2a+ – Balanced External Flow Scenario

Table 10 above suggests that the residential component of Option 2a+ would occupy about 20% (13ha) of the estimated developable site area (65ha). Analysis suggests that if this component were increased to 85% (55ha), vehicle flow balance in and out of the site would be achieved.

The following table shows the suggested rebalanced land use mix, which would result in about twice as many residents on-site as jobs, and a net increase in jobs over existing levels of 1,095:

Table 19: Suggested rebalanced land use mix for maximising internalised trips

Land Use	Hectares	Proportion	Dwellings/GFA	Residents/Jobs	
				Total	New
Residential	55	84%	4,400	10,120[8]	+10,120
B1	8	12%	54,879	4,612[9]	+1,032
B2	2	4%	10,053	284[7]	+63
Total	**65**	**100%**	-	-	

Source: MM calculation

This revised land use mix results in the pre-discounted vehicle trip levels, discounted trips levels and final post-discounted vehicle trip levels shown in the following three tables respectively. These tables are based on total site trip generation and therefore include existing trips generated by the site.

Table 20: Balanced external flow scenario – total pre-discounted vehicle trips by land use type

Land Use	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Residential	466	1,351	1,170	546	7,515	7,788
B1	930	160	120	823	4,352	4,052
B2	42	8	6	37	225	220
Total	**1,438**	**1,518**	**1,297**	**1,406**	**12,092**	**12,060**

Source: TRICS 7.4.1

[8] Based on a national average of 2.3 persons per household, as per 2011 Census

[9] Based on GFA per job values shown in Table 1 above

Table 21: Balanced external flow scenario – vehicle trips discounted due to internalisation

Land Use	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Residential	-17	-99	-87	-13	-370	-396
B1	-94	-16	-12	-84	-377	-351
B2	-4	-1	-1	-4	-19	-19
Average	**-58**	**-58**	**-50**	**-50**	**-383**	**-383**

Source: MM calculation

Table 21 shows that the level of internalised trips is lower in this scenario than in the 'maximised internalised trips' scenario.

Table 22: Balanced external flow scenario – total post-discounted vehicle trips by land use type

Land Use	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Residential	449	1,252	1,083	533	7,145	7,392
B1	835	143	108	739	3,975	3,701
B2	37	7	6	34	205	201
Total	**1,322**	**1,403**	**1,197**	**1,305**	**11,325**	**11,293**

Table 22 confirms that this option would result in balanced flows in and out of the site in the peak hours, which increases use of available network capacity.

Although the level of internalised trips is lower in this scenario than in the 'maximised internalised trips' scenario, Table 22 shows that the overall level of external vehicle trips generated by the site is nonetheless lower. Compared to the unadjusted Option 2a+, however, the level of internalised vehicle trips in this scenario is over twice as high, while the total level of vehicle trips is over 50% lower.

4.7.3 Rebalanced Option 2a+ – Minimum Trip Generation Scenario

For completeness, it is noted that the site would generate least trips if it comprised the least intensive trip generating employment land use (B2). The following table shows the rebalanced land use mix if the sole use was B2, resulting in a net increase in jobs over existing levels of 3,957.

Table 23: Suggested rebalanced land use mix for minimising trip generation

Land Use	Hectares	Proportion	Dwellings/GFA	Residents/Jobs	
				Total	New
Residential	0	0%	-	-	+0
B1	0	0%	-	-	-3,580
B2	65	100%	274,904	7,757[10]	+7,537
Total	65	100%	-	-	

Source: MM calculation

This revised distribution results in the pre-discounted vehicle trip levels, discounted trips levels and final post-discounted vehicle trip levels shown in the following three tables respectively. These tables are based on total site trip generation and therefore include existing trips generated by the site.

[10] Based on GFA per job values shown in Table 1 above

Table 24: Minimum trip generation scenario – total pre-discounted vehicle trips by land use type

Land Use	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Residential	-	-	-	-	-	-
B1	-	-	-	-	-	-
B2	1,138	214	173	1,025	6,147	6,018
Total	**1,138**	**214**	**173**	**1,025**	**6,147**	**6,018**

Source: TRICS 7.4.1

Table 25: Minimum trip generation scenario – vehicle trips discounted due to internalisation

Land Use	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Residential	0	0	0	0	0	0
B1	0	0	0	0	0	0
B2	0	0	0	0	0	0
Average	**0**	**0**	**0**	**0**	**0**	**0**

Source: MM calculation

Table 26: Minimum trip generation scenario – total post-discounted vehicle trips by land use type

Land Use	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Residential	-	-	-	-	-	-
B1	-	-	-	-	-	-
B2	1,138	214	173	1,025	6,147	6,018
Total	**1,138**	**214**	**173**	**1,025**	**6,147**	**6,018**

Table 26 confirms that this option would result in the lowest overall vehicle trip generation level, with the level shown being about a quarter of the unadjusted Option 2a+ level. However, there is of course no trip internalisation with this scenario as there is only one land use type represented.

Though this scenario is clearly unlikely to be considered as a viable planning option, it does serve to show the lower limit of the vehicle trip generation potential of the developable area implied by Option 2a+.

4.8 Summary

Based on the above analysis, the following tables summarise, for the unadjusted Option 2a+ and then the three rebalanced land use scenarios:

- The land use mix, in terms of the residential site area proportion and resulting distribution of dwellings, employment floor areas, residents and jobs
- The average level of internalised vehicle trips
- The resulting total external vehicle trip generation level, including existing trips generated by the site

Table 27: Summary of land use mix data per scenario

Scenario	Residential Site Area	Units			People		
		Dwellings	B1 GFA	B2 GFA	Residents	B1 Jobs	B2 Jobs
Option 2a+	20% (13 ha)	1,062	273,932 m^2	50,180 m^2	2,443	23,019	1,416
Max internalisation	75% (49 ha)	3,920	86,379 m^2	15,823 m^2	9,016	7,259	447
Balanced flows	84% (55 ha)	4,400	54,879 m^2	10,053 m^2	10,120	4,612	284
Minimum trips	0% (0 ha)	0	0 m^2	274,904 m^2	0	0	7,757

Table 28: Summary of average internalised vehicle trip discount levels per scenario

Scenario	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Option 2a+	-22	-22	-21	-21	-160	-160
Max internalisation	-82	-82	-78	-78	-591	-591
Balanced flows	-58	-58	-50	-50	-383	-383
Minimum trips	0	0	0	0	0	0

Table 29: Summary of total external vehicle trip levels per scenario

Scenario	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Option 2a+	4,916	1,118	872	4,383	24,339	22,883
Max internalisation	1,780	1,303	1,086	1,685	12,718	12,481
Balanced flows	1,322	1,403	1,197	1,305	11,325	11,293
Minimum trips	1,138	214	173	1,025	6,147	6,018

Overall, it is suggested that, of the above scenarios, the ‘maximum trip internalisation’ scenario offers the best balance of planning and transport benefits. It does not generate significantly more external vehicle trips than the ‘balanced external flow’ scenario, but offers substantially fewer trips and an improved balance of in and out flows compared to the unadjusted Option 2a+, while still maintaining a credible on-site ratio of residents to jobs. This clearly indicates that for balanced development on the CNFE/CSP sites, there needs to be a much higher proportion of residential development in this area of Cambridge.

5 'Scenario 3 Rebalanced' Calculation Based on Option 4a+

5.1 Introduction

The purpose of this section is to explore the definition of 'Scenario 3 Rebalanced' by applying the above 6-step methodology to the Option 4a+ land use mix.

5.2 Step 1 – Establishing the Developable Area and Land Use Mix Ratio

Based on Table 2 above, the land use data proposed for Option 4a+ is as follows:

Table 30: Option 4a+ land use data summary

Land Use	Units / Floorspace
Residential	7,692 dwellings
B1	286,910 sqm GFA
B2	0 sqm GFA

It is important to note that this land use mix *includes* the existing uses within the CNFE site, which are assumed from the CSRM1 model to comprise zero dwellings but employment uses providing 3,800 jobs.

Applying the higher density and mid-value Floor Area Ratios from Table 4 above, as used for Option 2a+ above, converts the above data to the following implied site areas per land use type.

Table 31: Option 4a+ site area implied by higher density Floor Area Ratios

Land Use	Units / Floorspace	Floor Area Ratio Applied	Site Area Implied	Land Use Mix
Residential	7,692 dwellings	80 dwellings per ha	96 ha	70%
B1	286,910 sqm GFA	6,809 sqm GFA per ha	42 ha	30%
B2	0 sqm GFA	4,200 sqm GFA per ha	0 ha	0%
Total site area			**138 ha**	**100%**

This calculation implies a total developed site area of 138 hectares, which is 38 hectares greater than the assumed maximum developable area of the whole site (see Section 3.3 above). This option is assumed to cover the full estimated site area of 100 ha.

The following table therefore shows the Floor Area Ratios which would be required to meet this maximum developable area target, which have been derived by applying pro-rata uplifts to the above Ratios.

Table 32: Option 4a+ site area implied by even higher density Floor Area Ratios

Land Use	Units / Floorspace	Floor Area Ratio Applied	Site Area Implied	Land Use Mix
Residential	7,692 dwellings	111 dwellings per ha	70 ha	70%
B1	286,910 sqm GFA	9,416 sqm GFA per ha	30 ha	30%
B2	0 sqm GFA	5,808 sqm GFA per ha	0 ha	0%
Total site area			**100 ha**	**100%**

This therefore suggests that Option 4a+ does not just develop more of the site than Option 2a+, but also involves a more intensive level of development.

It is therefore assumed that Option 4a+ is based on a total developable site area of 100 hectares, of which 70% is assumed to comprise residential uses.

5.3 Step 2 – Calculating Vehicle Trip Rates per Hectare

Applying the applied Floor Area Ratios detailed in Table 32 above to the vehicle trip rates of Table 6 above generates the following vehicle trip generation per hectare.

Table 33: Option 4a+ vehicle trip generation per hectare by land use type

Land Use	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Residential	12	34	29	14	189	196
B1	160	27	21	141	747	695
B2	24	5	4	22	130	127

Source: TRICS 7.4.1

It is noted from this table that, on a per hectare basis and as observed for Option 2a+, B1 office uses generate considerably more trips than both the residential and B2 uses, being about 4 to 6 times greater respectively. In transport terms, therefore, B1 uses represent the most intensive use of the site.

5.4 Step 3 – Calculating Pre-Discounted Vehicle Trip Totals

Multiplying the above 'vehicle trip rates per hectare' by each land-use's site area detailed in Table 32 above produces a pre-discounted estimate of the total vehicle trips generated by Option 4a+, as follows:

Table 34: Option 4a+ total pre-discounted vehicle trips by land use type

Land Use	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Residential	815	2,361	2,046	954	13,138	13,615
B1	4,860	835	628	4,301	22,752	21,183
B2	-	-	-	-	-	-
Total	**5,676**	**3,196**	**2,674**	**5,255**	**35,890**	**34,797**

Source: TRICS 7.4.1

It is noted that these trips include the existing trips generated by the site.

5.5 Step 4 – Calculating Site Internalisation Trip Discount Factor

To calculate the trip discount level for Option 4a+'s land use mix, the internalisation discount factors shown in Table 7 above are applied to the lower of the total number of trips generated by on-site residential or attracted by on-site employment. It can be seen from Table 34 that, for Option 4a+, the discount factor should be applied to the residential trips. However, as for Option 2a+, the same number of trips can then also be deducted from the employment trips to reflect that fewer residential departures becomes correspondingly fewer employment arrivals, and vice versa.

The result of this calculation is shown in the following table. The discounted residential trips have been applied pro-rata to the employment uses.

Table 35: Option 4a+ vehicle trips discounted due to internalisation

Land Use	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Residential	-83	-240	-208	-97	-1138	-1179
B1	-240	-83	-97	-208	-1179	-1138
B2	0	0	0	0	0	0
Average	**-161**	**-161**	**-152**	**-152**	**-1159**	**-1159**

Source: MM calculation

As can be seen, the land use mix assumed by Option 4a+ leads to significantly higher levels of internalised trips than Option 2a+. This is because both options propose similar levels of on-site jobs, but Option 4a+ proposes over seven times as many dwellings.

5.6 Step 5 – Calculating Post-Discounted Vehicle Trip Totals

The post-discounted vehicle trip totals for Option 4a+ are calculated simply by deducting the above discounted vehicle trips from the pre-discounted vehicle trip totals shown above in Table 34. The results of this calculation are shown in the following table.

Table 36: Option 4a+ total post-discounted vehicle trips by land use type

Land Use	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Residential	732	2,121	1,838	857	12,000	12,435
B1	4,620	752	531	4,093	21,573	20,044
B2	-	-	-	-	-	-
Total	**5,353**	**2,873**	**2,369**	**4,950**	**33,572**	**32,480**

It is noted that these trips include existing trips generated by the site.

This table suggests that Option 4a+, as currently proposed, will:

- Produce less tidal flows in the morning and evening peak hours than Option 2a+, but still noticeably tidal. This is due to the current development mix bias towards employment uses.
- Produce very high levels of flows in both peak hours, with potentially over 5,000 vehicle trips being attracted to the site in a single peak hour and over 33,000 being attracted across the day. This is due to the high proportion of B1 uses which, as noted above, results in the most intensive use of the site in terms of vehicle trip generation.

By increasing the ratio of residential to employment uses on the site, the above two problems of imbalanced flows and high flow levels should be reduced. This is explored in the next step.

5.7 Step 6 – Calculating Rebalanced Vehicle Trip Totals

As described in Section 3.8 above, the ratio of residential to employment uses within the developable area of the site can be altered to deliver certain target transport scenarios. As considered for Option 2a+ above, the three transport scenarios explored in the sections below are:

1. Maximum trip internalisation scenario
2. Balanced external flow scenario
3. Minimum trip generation scenario

5.7.1 Rebalanced Option 4a+ – Maximum Trip Internalisation Scenario

Trip internalisation is maximised if the residential uses on the site produce approximately the same number of trips as are attracted by the site's employment uses.

Table 32 above suggests that the residential component of Option 4a+ would occupy about 70% (70ha) of the estimated developable site area (100ha). Analysis suggests that trip internalisation would be maximised if this component were increased to 79% (47ha).

The following table shows the suggested rebalanced land use mix, which would result in a little more residents than jobs, and a net increase in jobs over existing levels of 12,816:

Table 37: Suggested rebalanced land use mix for maximising internalised trips

Land Use	Hectares	Proportion	Dwellings/GFA	Residents/Jobs	
				Total	New
Residential	79	79%	8,740	20,101[11]	+20,101
B1	21	21%	197,735	16,616[12]	+12,816
B2	0	0%	-	-	+0
Total	**100**	**100%**			

Source: MM calculation

This revised land use mix results in the pre-discounted vehicle trip levels, discounted trips levels and final post-discounted vehicle trip levels shown in the following three tables respectively. These tables are based on total site trip generation and therefore include existing trips generated by the site.

Table 38: Maximised internalised trips scenario – total pre-discounted vehicle trips by land use type

Land Use	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Residential	926	2,683	2,325	1,084	14,927	15,469
B1	3,350	575	433	2,964	15,680	14,599
B2	-	-	-	-	-	-
Total	**4,276**	**3,259**	**2,758**	**4,048**	**30,608**	**30,068**

Source: TRICS 7.4.1

Table 39: Maximised internalised trips scenario – vehicle trips discounted due to internalisation

Land Use	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Residential	-58	-340	-301	-44	-1265	-1358
B1	-340	-58	-44	-301	-1358	-1265
B2	0	0	0	0	0	0
Average	**-199**	**-199**	**-173**	**-173**	**-1311**	**-1311**

Source: MM calculation

[11] Based on a national average of 2.3 persons per household, as per 2011 Census

[12] Based on GFA per job values shown in Table 1 above

Table 40: Maximised internalised trips scenario – total post-discounted vehicle trips by land use type

Land Use	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Residential	868	2,343	2,023	1,040	13,663	14,111
B1	3,009	517	389	2,663	14,322	13,334
B2	-	-	-	-	-	-
Total	**3,877**	**2,860**	**2,412**	**3,702**	**27,985**	**27,445**

As can be seen by comparing Table 39 with Table 35 above, this suggested land use mix would result in an increase of internalised trips of about 13% compared to the currently proposed Option 4a+ mix. This suggests that the level of internalisation implied by the current Option 4a+ proposals are already quite high.

Table 40 also shows that this option would result in more balanced flows in and out of the site in the peak hours, which increases use of available network capacity, while comparison with Table 14 shows that this land use mix would reduce the total level of vehicle trips generated across the day by about 15%. For the AM arrivals and PM departures, this reduction is more like 25%.

5.7.2 Rebalanced Option 4a+ – Balanced External Flow Scenario

Table 32 above suggests that the residential component of Option 4a+ would occupy about 70% (70ha) of the estimated developable site area (100ha). Analysis suggests that if this component were increased to 88% (88ha), vehicle flow balance in and out of the site would be achieved.

The following table shows the suggested rebalanced land use mix, which would result in about twice as many residents on-site as jobs, and a net increase in jobs over existing levels of 5,695:

Table 41: Suggested rebalanced land use mix for balancing external flows

Land Use	Hectares	Proportion	Dwellings/GFA	Residents/Jobs	
				Total	New
Residential	88	88%	9,735	22,391[13]	+22,391
B1	12	12%	112,991	9,495[14]	+5,695
B2	0	0%	-	-	+0
Total	**100**	**100%**	-	-	

Source: MM calculation

This revised land use mix results in the pre-discounted vehicle trip levels, discounted trips levels and final post-discounted vehicle trip levels shown in the following three tables respectively. These tables are based on total site trip generation and therefore include existing trips generated by the site.

Table 42: Balanced external flow scenario – total pre-discounted vehicle trips by land use type

Land Use	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Residential	1,032	2,989	2,590	1,207	16,628	17,232
B1	1,914	329	247	1,694	8,960	8,342
B2	-	-	-	-	-	-
Total	**2,946**	**3,318**	**2,837**	**2,901**	**25,588**	**25,574**

Source: TRICS 7.4.1

[13] Based on a national average of 2.3 persons per household, as per 2011 Census

[14] Based on GFA per job values shown in Table 1 above

Table 43: Balanced external flow scenario – vehicle trips discounted due to internalisation

Land Use	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Residential	-33	-195	-172	-25	-723	-776
B1	-195	-33	-25	-172	-776	-723
B2	0	0	0	0	0	0
Average	**-114**	**-114**	**-99**	**-99**	**-749**	**-749**

Source: MM calculation

Table 44: Balanced external flow scenario – total post-discounted vehicle trips by land use type

Land Use	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Residential	999	2,794	2,417	1,182	15,905	16,455
B1	1,720	295	222	1,522	8,184	7,620
B2	-	-	-	-	-	-
Total	**2,718**	**3,090**	**2,640**	**2,704**	**24,089**	**24,075**

Table 44 confirms that this option would result in balanced flows in and out of the site in the peak hours, which increases use of available network capacity.

Table 43 shows that the level of internalised trips is lower in this scenario than in the 'maximised internalised trips' scenario, but Table 44 shows that the overall level of vehicle trips generated by the site is nonetheless lower. Similarly, compared to the unadjusted Option 4a+, the level of internalised vehicle trips in this scenario is also lower, but the total level of vehicle trips is over 25% lower, and nearly 50% lower in the peaks.

5.7.3 Rebalanced Option 4a+ – Minimum Trip Generation Scenario

For completeness, it is noted that the site would generate least trips if it comprised the least intensive trip generating employment land use, (B2). The following table shows the rebalanced land use mix if the sole use was B2, resulting in a net increase in jobs over existing levels of 12,590.

Table 45: Suggested rebalanced land use mix for minimising trip generation

Land Use	Hectares	Proportion	Dwellings/GFA	Residents/Jobs	
				Total	New
Residential	0	0%	-	-	+0
B1	0	0%	-	-	-3,800
B2	100	100%	580,805	16,390[15]	+16,390
Total	**100**	**100%**	-	-	

Source: MM calculation

This revised land use mix results in the pre-discounted vehicle trip levels, discounted trips levels and final post-discounted vehicle trip levels shown in the following three tables respectively. These tables are based on total site trip generation and therefore include existing trips generated by the site.

[15] Based on GFA per job values shown in Table 1 above

Table 46: Minimum trip generation scenario – total pre-discounted vehicle trips by land use type

Land Use	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Residential	-	-	-	-	-	-
B1	-	-	-	-	-	-
B2	2,405	453	366	2,166	12,987	12,714
Total	**2,405**	**453**	**366**	**2,166**	**12,987**	**12,714**

Source: TRICS 7.4.1

Table 47: Minimum trip generation scenario – vehicle trips discounted due to internalisation

Land Use	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Residential	0	0	0	0	0	0
B1	0	0	0	0	0	0
B2	0	0	0	0	0	0
Average	**0**	**0**	**0**	**0**	**0**	**0**

Source: MM calculation

Table 48: Minimum trip generation scenario – total post-discounted vehicle trips by land use type

Land Use	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Residential	-	-	-	-	-	-
B1	-	-	-	-	-	-
B2	2,405	453	366	2,166	12,987	12,714
Total	**2,405**	**453**	**366**	**2,166**	**12,987**	**12,714**

Table 48 confirms that this option would result in the lowest overall vehicle trip generation level, with the level shown being about 40% of the unadjusted Option 4a+ level. However, there is of course no trip internalisation with this scenario as there is only one land use type represented.

Though this scenario is clearly unlikely to be considered as a viable planning option, it does serve to show the lower limit of the vehicle trip generation potential of the developable area implied by Option 4a+.

5.8 Summary

Based on the above analysis, the following tables summarise, for the unadjusted Option 4a+ and then the three rebalanced land use scenarios:

- The land use mix, in terms of the residential site area proportion and resulting distribution of dwellings, employment floor areas, residents and jobs
- The average level of internalised vehicle trips
- The resulting total external vehicle trip generation level, including existing trips generated by the site

Table 49: Summary of land use mix data per scenario

Scenario	Residential Site Area	Units			People		
		Dwellings	B1 GFA	B2 GFA	Residents	B1 Jobs	B2 Jobs
Option 4a+	70% (70 ha)	7,692	286,910 m^2	0 m^2	17,692	24,110	0
Max internalisation	79% (79 ha)	8,740	197,735 m^2	0 m^2	20,101	16,616	0
Balanced flows	88% (88 ha)	9,735	112,991 m^2	0 m^2	22,391	9,495	0
Minimum trips	0% (0 ha)	0	0 m^2	580,805 m^2	0	0	16,390

Table 50: Summary of average internalised vehicle trip discount levels per scenario

Scenario	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Option 4a+	-161	-161	-152	-152	-1159	-1159
Max internalisation	-199	-199	-173	-173	-1311	-1311
Balanced flows	-114	-114	-99	-99	-749	-749
Minimum trips	0	0	0	0	0	0

Table 51: Summary of total external vehicle trip levels per scenario

Scenario	AM		PM		Daily	
	Arr	Dep	Arr	Dep	Arr	Dep
Option 4a+	5,353	2,873	2,369	4,950	33,572	32,480
Max internalisation	3,877	2,860	2,412	3,702	27,985	27,445
Balanced flows	2,718	3,090	2,640	2,704	24,089	24,075
Minimum trips	2,405	453	366	2,166	12,987	12,714

Overall, it is suggested that, of the above scenarios, the ‘balanced external flow’ scenario potentially offers the best transport compromise for Option 4a+. Given the scale of development proposed under this option, it is considered that the option that results in the lowest external vehicle trip impacts while still offering a reasonable mix of land uses should be preferred.

6 ‘Scenario 3 Rebalanced’ Recommendation

The Milton Road corridor is significantly constrained in highway capacity terms, meaning it is unlikely to be practicable to develop CNFE/CSP with levels of car use traditionally seen at edge-of-town employment sites.

To this end, a range of measures are likely to be required to accompany development, from investment in and promotion of further non-car measures, to managing both on and off-site parking provision to seek to minimise external traffic generation.

To give these measures the greatest opportunity to be effective also ideally requires higher levels of internalised trip making to reduce impacts on the external networks, and also more balanced and less tidal patterns of demand which can make better use of available transport capacity.

Given the above, the analysis set out in this document indicates that the ‘Maximum Trip Internalisation’ scenario offers the best balance for the site in transport terms for the purposes of modelling. This offers significantly fewer vehicle trips on the external road network than the existing proposals for the site, whilst still maintaining a credible on-site ratio of residents to jobs and a more balanced pattern of demand.

The level of development set out in Table 15 above, and the resultant level of external vehicle trip generation, has thus fed into the transport modelling in support of the study Strategic Outline Business Case process.

These assumptions were used as a mechanism for developing potential transport demand to/from the sites for transport modelling purposes only, and do not necessarily represent either a viable or desired development mix for the site.

This level of development is also not prescriptive, and does not prejudge any future planning of the sites that will be considered through any Area Action Plan or other policy initiatives. The levels of external vehicle trip generation in line with the levels indicated by the modelling undertaken can be used as a start-point for defining a vehicular trip budget for the future development of the site.

Therefore, the development of these sites will need to deliver measures that significantly reduce the car mode share for trips to and from the area through a combination of demand-side mechanisms such as parking restraint, and investment in measures to support non-car transport.

Appendices

A. TRICS Trip Rate Calculation Parameters

A.1 Residential Trip Rates

TRICS 7.4.1
Trip Rate Parameter: Number of dwellings
TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use 03 - RESIDENTIAL
Category M - MIXED PRIVATE/AFFORDABLE HOUSING

VEHICLES

Selected regions and areas:

2	SOUTH EAST		
	ES	EAST SUSSEX	2 days
	HC	HAMPSHIRE	3 days
	KC	KENT	1 days
	SC	SURREY	3 days
	WS	WEST SUSSEX	8 days
3	SOUTH WEST		
	BR	BRISTOL CITY	1 days
	DV	DEVON	1 days
5	EAST MIDLANDS		
	DS	DERBYSHIRE	1 days
	LE	LEICESTERSHIRE	1 days
6	WEST MIDLANDS		
	WM	WEST MIDLANDS	1 days
8	NORTH WEST		
	GM	GREATER MANCHESTER	1 days
	MS	MERSEYSIDE	2 days
9	NORTH		
	DH	DURHAM	1 days
	TW	TYNE & WEAR	1 days

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

Secondary Filtering selection:

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

Parameter: Number of dwellings
Actual Range: 9 to 500 (units:)
Range Selected by User: 9 to 1874 (units:)

Public Transport Provision:
Selection by: Include all surveys

Date Range: 01/01/09 to 10/05/16

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

Selected survey days:
Monday 4 days
Tuesday 5 days
Wednesday 6 days

Thursday 8 days
Friday 4 days
This data displays the number of selected surveys by day of the week.

Selected survey types:
Manual count 27 days
Directional ATC Count 0 days
This data displays the number of manual classified surveys and the number of unclassified ATC surveys the total adding up to the overall number of surveys in the selected set. Manual surveys are undertaken using staff whilst ATC surveys are undertaking using machines.

Selected Locations:
Town Centre 0
Edge of Town Centre 1
Suburban Area (PPS6 Out of Centre) 13
Edge of Town 13
Neighbourhood Centre (PPS6 Local Centre) 0

Free Standing (PPS6 Out of Town) 0
Not Known 0
This data displays the number of surveys per main location category within the selected set. The main location categories consist of Free Standing, Edge of Town, Suburban Area, Neighbourhood Centre, Edge of Town Centre, Town Centre and Not Known.

Selected Location Sub Categories:
Industrial Zone 0
Commercial Zone 0
Development Zone 0
Residential Zone 27
Retail Zone 0
Built-Up Zone 0
Village 0
Out of Town 0
High Street 0
No Sub Category 0
This data displays the number of surveys per location sub-category within the selected set. The location sub-categories consist of Commercial Zone, Industrial Zone, Development Zone, Residential Zone, Retail Zone, Built-Up Zone, Village, Out of Town, High Street and No Sub Category.

Secondary Filtering selection:

Use Class:
C3 27 days
This data displays the number of surveys per Use Class classification within the selected set. The Use Classes Order 2005 has been used for this purpose which can be found within the Library module of TRICS®.

Population within 1 mile:
1,001 to 5,000 4 days
5,001 to 10,000 3 days
10,001 to 15,000 4 days
15,001 to 20,000 2 days
20,001 to 25,000 4 days
25,001 to 50,000 10 days

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

Population within 5 miles:
5,001 to 25,000 2 days
25,001 to 50,000 1 days
50,001 to 75,000 2 days
75,001 to 100,000 3 days
100,001 to 125,000 5 days
125,001 to 250,000 8 days
250,001 to 500,000 6 days
This data displays the number of selected surveys within stated 5-mile radii of population.

Car ownership within 5 miles:
0.6 to 1.0 8 days
1.1 to 1.5 17 days
1.6 to 2.0 2 days
This data displays the number of selected surveys within stated ranges of average cars owned per residential dwelling within a radius of 5-miles of selected survey sites.

Travel Plan:
Yes 15 days
No 12 days
This data displays the number of surveys within the selected set that were undertaken at sites with Travel Plans in place and the number of surveys that were undertaken at sites without Travel Plans.

PTAL Rating:
No PTAL Present 27 days
This data displays the number of selected surveys with PTAL Ratings.

LIST OF SITES relevant to selection parameters

1 BR-03-M-02 BLOCKS OF FLATS BRISTOL CITY
CLARENCE ROAD

BRISTOL
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Number of dwellings: 42
Survey date: MONDAY 12/10/2009 Survey Type: MANUAL

2 DH-03-M-02 SEMI DET. & DETACHED DURHAM

PUDSEY WALK

DARLINGTON
Edge of Town
Residential Zone
Total Number of dwellings: 39
Survey date: WEDNESDAY 10/11/2010 Survey Type: MANUAL

3 DS-03-M-01 TERRACED/SEMI DETACHED DERBYSHIRE

COCKAYNE STREET
BOULTON
DERBY
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Number of dwellings: 32
Survey date: TUESDAY 21/10/2014 Survey Type: MANUAL

4 DV-03-M-01 HOUSES & FLATS DEVON
TOPSHAM ROAD

EXETER
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Number of dwellings: 61
Survey date: THURSDAY 06/10/2011 Survey Type: MANUAL

5 ES-03-M-07 MIXED HOUSING EAST SUSSEX
SOUTH COAST ROAD

PEACEHAVEN
Edge of Town
Residential Zone
Total Number of dwellings: 188
Survey date: THURSDAY 12/11/2015 Survey Type: MANUAL

6 ES-03-M-08 MIXED HOUSES EAST SUSSEX
FIELD END

MARESFIELD
Edge of Town
Residential Zone
Total Number of dwellings: 80
Survey date: TUESDAY 10/05/2016 Survey Type: MANUAL

7 GM-03-M-01 TERRACED & FLATS GREATER MANCHESTER

PARK ROAD

ROCHDALE
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Number of dwellings: 9
Survey date: TUESDAY 25/11/2014 Survey Type: MANUAL

8 HC-03-M-02 BLOCKS OF FLATS HAMPSHIRE
COOMBE WAY

FARNBOROUGH
Edge of Town Centre
Residential Zone
Total Number of dwellings: 253
Survey date: MONDAY 26/11/2012 Survey Type: MANUAL

9 HC-03-M-05 HOUSES & FLATS HAMPSHIRE
WIMPSON LANE
MAYBUSH
SOUTHAMPTON
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Number of dwellings: 62
Survey date: FRIDAY 03/10/2014 Survey Type: MANUAL

10 HC-03-M-06 HOUSES & FLATS HAMPSHIRE
HUNTS POND ROAD
TITCHFIELD
NEAR FAREHAM
Edge of Town
Residential Zone
Total Number of dwellings: 328
Survey date: WEDNESDAY 04/11/2015 Survey Type: MANUAL

11 KC-03-M-01 BLOCKS OF FLATS KENT
HIGH STREET

RAMSGATE
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Number of dwellings: 103
Survey date: TUESDAY 08/12/2009 Survey Type: MANUAL

12 LE-03-M-01 SEMI DETACHED LEICESTERSHIRE

RYDER ROAD
BRAUNSTONE FRITH
LEICESTER
Edge of Town
Residential Zone
Total Number of dwellings: 16
Survey date: THURSDAY 27/09/2012 Survey Type: MANUAL

13 MS-03-M-02 TERRACED MERSEYSIDE
LOVEL ROAD
SPEKE
LIVERPOOL
Edge of Town
Residential Zone
Total Number of dwellings: 27
Survey date: FRIDAY 21/06/2013 Survey Type: MANUAL

14 MS-03-M-03 SEMI DETACHED/TERRACED MERSEYSIDE

LOVEL ROAD
SPEKE
LIVERPOOL
Edge of Town
Residential Zone
Total Number of dwellings: 24
Survey date: FRIDAY 21/06/2013 Survey Type: MANUAL

15 SC-03-M-05 HOUSES & FLATS SURREY
HOLYWELL WAY
STANWELL
STAINES
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Number of dwellings: 52
Survey date: MONDAY 19/11/2012 Survey Type: MANUAL

16 SC-03-M-06 HOUSES & FLATS SURREY
ST ANNE'S DRIVE

REDHILL
Edge of Town
Residential Zone
Total Number of dwellings: 500
Survey date: WEDNESDAY 11/12/2013 Survey Type: MANUAL

17 SC-03-M-07 HOUSES/FLATS SURREY
EPSOM ROAD

GUILDFORD
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Number of dwellings: 199
Survey date: THURSDAY 24/10/2013 Survey Type: MANUAL

18 TW-03-M-01 DETACHED & BUNGALOWS TYNE & WEAR

WESTLANDS
CHAPEL HOUSE
NEWCASTLE
Edge of Town
Residential Zone
Total Number of dwellings: 27
Survey date: FRIDAY 13/11/2015 Survey Type: MANUAL

19 WM-03-M-01 SEMI DETACHED WEST MIDLANDS

MEADOWSWEET AVENUE
KINGS NORTON
BIRMINGHAM
Edge of Town
Residential Zone
Total Number of dwellings: 56
Survey date: MONDAY 09/11/2015 Survey Type: MANUAL

20 WS-03-M-04 HOUSES & FLATS WEST SUSSEX

SUMMERSDALE ROAD

CHICHESTER
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Number of dwellings: 214

Survey date: THURSDAY 08/05/2014 Survey Type: MANUAL

21 WS-03-M-05 MIXED HOUSING WEST SUSSEX

ELLIS ROAD
S BROADBRIDGE HEATH
WEST HORSHAM
Edge of Town
Residential Zone
Total Number of dwellings: 92
Survey date: THURSDAY 23/10/2014 Survey Type: MANUAL

22 WS-03-M-06 SEMI DETACHED/DETACHED WEST SUSSEX

SOUTHFIELDS CLOSE

CHICHESTER
Edge of Town
Residential Zone
Total Number of dwellings: 67
Survey date: TUESDAY 27/01/2015 Survey Type: MANUAL

23 WS-03-M-07 HOUSES & FLATS WEST SUSSEX

ROSE GREEN ROAD
ALDWICK
BOGNOR REGIS
Edge of Town
Residential Zone
Total Number of dwellings: 90
Survey date: WEDNESDAY 05/03/2014 Survey Type: MANUAL

24 WS-03-M-08 MIXED HOUSES & FLATS WEST SUSSEX

WESTLOATS LANE
NORTH BERSTED
BOGNOR REGIS
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Number of dwellings: 86
Survey date: THURSDAY 22/10/2015 Survey Type: MANUAL

25 WS-03-M-09 MIXED HOUSES & FLATS WEST SUSSEX

ADLINGTON GARDENS

BOGNOR REGIS
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Number of dwellings: 32
Survey date: THURSDAY 22/10/2015 Survey Type: MANUAL

26 WS-03-M-10 MIXED FLATS & HOUSES WEST SUSSEX

BROYLE ROAD

CHICHESTER
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Number of dwellings: 194
Survey date: WEDNESDAY 23/03/2016 Survey Type: MANUAL

27 WS-03-M-12 HOUSES & FLATS WEST SUSSEX

UPPER SHOREHAM ROAD

SHOREHAM BY SEA
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Number of dwellings: 192
Survey date: WEDNESDAY 27/04/2016 Survey Type: MANUAL

This section provides a list of all survey sites and days in the selected set. For each individual survey site it displays a unique site reference code and site address the selected trip rate calculation parameter and its value the day of the week and date of each survey and whether the survey was a manual classified count or an ATC count.

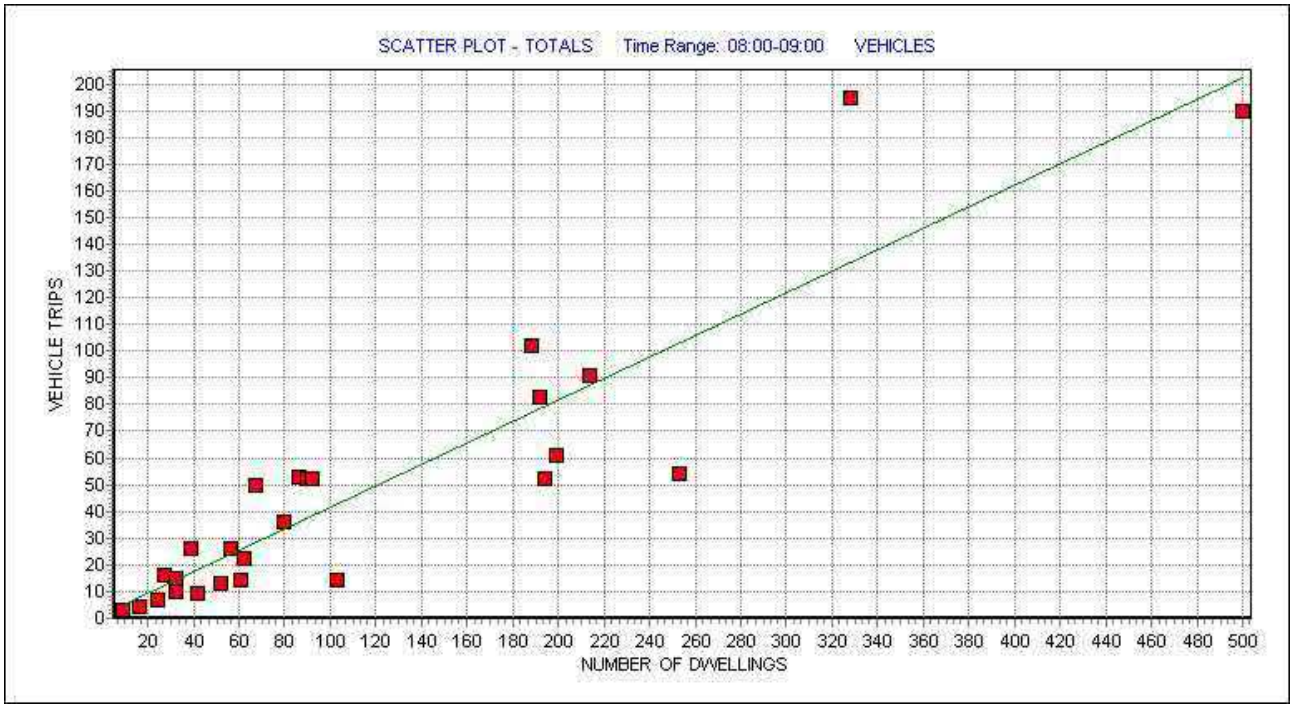
TRIP RATE for Land Use 03 - RESIDENTIAL/M - MIXED PRIVATE/AFFORDABLE HOUSING

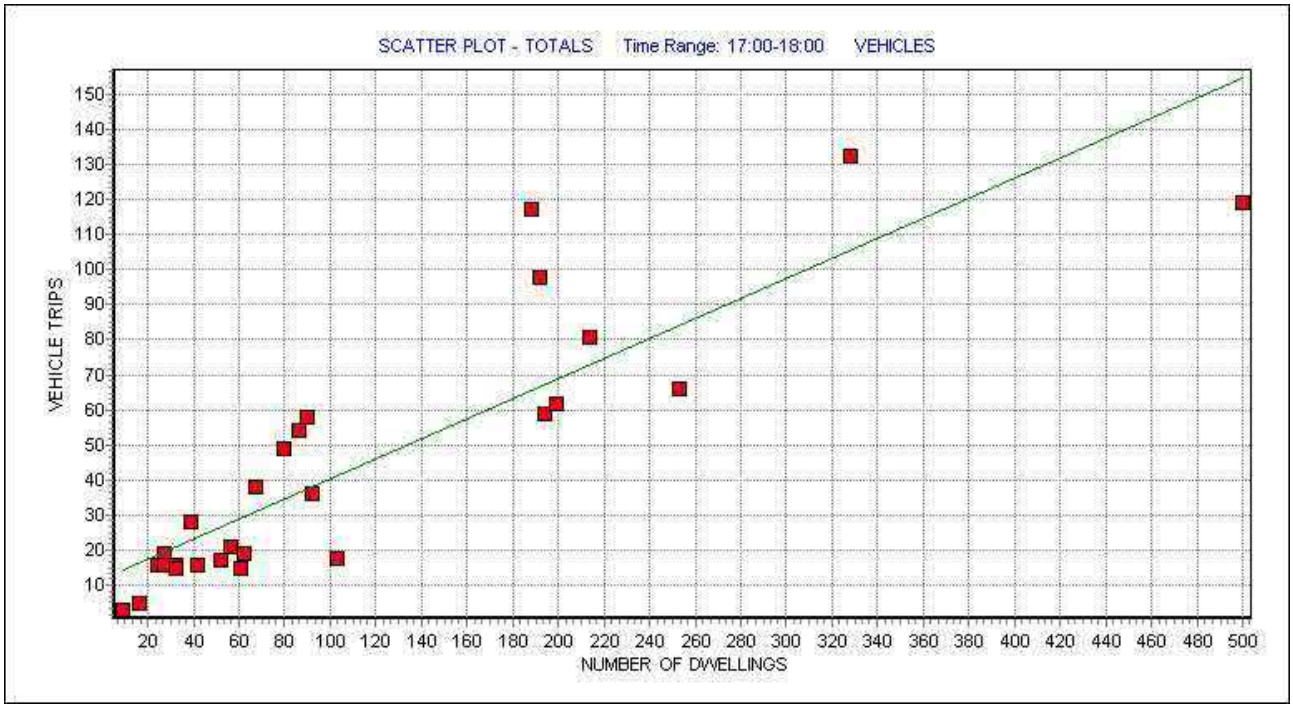
Calculation Factor: 1 DWELLS
Count Type: VEHICLES

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. Dwells	Trip Rate	No. Days	Ave. Dwells	Trip Rate	No. Days	Ave. Dwells	Trip Rate
00:00-01:00									
01:00-02:00									
02:00-03:00									
03:00-04:00									
04:00-05:00									
05:00-06:00									
06:00-07:00									
07:00-08:00	27	114	0.056	27	114	0.217	27	114	0.273
08:00-09:00	27	114	0.106	27	114	0.307	27	114	0.413
09:00-10:00	27	114	0.106	27	114	0.139	27	114	0.245
10:00-11:00	27	114	0.103	27	114	0.115	27	114	0.218
11:00-12:00	27	114	0.11	27	114	0.12	27	114	0.23
12:00-13:00	27	114	0.11	27	114	0.114	27	114	0.224
13:00-14:00	27	114	0.111	27	114	0.113	27	114	0.224
14:00-15:00	27	114	0.106	27	114	0.131	27	114	0.237
15:00-16:00	27	114	0.199	27	114	0.13	27	114	0.329
16:00-17:00	27	114	0.198	27	114	0.129	27	114	0.327
17:00-18:00	27	114	0.266	27	114	0.124	27	114	0.39
18:00-19:00	27	114	0.237	27	114	0.131	27	114	0.368
19:00-20:00									
20:00-21:00									
21:00-22:00									
22:00-23:00									
23:00-24:00									
Daily Trip Rates:			1.708			1.77			3.478

Parameter summary

Trip rate parameter range selected:	9 - 500 (units:)
Survey date date range:	01/01/09 - 10/05/16
Number of weekdays (Monday-Friday):	27
Number of Saturdays:	0
Number of Sundays:	0
Surveys automatically removed from selection:	8
Surveys manually removed from selection:	0





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

A.2 B1 Office Trip Rates

TRICS 7.4.1
Trip Rate Parameter: Gross floor area

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use 02 - EMPLOYMENT
Category A - OFFICE
VEHICLES

Selected regions and areas:

2	SOUTH EAST		
	BD	BEDFORDSHIRE	1 days
	ES	EAST SUSSEX	2 days
	HC	HAMPSHIRE	2 days
	HF	HERTFORDSHIRE	2 days
	KC	KENT	6 days
	SC	SURREY	3 days
	SO	SLOUGH	1 days
3	SOUTH WEST		
	DC	DORSET	1 days
4	EAST ANGLIA		
	CA	CAMBRIDGESHIRE	1 days
	NF	NORFOLK	1 days
	SF	SUFFOLK	2 days
6	WEST MIDLANDS		
	WM	WEST MIDLANDS	1 days
7	YORKSHIRE & NORTH LINCOLNSHIRE		
	WY	WEST YORKSHIRE	1 days
8	NORTH WEST		
	LC	LANCASHIRE	1 days
9	NORTH		
	DH	DURHAM	2 days
	TW	TYNE & WEAR	3 days

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

Secondary Filtering selection:

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

Parameter: Gross floor area
Actual Range: 186 to 70291 (units: sqm)
Range Selected by User: 186 to 175000 (units: sqm)

Public Transport Provision:
Selection by: Include all surveys

Date Range: 01/01/09 to 23/09/16

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

Selected survey days:

Monday	8 days
Tuesday	10 days
Wednesday	4 days
Thursday	6 days
Friday	2 days

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

Selected survey types:

Manual count	30 days
Directional ATC Count	0 days

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

Selected Locations:

Town Centre	0
Edge of Town Centre	11
Suburban Area (PPS6 Out of Centre)	11
Edge of Town	8
Neighbourhood Centre (PPS6 Local Centre)	0
Free Standing (PPS6 Out of Town)	0
Not Known	0

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

Selected Location Sub Categories:

Industrial Zone	4
Commercial Zone	6
Development Zone	0
Residential Zone	9
Retail Zone	0
Built-Up Zone	9
Village	0
Out of Town	0
High Street	0
No Sub Category	2

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

Secondary Filtering selection:

Use Class:

A1	1 days
B1	29 days

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

Population within 1 mile:
Not Known 1 days
1,001 to 5,000 1 days
5,001 to 10,000 7 days
10,001 to 15,000 4 days
15,001 to 20,000 5 days
25,001 to 50,000 12 days
This data displays the number of selected surveys within stated 1-mile radii of population.

Population within 5 miles:
Not Known 1 days
25,001 to 50,000 3 days
75,001 to 100,000 5 days
100,001 to 125,000 1 days
125,001 to 250,000 12 days
250,001 to 500,000 6 days
500,001 or More 2 days
This data displays the number of selected surveys within stated 5-mile radii of population.

Car ownership within 5 miles:
0.5 or Less 1 days
0.6 to 1.0 11 days
1.1 to 1.5 16 days
1.6 to 2.0 2 days
This data displays the number of selected surveys within stated ranges of average cars owned per residential dwelling within a radius of 5-miles of selected survey sites.

Travel Plan:
Yes 16 days
No 14 days
This data displays the number of surveys within the selected set that were undertaken at sites with Travel Plans in place and the number of surveys that were undertaken at sites without Travel Plans.

PTAL Rating:
No PTAL Present 30 days
This data displays the number of selected surveys with PTAL Ratings.

LIST OF SITES relevant to selection parameters

1 BD-02-A-03 OFFICES BEDFORDSHIRE
BROMHAM ROAD

BEDFORD
Edge of Town Centre
No Sub Category
Total Gross floor area: 1469 sqm
Survey date: MONDAY 14/10/2013 Survey Type: MANUAL

2 CA-02-A-04 OFFICE CAMBRIDGESHIRE
BRETTON WAY

PETERBOROUGH
Edge of Town
Commercial Zone
Total Gross floor area: 6483 sqm
Survey date: THURSDAY 20/10/2011 Survey Type: MANUAL

3 DC-02-A-09 COUNCIL OFFICES DORSET
THE GROVE

DORCHESTER
Edge of Town Centre
Built-Up Zone
Total Gross floor area: 11664 sqm
Survey date: MONDAY 28/11/2011 Survey Type: MANUAL

4 DH-02-A-01 RPMI OFFICES DURHAM
BRINKBURN ROAD

DARLINGTON
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Gross floor area: 3372 sqm
Survey date: FRIDAY 05/11/2010 Survey Type: MANUAL

5 DH-02-A-02 CONSTRUCTION COMPANY DURHAM

DURHAM ROAD
BOWBURN
NEAR DURHAM
Edge of Town
Industrial Zone
Total Gross floor area: 2000 sqm
Survey date: TUESDAY 27/11/2012 Survey Type: MANUAL

6 ES-02-A-11 HOUSING COMPANY EAST SUSSEX
THE SIDINGS
ORE VALLEY
HASTINGS
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Gross floor area: 186 sqm
Survey date: TUESDAY 17/11/2015 Survey Type: MANUAL

7 ES-02-A-12 COUNCIL OFFICES EAST SUSSEX
VICARAGE LANE

HAILSHAM
Edge of Town Centre
Built-Up Zone
Total Gross floor area: 3640 sqm
Survey date: THURSDAY 26/11/2015 Survey Type: MANUAL

8 HC-02-A-11 DIY CO. HQ HAMPSHIRE
CHESTNUT AVENUE

CHANDLER'S FORD
Edge of Town
Commercial Zone
Total Gross floor area: 26100 sqm
Survey date: MONDAY 17/10/2011 Survey Type: MANUAL

9 HC-02-A-12 HMRC HAMPSHIRE
NORTHERN ROAD
COSHAM
PORTSMOUTH
Suburban Area (PPS6 Out of Centre)
No Sub Category
Total Gross floor area: 10100 sqm
Survey date: MONDAY 23/11/2015 Survey Type: MANUAL

10 HF-02-A-03 OFFICE HERTFORDSHIRE
60 VICTORIA STREET

ST ALBANS
Edge of Town Centre
Built-Up Zone
Total Gross floor area: 610 sqm
Survey date: WEDNESDAY 16/10/2013 Survey Type: MANUAL

11 HF-02-A-04 OFFICES HERTFORDSHIRE
STATION WAY

ST ALBANS
Edge of Town Centre
Residential Zone
Total Gross floor area: 5000 sqm
Survey date: THURSDAY 02/10/2014 Survey Type: MANUAL

12 KC-02-A-06 LAND REGISTRY KENT
FOREST ROAD
CAMDEN PARK
TUNBRIDGE WELLS
Edge of Town
Residential Zone
Total Gross floor area: 5677 sqm
Survey date: TUESDAY 01/12/2009 Survey Type: MANUAL

13 KC-02-A-07 KCC HIGHWAYS REG. KENT
KAVELIN WAY
HENWOOD IND. ESTATE
ASHFORD
Edge of Town
Commercial Zone
Total Gross floor area: 2525 sqm
Survey date: MONDAY 05/12/2011 Survey Type: MANUAL

14 KC-02-A-08 KCC HIGHWAYS REG. OFFICE KENT

ST MICHAEL'S CLOSE
CLAY WOOD
AYLESFORD
Edge of Town
Industrial Zone
Total Gross floor area: 3168 sqm
Survey date: MONDAY 28/11/2011 Survey Type: MANUAL

15 KC-02-A-09 COUNCIL OFFICES KENT
SANDLING ROAD

MAIDSTONE
Edge of Town Centre
Built-Up Zone
Total Gross floor area: 1500 sqm
Survey date: WEDNESDAY 19/10/2011 Survey Type: MANUAL

16 KC-02-A-10 COUNCIL OFFICES KENT
SANDLING ROAD

MAIDSTONE
Edge of Town Centre
Built-Up Zone
Total Gross floor area: 2900 sqm
Survey date: WEDNESDAY 19/10/2011 Survey Type: MANUAL

17 KC-02-A-11 COUNTY HALL KENT
SANDLING ROAD

MAIDSTONE
Edge of Town Centre
Built-Up Zone
Total Gross floor area: 32793 sqm
Survey date: MONDAY 17/10/2011 Survey Type: MANUAL

18 LC-02-A-09 OFFICES LANCASHIRE
FURTHERGATE

BLACKBURN
Suburban Area (PPS6 Out of Centre)
Built-Up Zone
Total Gross floor area: 2600 sqm
Survey date: TUESDAY 04/06/2013 Survey Type: MANUAL

19 NF-02-A-01 COUNCIL OFFICE NORFOLK
CHAPEL STREET

KING'S LYNN
Edge of Town Centre
Built-Up Zone
Total Gross floor area: 5500 sqm
Survey date: THURSDAY 30/09/2010 Survey Type: MANUAL

20 SC-02-A-14 UNILEVER SURREY
SPRINGFIELD DRIVE

LEATHERHEAD
Edge of Town
Commercial Zone
Total Gross floor area: 19974 sqm
Survey date: TUESDAY 10/03/2009 Survey Type: MANUAL

21 SC-02-A-15 ACCOUNTANTS SURREY
BOXGROVE ROAD

GUILDFORD
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Gross floor area: 1896 sqm
Survey date: TUESDAY 05/10/2010 Survey Type: MANUAL

22 SC-02-A-17 PHARMACEUTICALS SURREY
ST GEORGE'S AVENUE
THE HEATH
WEYBRIDGE
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Gross floor area: 10293 sqm
Survey date: TUESDAY 18/10/2011 Survey Type: MANUAL

23 SF-02-A-01 COUNCIL OFFICES SUFFOLK
BEETONS WAY

BURY ST. EDMUNDS
Suburban Area (PPS6 Out of Centre)
Industrial Zone
Total Gross floor area: 8000 sqm
Survey date: MONDAY 27/09/2010 Survey Type: MANUAL

24 SF-02-A-02 OFFICES SUFFOLK
BATH STREET

IPSWICH
Edge of Town Centre
Commercial Zone
Total Gross floor area: 6505 sqm
Survey date: FRIDAY 19/07/2013 Survey Type: MANUAL

25 SO-02-A-02 COUNCIL OFFICES SLOUGH
BATH ROAD

SLOUGH
Edge of Town Centre
Built-Up Zone
Total Gross floor area: 5050 sqm
Survey date: THURSDAY 27/02/2014 Survey Type: MANUAL

26 TW-02-A-04 HOUSING CO. TYNE & WEAR
EARLSWAY
TEAM VALLEY TRAD. EST.
GATESHEAD
Edge of Town
Industrial Zone
Total Gross floor area: 2500 sqm
Survey date: TUESDAY 29/09/2009 Survey Type: MANUAL

27 TW-02-A-05 TELEVISION CO. TYNE & WEAR
DELTA BANK ROAD
METRO RIVERSIDE PARK
GATESHEAD
Suburban Area (PPS6 Out of Centre)
Commercial Zone
Total Gross floor area: 1500 sqm
Survey date: TUESDAY 29/09/2009 Survey Type: MANUAL

28 TW-02-A-06 GOVERNMENT OFFICES TYNE & WEAR

BENTON PARK ROAD
LONGBENTON
NEWCASTLE UPON TYNE
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Gross floor area: 70291 sqm
Survey date: WEDNESDAY 25/11/2009 Survey Type: MANUAL

29 WM-02-A-04 OFFICE WEST MIDLANDS
BOURNVILLE LANE

BIRMINGHAM
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Gross floor area: 1800 sqm
Survey date: TUESDAY 10/11/2015 Survey Type: MANUAL

30 WY-02-A-03 OFFICE WEST YORKSHIRE
VICTORIA ROAD
HEADINGLEY
LEEDS
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Gross floor area: 2696 sqm
Survey date: THURSDAY 17/06/2010 Survey Type: MANUAL

This section provides a list of all survey sites and days in the selected set. For each individual survey site it displays a unique site reference code and site address the selected trip rate calculation parameter and its value the day of the week and date of each survey and whether the survey was a manual classified count or an ATC count.

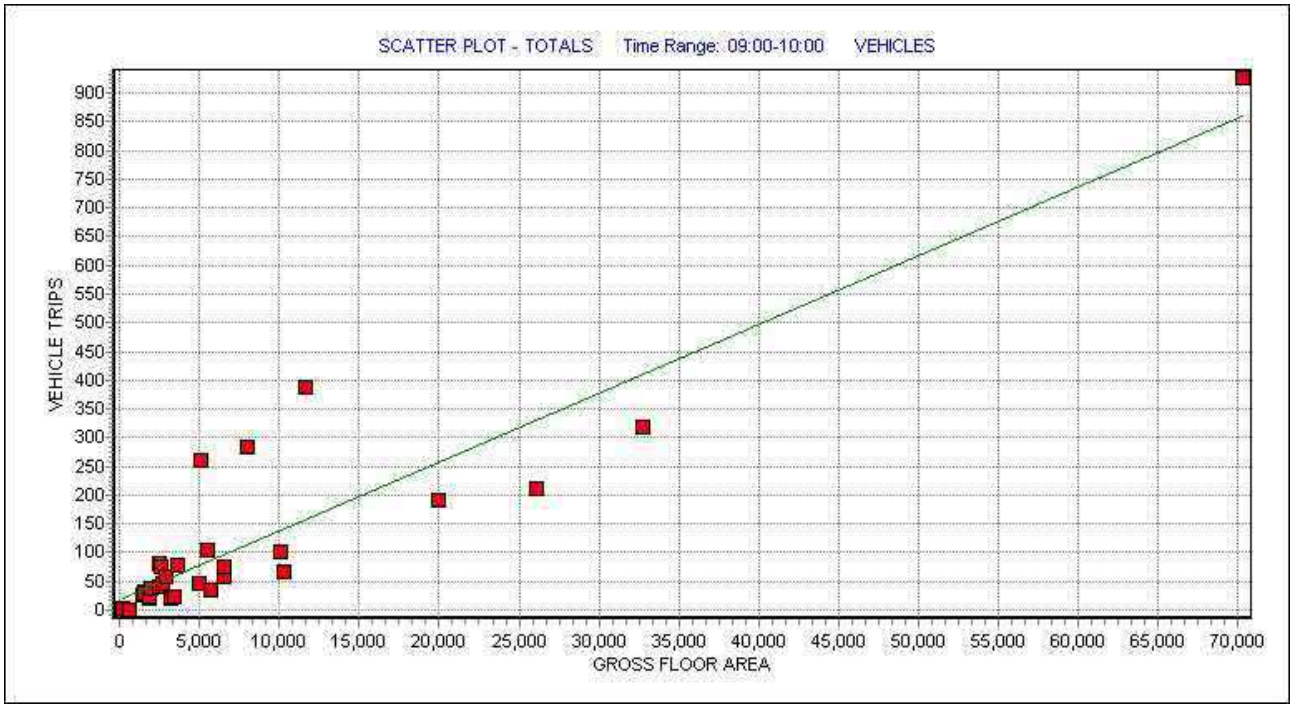
Manually Deselected Sites
Site RefReason for Deselection
SC-02-A-16 Anomalous result on the scatter plot

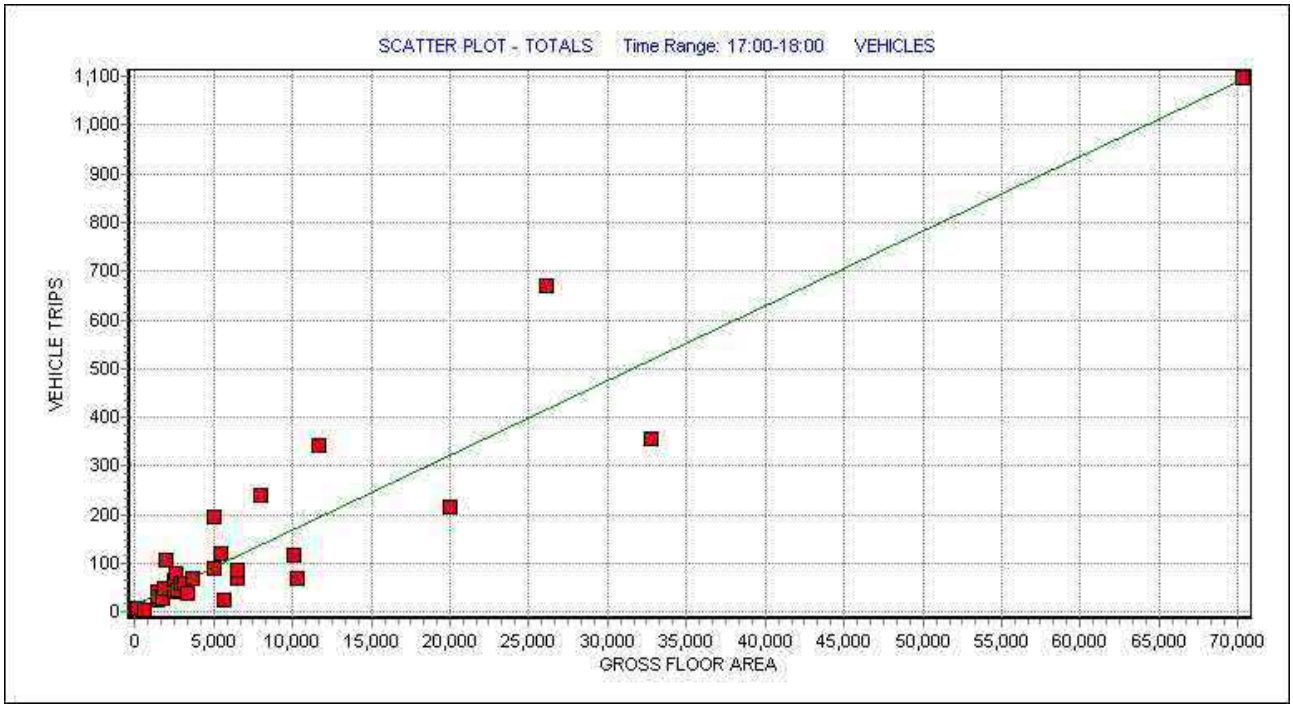
TRIP RATE for Land Use 02 - EMPLOYMENT/A - OFFICE
Calculation Factor: 100 sqm
Count Type: VEHICLES

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate
00:00-00:30									
00:30-01:00									
01:00-01:30									
01:30-02:00									
02:00-02:30									
02:30-03:00									
03:00-03:30									
03:30-04:00									
04:00-04:30									
04:30-05:00									
05:00-05:30	1	19974	0	1	19974	0.005	1	19974	0.005
05:30-06:00	1	19974	0.02	1	19974	0.005	1	19974	0.025
06:00-06:30	2	15037	0.183	2	15037	0.013	2	15037	0.196
06:30-07:00	3	33455	0.679	3	33455	0.183	3	33455	0.862
07:00-07:30	30	8593	0.361	30	8593	0.071	30	8593	0.432
07:30-08:00	30	8593	0.572	30	8593	0.122	30	8593	0.694
08:00-08:30	30	8593	0.792	30	8593	0.147	30	8593	0.939
08:30-09:00	30	8593	0.902	30	8593	0.144	30	8593	1.046
09:00-09:30	30	8593	0.692	30	8593	0.173	30	8593	0.865
09:30-10:00	30	8593	0.415	30	8593	0.14	30	8593	0.555
10:00-10:30	30	8593	0.258	30	8593	0.12	30	8593	0.378
10:30-11:00	30	8593	0.206	30	8593	0.107	30	8593	0.313
11:00-11:30	30	8593	0.193	30	8593	0.138	30	8593	0.331
11:30-12:00	30	8593	0.165	30	8593	0.144	30	8593	0.309
12:00-12:30	30	8593	0.162	30	8593	0.184	30	8593	0.346
12:30-13:00	30	8593	0.176	30	8593	0.191	30	8593	0.367
13:00-13:30	30	8593	0.205	30	8593	0.18	30	8593	0.385
13:30-14:00	30	8593	0.201	30	8593	0.159	30	8593	0.36
14:00-14:30	30	8593	0.183	30	8593	0.161	30	8593	0.344
14:30-15:00	30	8593	0.178	30	8593	0.267	30	8593	0.445
15:00-15:30	30	8593	0.156	30	8593	0.335	30	8593	0.491
15:30-16:00	30	8593	0.161	30	8593	0.405	30	8593	0.566
16:00-16:30	30	8593	0.149	30	8593	0.596	30	8593	0.745
16:30-17:00	30	8593	0.14	30	8593	0.704	30	8593	0.844
17:00-17:30	30	8593	0.124	30	8593	0.93	30	8593	1.054
17:30-18:00	30	8593	0.095	30	8593	0.569	30	8593	0.664
18:00-18:30	30	8593	0.073	30	8593	0.374	30	8593	0.447
18:30-19:00	30	8593	0.044	30	8593	0.216	30	8593	0.26
19:00-19:30	1	70291	0.095	1	70291	0.128	1	70291	0.223
19:30-20:00	1	70291	0.08	1	70291	0.09	1	70291	0.17
20:00-20:30	1	70291	0.088	1	70291	0.115	1	70291	0.203
20:30-21:00	1	70291	0.097	1	70291	0.083	1	70291	0.18
21:00-21:30	1	70291	0.085	1	70291	0.184	1	70291	0.269
21:30-22:00									
22:00-22:30									
22:30-23:00									
23:00-23:30									
23:30-24:00									
Daily Trip Rates:				7.93			7.383		15.313

Parameter summary

Trip rate parameter range selected:	186 - 70291 (units: sqm)
Survey date range:	01/01/09 - 23/09/16
Number of weekdays (Monday-Friday):	30
Number of Saturdays:	0
Number of Sundays:	0
Surveys automatically removed from selection:	4
Surveys manually removed from selection:	1





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

A.3 B2 Industrial Trip Rates

TRICS 7.4.1
Trip Rate Parameter: Gross floor area

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use 02 - EMPLOYMENT
Category C - INDUSTRIAL UNIT
VEHICLES

Selected regions and areas:

1	GREATER LONDON		
	BT	BRENT	1 days
	HD	HILLINGDON	2 days
2	SOUTH EAST		
	RE	READING	1 days
	WS	WEST SUSSEX	1 days
3	SOUTH WEST		
	BR	BRISTOL CITY	2 days
	DV	DEVON1 days	
4	EAST ANGLIA		
	SF	SUFFOLK	1 days
5	EAST MIDLANDS		
	DS	DERBYSHIRE	1 days
6	WEST MIDLANDS		
	HE	HEREFORDSHIRE	1 days
	WM	WEST MIDLANDS	2 days
7	YORKSHIRE & NORTH LINCOLNSHIRE		
	WY	WEST YORKSHIRE	1 days
8	NORTH WEST		
	CH	CHESHIRE	1 days
	LC	LANCASHIRE	1 days
9	NORTH		
	TW	TYNE & WEAR	1 days

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

Secondary Filtering selection:

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

Parameter: Gross floor area
Actual Range: 300 to 20000 (units: sqm)
Range Selected by User: 300 to 43325 (units: sqm)

Public Transport Provision:
Selection by: Include all surveys

Date Range: 01/01/09 to 19/10/15

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

Selected survey days:

Monday	2 days
Tuesday	4 days
Wednesday	4 days
Thursday	5 days
Friday	2 days

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

Selected survey types:

Manual count	17 days
Directional ATC Count	0 days

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

Selected Locations:

Town Centre	0
Edge of Town Centre	1
Suburban Area (PPS6 Out of Centre)	8
Edge of Town	7
Neighbourhood Centre (PPS6 Local Centre)	0
Free Standing (PPS6 Out of Town)	1
Not Known	0

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

Selected Location Sub Categories:

Industrial Zone	14
Commercial Zone	2
Development Zone	0
Residential Zone	0
Retail Zone	0
Built-Up Zone	0
Village	0
Out of Town	1
High Street	0
No Sub Category	0

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

Secondary Filtering selection:

Use Class:

B1	10 days
B2	6 days

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

Population within 1 mile:
1,000 or Less 1 days
1,001 to 5,000 1 days
5,001 to 10,000 1 days
10,001 to 15,000 6 days
15,001 to 20,000 2 days
25,001 to 50,000 5 days
50,001 to 100,000 1 days
This data displays the number of selected surveys within stated 1-mile radii of population.

Population within 5 miles:
50,001 to 75,000 2 days
75,001 to 100,000 2 days
125,001 to 250,000 7 days
250,001 to 500,000 4 days
500,001 or More 2 days
This data displays the number of selected surveys within stated 5-mile radii of population.

Car ownership within 5 miles:
0.5 or Less 1 days
0.6 to 1.0 6 days
1.1 to 1.5 9 days
1.6 to 2.0 1 days
This data displays the number of selected surveys within stated ranges of average cars owned per residential dwelling within a radius of 5-miles of selected survey sites.

Travel Plan:
Yes 1 days
No 16 days
This data displays the number of surveys within the selected set that were undertaken at sites with Travel Plans in place and the number of surveys that were undertaken at sites without Travel Plans.

PTAL Rating:
No PTAL Present 16 days
1b Very poor 1 days
This data displays the number of selected surveys with PTAL Ratings.

LIST OF SITES relevant to selection parameters

1 BR-02-C-01 MECH. ENGINEERS BRISTOL CITY
NOVERS HILL
BEDMINSTER
BRISTOL
Suburban Area (PPS6 Out of Centre)
Industrial Zone
Total Gross floor area: 1100 sqm
Survey date: MONDAY 19/10/2009 Survey Type: MANUAL

2 BR-02-C-02 STAINLESS FITTINGS BRISTOL CITY
SOUTH LIBERTY LANE

BRISTOL
Edge of Town
Industrial Zone
Total Gross floor area: 1475 sqm
Survey date: TUESDAY 22/09/2015 Survey Type: MANUAL

3 BT-02-C-02 FOOD PRODUCTION BRENT
ABBEYDALE ROAD

ALPERTON
Suburban Area (PPS6 Out of Centre)
Industrial Zone
Total Gross floor area: 6100 sqm
Survey date: WEDNESDAY 10/09/2014 Survey Type: MANUAL

4 CH-02-C-02 INDUSTRIAL MATERIALS CHESHIRE

JUPITER DRIVE
CHESTER W. EMP. PARK
CHESTER
Edge of Town
Industrial Zone
Total Gross floor area: 8100 sqm
Survey date: WEDNESDAY 19/11/2014 Survey Type: MANUAL

5 DS-02-C-02 ENGINEERED PRODUCTS DERBYSHIRE

PONTEFRACT STREET

DERBY
Suburban Area (PPS6 Out of Centre)
Industrial Zone
Total Gross floor area: 2600 sqm
Survey date: THURSDAY 25/06/2015 Survey Type: MANUAL

6 DV-02-C-01 TUBE MANUFACTURE DEVON
PLYMBRIDGE ROAD
ESTOVER
PLYMOUTH
Edge of Town
Industrial Zone
Total Gross floor area: 20000 sqm
Survey date: TUESDAY 17/07/2012 Survey Type: MANUAL

7 HD-02-C-01 TARMAC PRODUCTION HILLINGDON

PUMP LANE

HAYES
Suburban Area (PPS6 Out of Centre)
Industrial Zone
Total Gross floor area: 3912 sqm

Survey date: FRIDAY 11/05/2012 Survey Type: MANUAL

8 HD-02-C-02 WINDOW PRODUCTION HILLINGDON

BETAM ROAD

HAYES
Suburban Area (PPS6 Out of Centre)
Industrial Zone
Total Gross floor area: 1080 sqm
Survey date: WEDNESDAY 05/12/2012 Survey Type: MANUAL

9 HE-02-C-02 THERMAL PROCESSING HEREFORDSHIRE

COLLEGE ROAD
BURCOTT
HEREFORD
Edge of Town
Commercial Zone
Total Gross floor area: 1880 sqm
Survey date: TUESDAY 22/10/2013 Survey Type: MANUAL

10 LC-02-C-02 RECYCLING CO. LANCASHIRE
ESSEX STREET
RED SCAR IND ESTATE
PRESTON
Edge of Town Centre
Industrial Zone
Total Gross floor area: 8000 sqm
Survey date: THURSDAY 10/05/2012 Survey Type: MANUAL

11 RE-02-C-01 SHEET METAL FABRICATION READING

COMMERCIAL ROAD

READING
Edge of Town
Industrial Zone
Total Gross floor area: 645 sqm
Survey date: THURSDAY 22/11/2012 Survey Type: MANUAL

12 SF-02-C-01 JOINERY SUFFOLK
ANSON ROAD
MARTLESHAM HEATH
IPSWICH
Edge of Town
Industrial Zone
Total Gross floor area: 1100 sqm
Survey date: FRIDAY 12/07/2013 Survey Type: MANUAL

13 TW-02-C-01 INDUSTRIAL UNIT TYNE & WEAR
SHAFTESBURY AVENUE
TYNE POINT IND. ESTATE
JARROW
Suburban Area (PPS6 Out of Centre)
Industrial Zone

Total Gross floor area: 950 sqm
Survey date: THURSDAY 15/11/2012 Survey Type: MANUAL

14 WM-02-C-02 ARDONPRINT WEST MIDLANDS
SYDNEY ROAD
SMALL HEATH
BIRMINGHAM
Suburban Area (PPS6 Out of Centre)
Commercial Zone
Total Gross floor area: 300 sqm
Survey date: WEDNESDAY 17/06/2009 Survey Type: MANUAL

15 WM-02-C-03 INDUSTRIAL GLASS WEST MIDLANDS

DOWNING STREET

SMETHWICK
Edge of Town
Industrial Zone
Total Gross floor area: 5070 sqm
Survey date: TUESDAY 06/11/2012 Survey Type: MANUAL

16 WS-02-C-02 AVIATION COMPANY WEST SUSSEX

MAYDWELL AVENUE
SLINFOLD
NEAR HORSHAM
Free Standing (PPS6 Out of Town)
Out of Town
Total Gross floor area: 11375 sqm
Survey date: THURSDAY 23/01/2014 Survey Type: MANUAL

17 WY-02-C-02 FLUID SYSTEMS WEST YORKSHIRE

BROWN LANE WEST
HOLBECK
LEEDS
Suburban Area (PPS6 Out of Centre)
Industrial Zone
Total Gross floor area: 13350 sqm
Survey date: MONDAY 19/10/2015 Survey Type: MANUAL

This section provides a list of all survey sites and days in the selected set. For each individual survey site it displays a unique site reference code and site address the selected trip rate calculation parameter and its value the day of the week and date of each survey and whether the survey was a manual classified count or an ATC count.

TRIP RATE for Land Use 02 - EMPLOYMENT/C - INDUSTRIAL UNIT
Calculation Factor: 100 sqm
Count Type: VEHICLES

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate
00:00-00:30									
00:30-01:00									
01:00-01:30									
01:30-02:00									
02:00-02:30									
02:30-03:00									
03:00-03:30									
03:30-04:00									
04:00-04:30									
04:30-05:00									
05:00-05:30									
05:30-06:00									
06:00-06:30	3	10275	0.117	3	10275	0	3	10275	0.117
06:30-07:00	3	10275	0.224	3	10275	0.049	3	10275	0.273
07:00-07:30	17	5120	0.094	17	5120	0.036	17	5120	0.13
07:30-08:00	17	5120	0.203	17	5120	0.031	17	5120	0.234
08:00-08:30	17	5120	0.261	17	5120	0.037	17	5120	0.298
08:30-09:00	17	5120	0.153	17	5120	0.041	17	5120	0.194
09:00-09:30	17	5120	0.093	17	5120	0.053	17	5120	0.146
09:30-10:00	17	5120	0.084	17	5120	0.06	17	5120	0.144
10:00-10:30	17	5120	0.072	17	5120	0.063	17	5120	0.135
10:30-11:00	17	5120	0.063	17	5120	0.055	17	5120	0.118
11:00-11:30	17	5120	0.059	17	5120	0.061	17	5120	0.12
11:30-12:00	17	5120	0.043	17	5120	0.051	17	5120	0.094
12:00-12:30	17	5120	0.057	17	5120	0.078	17	5120	0.135
12:30-13:00	17	5120	0.059	17	5120	0.079	17	5120	0.138
13:00-13:30	17	5120	0.074	17	5120	0.076	17	5120	0.15
13:30-14:00	17	5120	0.111	17	5120	0.051	17	5120	0.162
14:00-14:30	17	5120	0.057	17	5120	0.106	17	5120	0.163
14:30-15:00	17	5120	0.07	17	5120	0.074	17	5120	0.144
15:00-15:30	17	5120	0.049	17	5120	0.121	17	5120	0.17
15:30-16:00	17	5120	0.055	17	5120	0.078	17	5120	0.133
16:00-16:30	17	5120	0.046	17	5120	0.146	17	5120	0.192
16:30-17:00	17	5120	0.051	17	5120	0.175	17	5120	0.226
17:00-17:30	17	5120	0.032	17	5120	0.154	17	5120	0.186
17:30-18:00	17	5120	0.031	17	5120	0.219	17	5120	0.25
18:00-18:30	16	5059	0.022	16	5059	0.12	16	5059	0.142
18:30-19:00	16	5059	0.012	16	5059	0.043	16	5059	0.055
19:00-19:30	1	11375	0.035	1	11375	0.044	1	11375	0.079
19:30-20:00	1	11375	0.009	1	11375	0.088	1	11375	0.097
20:00-20:30									
20:30-21:00									
21:00-21:30									
21:30-22:00									
22:00-22:30									
22:30-23:00									
23:00-23:30									
23:30-24:00									
Daily Trip Rates:				2.236			2.189		4.425

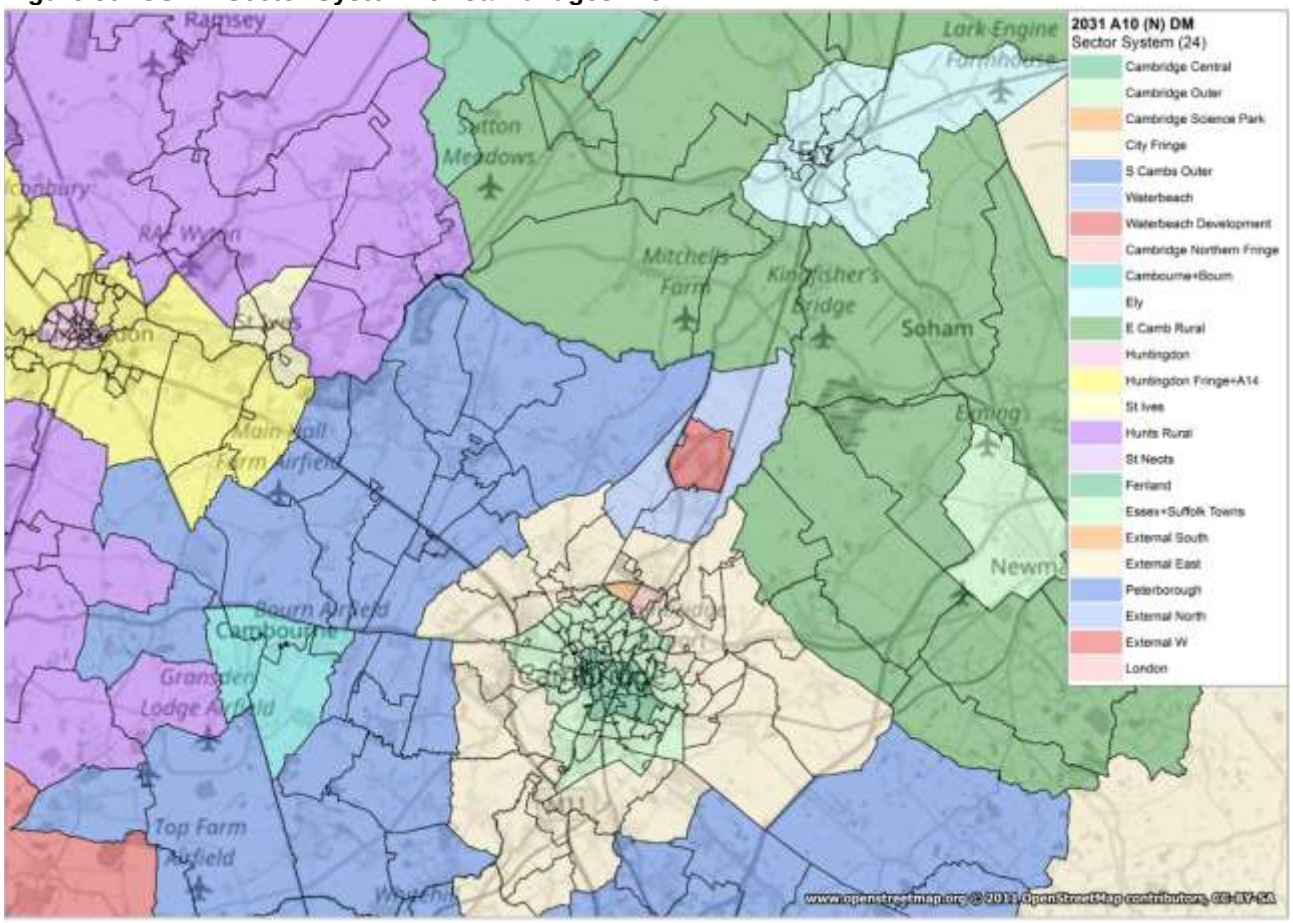
Parameter summary

Trip rate parameter range selected:	300 - 20000 (units: sqm)
Survey date range:	01/01/09 - 19/10/15
Number of weekdays (Monday-Friday):	17
Number of Saturdays:	0
Number of Sundays:	0
Surveys automatically removed from selection:	2
Surveys manually removed from selection:	0

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

C. CSRM Sector System

Figure 39: CSRM Sector System for Cambridgeshire



Source: Atkins