MOTT MACDONALD

Ely to Cambridge Transport Study

Strand 1 - Options Modelling Report

5 January 2018

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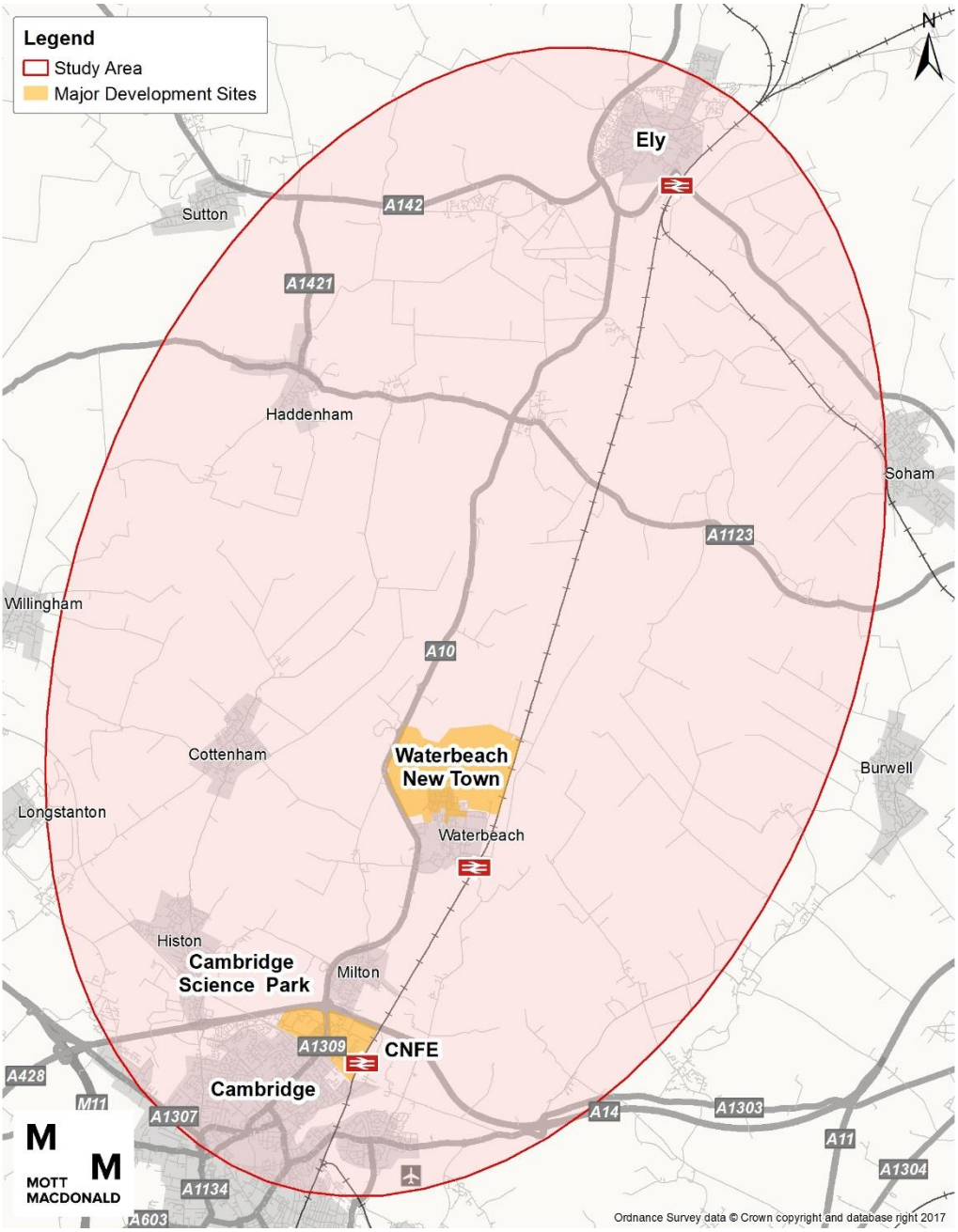
Contents

1 Introduction

1.1 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 corridor study area, which 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, is as follows:

Figure 1: Indicative A10 (N) Study Area



The study area includes key rail and highway corridor links (both primary and secondary) between Cambridge, Ely, and beyond. It is also the focus of significant future development, with the new town north of Waterbeach and the Cambridge Northern Fringe East (CNFE) and Cambridge Science Park (CSP) sites being the main future focus for significant residential and employment development in the study area. These key elements are shown in the indicative study area plan above.

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, supported by modelling, that identifies the infrastructure package and phasing of that package to provide for the transport demand of the development of a new town north of Waterbeach.
- Strand 3 – A Transport Study, supported by modelling, which provides evidence for the level of development which could be supported in the CNFE and CSP areas and their phasing, in transport terms.

In order to progress these three strands, 'Do Minimum' modelling has been undertaken using the Cambridgeshire Sub-Region Model (CSRM2) in order to identify transport conditions in 2031 with and without the above development sites, but without development-related transport mitigation measures. The results of this process are reported in our Do Minimum Modelling Report, which covers the following 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 Waterbeach Scenario, which represents the future situation in 2031 where the full development of the new town north of Waterbeach takes place but with no additional development at either CNFE or CSP
- The CNFE/CSP Scenario, which represents the future situation in 2031 where new development at the CNFE and CSP sites takes place but with no development of the new town north of Waterbeach
- The Combined Scenario, which represents the future situation in 2031 where both the new town north of Waterbeach and CNFE/CSP developments take place

These scenarios identify where transport performance issues are likely to arise on the network as a direct result of the proposed developments.

This report represents the Strand 1 'Options Study', and describes the process by which 'Do Something' packages have been developed for the study area and the transport modelling results for each of them. This report therefore supports and informs the Option Appraisal section of the Strand 1 Strategic Outline Business Case report.

1.2 Option Development Process Overview

The main steps undertaken to identify potential Do Something packages for the study area and to compare them on transport grounds are as follows:

1. Analysis of Do Minimum modelling results to better understand future demand on the A10 highway corridor with and without development, with a view to identifying the type of transport measures most likely to be required to mitigate development impact on the corridor and facilitate sustainable travel patterns
2. Identification of potential Do Something package options for the study area, based on the Do Minimum corridor analysis
3. Testing of potential Do Something package options in CSRM2 full demand model

4. Comparison of packages based on key model outputs

It is noted that, as agreed with the client team, all Do Something testing has been undertaken based on the Do Minimum 'Combined Scenario' in order to develop measures on a worst-case development scenario basis.

As noted above, the outputs from this report support and inform the Options Appraisal section of the Strand 1 Strategic Outline Business Case report.

1.3 Report Structure

The report is structured as follows:

- An analysis of the future Do Minimum highway demand on the study area is outlined in Section 2
- The development and sifting of potential Do Something packages are described in Second 3
- The Mode Shift package modelling results are presented and discussed in Section 4
- The Junction+ package modelling results are presented and discussed in Section 5
- The North Dual package modelling results are presented and discussed in Section 6
- The South Dual package modelling results are presented and discussed in Section 7
- The Full Dual package modelling results are presented and discussed in Section 8
- Sensitivity test results are presented and discussed in Section 9
- A report summary and conclusion is provided in Section 10

2 Do Minimum A10 Corridor Demand Analysis

The purpose of this section is to review specific outcomes from the Combined Scenario Do Minimum highway modelling in order to identify the Do Something measures which are likely to be required to mitigate both the development and background traffic impacts in the study area and to facilitate sustainable travel patterns.

2.1 Analysis Method

In addition to the analysis presented in the Do Minimum report, we have undertaken further analysis of the origins and destinations of highway traffic using the A10, as well as the B1049 between Wilburton and the A14 at Histon Interchange, and the B1047 through Horningsea and Clayhithe to the A14. In order to do this, we used the CSRM2 Highway Model zones as shown in Figure 2 to create the following sectors:

- Cambridge (Central + Outer)
- CNFE+CSP
- Waterbeach
- New town north of Waterbeach
- Ely
- Other Local (ie other destinations directly accessed from the A10, eg Stretham)
- External (ie all other UK)

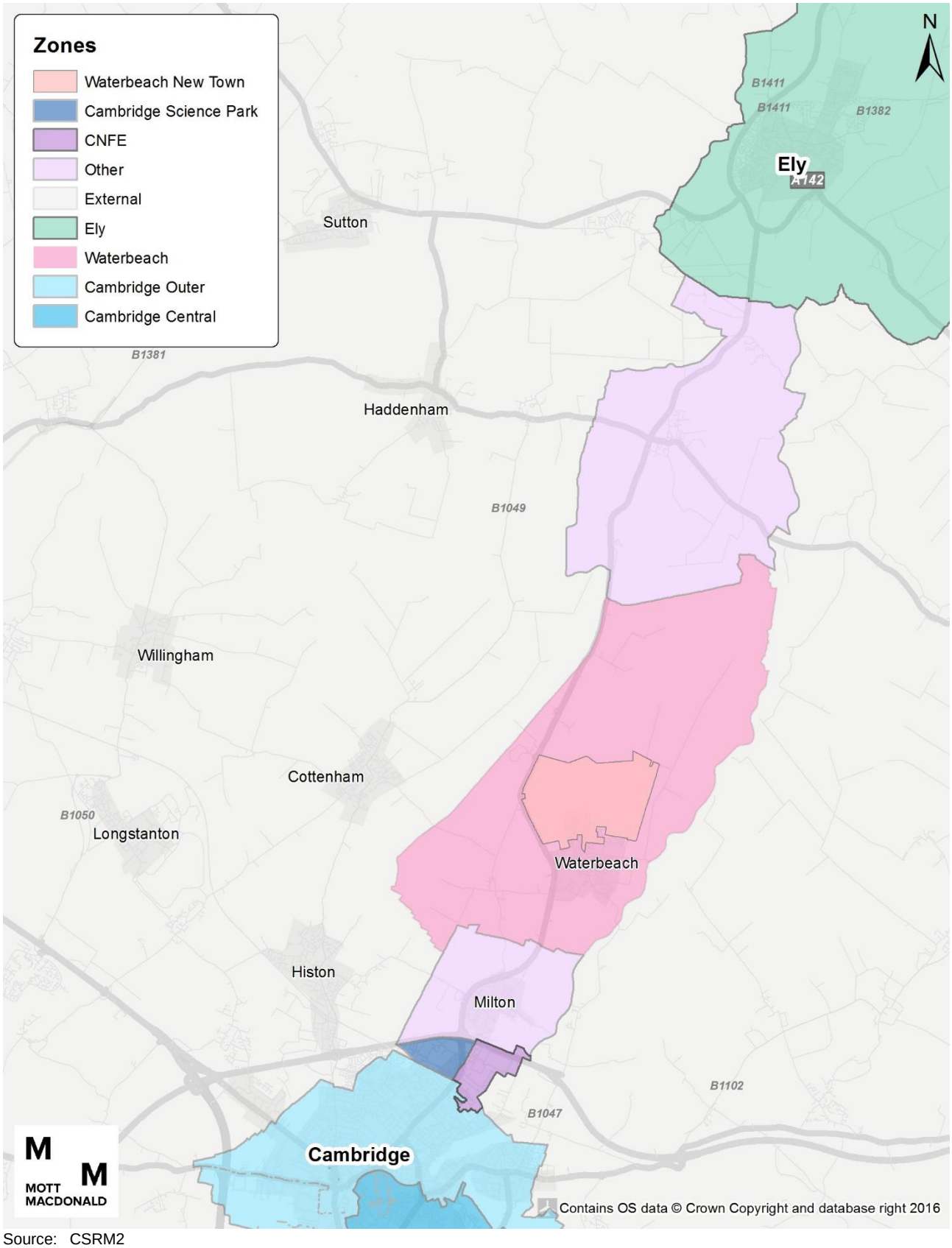
Trips between these locations have then been categorised as follows and as shown in the following origin/destination matrix:

- *Local-Local trips* ('LL', shown grey) – trips between locations in the study area
- *Local-External trips* ('LE', shown white) – trips between study area locations and locations outside the study area
- *External-External trips* ('EE', shown black) – trips between locations outside the study area

Table 1: A10 corridor trip type categories

		DESTINATION						
		Cambridge (Central + Outer)	CNFE + CSP	Waterbeach	New town north of Waterbeach	Ely	Other Local	External
ORIGIN	Cambridge (Central + Outer)	LL	LL	LL	LL	LL	LL	LE
	CNFE + CSP	LL	LL	LL	LL	LL	LL	LE
	Waterbeach	LL	LL	LL	LL	LL	LL	LE
	New town north of Waterbeach	LL	LL	LL	LL	LL	LL	LE
	Ely	LL	LL	LL	LL	LL	LL	LE
	Other Local	LL	LL	LL	LL	LL	LL	LE
	External	LE	LE	LE	LE	LE	LE	EE

Figure 2: CSRM2 sectorisation for A10N corridor Do Minimum analysis



Source: CSRM2

We then undertook select link analysis in the highway model at the key points shown in Figure 3, which are listed as follows:

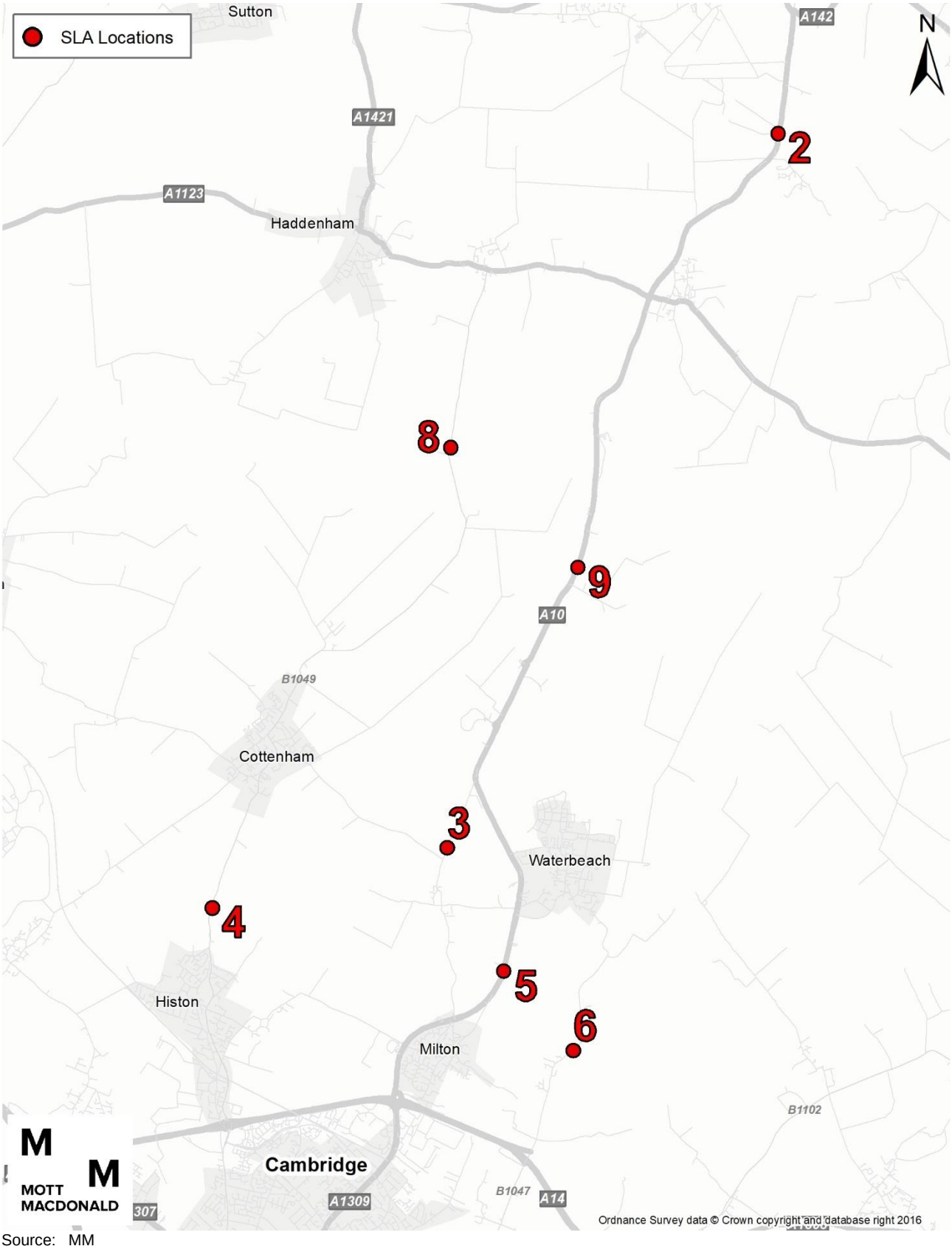
- A10 corridor points:
  - A10 South (point 5)
  - A10 Mid (point 9)
  - A10 North (point 2)
- Parallel route points:
  - B1047 (point 6)
  - B1049 South (point 4)
  - B1049 North (point 8)
  - Landbeach Road (point 3)

Together, these points represent the main sections of the study area highway-network under consideration in this report. The Select Link Analysis showed, for each of these points, which of the above sector pairings are generating trips in the model on each link. This allows us to understand the trip types which are predicted to generate traffic demand in the corridor.

The main purpose of the analysis is to identify:

1. The impact of new development highway traffic in the A10 study area
2. The extent to which mode shift alone could potentially resolve this impact

Figure 3: Select link analysis point locations



Source: MM

2.2 Development Traffic Flow Impact

The following three sector matrix tables show, for the three A10 sites combined and for AM and PM peak hours combined, the trips predicted to use the highway in both the Future-Base and Combined-Scenario Do-Minimum cases. The sites and peak hours have been averaged together to simplify the interpretation of results, so that the results represent an average section of the A10N corridor during an average peak period.

Table 2: A10 corridor average peak hour highway flows – Future-Base Do-Minimum

		DESTINATION							
		Cambridge (Central + Outer)	CNFE + CSP	Waterbeach	New town north of Waterbeach	Ely	Other Local	External	**Total**
ORIGIN	Cambridge (Central + Outer)	0	0	5	0	39	7	60	**111**
	CNFE + CSP	0	0	5	0	9	2	14	**29**
	Waterbeach	7	3	0	0	23	7	53	**93**
	New town north of Waterbeach	0	0	0	0	0	0	0	**0**
	Ely	25	8	6	0	0	10	71	**120**
	Other Local	6	2	6	0	9	2	35	**60**
	External	67	16	48	0	83	34	206	**454**
Total		**106**	**29**	**70**	**0**	**163**	**62**	**439**	**869**

Source: CSRM2

Table 3: A10 corridor average peak hour highway flows – Combined-Scenario Do-Minimum

		DESTINATION							
		Cambridge (Central + Outer)	CNFE + CSP	Waterbeach	New town north of Waterbeach	Ely	Other Local	External	**Total**
ORIGIN	Cambridge (Central + Outer)	0	0	1	33	28	5	34	**101**
	CNFE + CSP	0	0	2	9	12	2	9	**35**
	Waterbeach	2	1	0	4	20	3	12	**40**
	New town north of Waterbeach	23	8	0	0	43	12	117	**203**
	Ely	18	10	5	41	0	9	42	**125**
	Other Local	4	2	4	10	9	1	20	**49**
	External	38	12	25	111	64	24	131	**406**
Total		**85**	**32**	**37**	**208**	**176**	**55**	**365**	**959**

Source: CSRM2

To aid interpretation, the following table shows the difference between the above Combined-Scenario result and the Future-Base result, to isolate the changes resulting from new development on the corridor. New development flows are highlighted in the blue cells.

Table 4: A10 corridor average peak hour highway flows – Combined-Scenario DM vs Future-Base DM

		DESTINATION							
		Cambridge (Central + Outer)	CNFE + CSP	Waterbeach	New town north of Waterbeach	Ely	Other Local	External	**Total**
ORIGIN	Cambridge (Central + Outer)	0	0	-4	33	-11	-2	-26	**-10**
	CNFE + CSP	-0	0	-3	9	3	0	-5	**5**
	Waterbeach	-6	-3	0	4	-3	-4	-41	**-53**
	New town north of Waterbeach	23	8	-0	0	43	12	117	**203**
	Ely	-7	2	-1	41	0	-1	-28	**4**
	Other Local	-2	-0	-3	10	-0	-1	-16	**-11**
	External	-29	-4	-22	111	-19	-11	-74	**-48**
Total		**-21**	**3**	**-33**	**208**	**14**	**-7**	**-74**	**89**

Source: CSRM2

This latter table shows that:

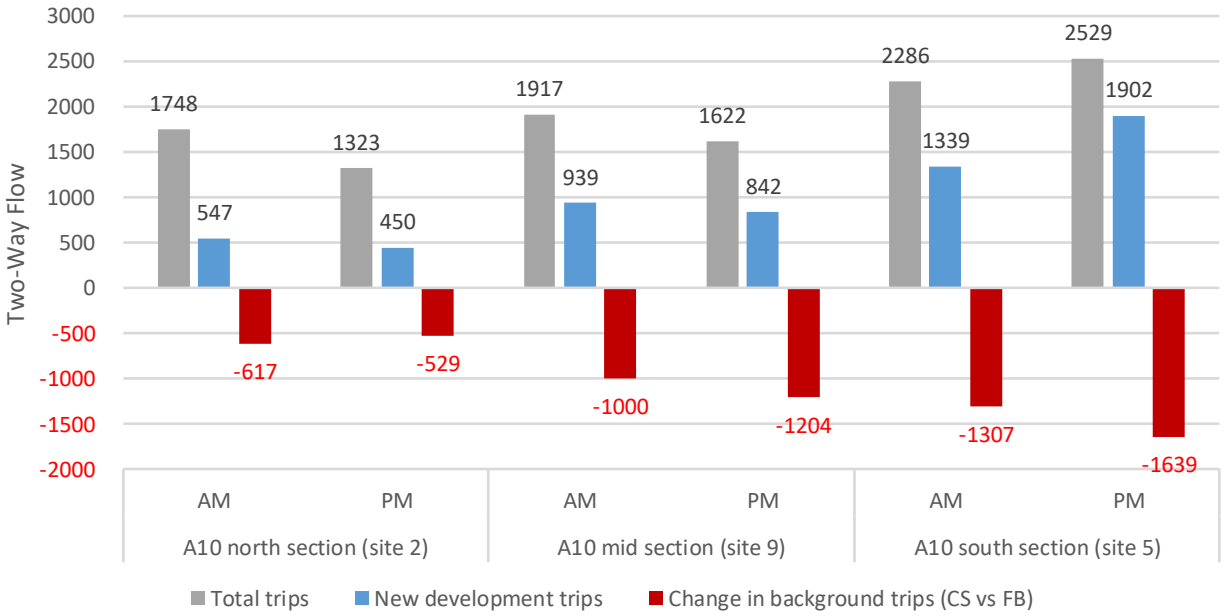
- Overall, average peak hour A10 flows increase by 89 trips in the Combined-Scenario to a level of 959 trips, which corresponds to an increase of 10% from the Future-Base level.
- However, the highlighted cells show that, of the Combined-Scenario total trips, 401 are new development flows which are not present in the Future-Base. These new trips constitute 42% of the Combined-Scenario total trips.
- For these new trips to be accommodated while only generating an overall increase of 89 trips, the other cells show that background traffic has had to reduce by 312 trips, which is a 39% reduction compared to the same cells in the Future-Base table.

It can be assumed that, if there were spare capacity to accommodate all the new development trips on the A10, there would not need to be background traffic displacement. The level of displacement is therefore an indication of the level of development impact on the route.

The distribution of this impact on the three main sections of the A10 route (see Figure 3 above) is summarised for the AM and PM peak hours in the following chart. For the Combined-Scenario Do-Minimum results, this shows two-way flows for:

- All trips
- New development trips
- Displaced trips (ie background traffic change from Future-Base to Combined-Scenario)

Figure 4: Predicted two-way flows by trip type on A10 highway sections in Combined-Scenario

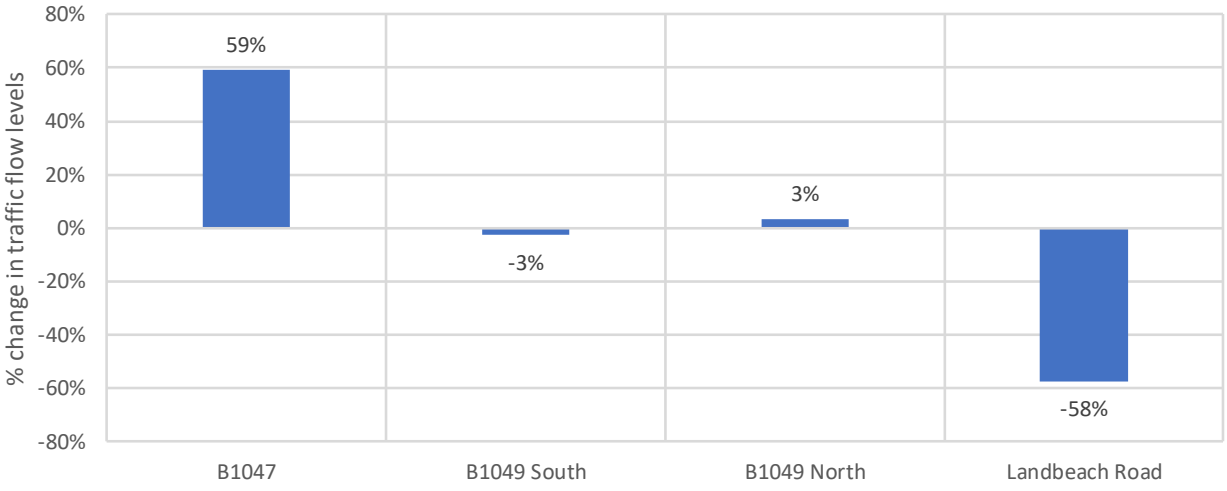


Source: CSRM2

This chart shows that the highest level of development impact is predicted on the southern section of the A10. This section shows the greatest total flows, the highest level of new development flow, and hence the greatest level of background traffic displacement to accommodate these in the absence of development-related mitigation measures. This reflects the high level of trips between the new town north of and Cambridge, which increases the strain on this section of the A10. However, both the northern and middle sections also show signs of development impact pressure and associated capacity constraints.

Lastly, the following chart shows, for the parallel route points shown above in Figure 3 and for an average weekday peak hour, the predicted two-way traffic flow change in the Combined-Scenario Do-Minimum compared to the Future-Base Do-Minimum.

Figure 5: Predicted avg peak-hour 2-way traffic changes, Combined-Scenario DM vs Future-Base DM



Source: CSRM2

This chart suggests that the introduction of development without specific mitigation measures results in little negative traffic impact on the B1049 and Landbeach Road parallel routes, but does show a significant increase in use of the parallel and directly accessible B1047 through Waterbeach and Horningsea. This corresponds with the south section of the A10 corridor showing the greatest traffic displacement impact.

As detailed in the next section, the policy-compliant approach adopted by this study for the consideration of mitigation measures to address this predicted development impact is as follows:

1. Consider demand-side mitigation first, to minimise need to travel and to maximise trips by non-car modes
2. Consider supply-side mitigation second, to alleviate residual highway impacts of highway demand

The next section therefore considers the potential for delivering mode-shift for both background traffic and new development trips, in order to scope out the degree to which the predicted impact of development trips in the study area can be mitigated by other modes. Any residual impacts would then need to be addressed by supply-side mitigation measures.

2.3 Mode-Shift Potential

2.3.1 Background Traffic Trips

The following table represents the Future-Base Do-Minimum trip matrix shown above in Table 2 as a proportional distribution of trips. This shows how the total flows in the study area in an average weekday peak hour is comprised of different journey types. As per the template shown in Table 1 above, the cells are coloured to highlight the main trip-type categories, which are:

- *Local-Local trips* ('LL', shown grey) – trips between A10 corridor locations
- *Local-External trips* ('LE', shown white) – trips between corridor locations and locations outside the corridor
- *External-External trips* ('EE', shown black) – trips between locations outside the corridor

Table 5: A10 corridor average peak-hour highway-flow distribution – Future-Base Do-Minimum

		DESTINATION						
		Cambridge (Central + Outer)	CNFE + CSP	Waterbeach	New town north of Waterbeach	Ely	Other Local	External
ORIGIN	Cambridge (Central + Outer)	0%	0%	1%	0%	4%	1%	7%
	CNFE + CSP	0%	0%	1%	0%	1%	0%	2%
	Waterbeach	1%	0%	0%	0%	3%	1%	6%
	New town north of Waterbeach	0%	0%	0%	0%	0%	0%	0%
	Ely	3%	1%	1%	0%	0%	1%	8%
	Other Local	1%	0%	1%	0%	1%	0%	4%
	External	8%	2%	5%	0%	10%	4%	24%

Source: MM/CSRM2

The mode-shift potential for each of these trips depends on the availability of non-car modes for making the same journey. Broadly speaking, this varies according to the trip categories as summarised in the following table.

Table 6: Future-Base A10 trip-category distribution and non-car mode-availability characteristics

Trip Category	Potential Non-Car Modes	Probability of Availability	Proportion of A10 Trips
Local-Local	Rail, bus, P&R, cycle, walk	High probability	21%
Local-External	Rail, P&R, long-distance bus/coach	Lower probability	55%
External-External	Rail, long-distance bus/coach	Lowest probability	24%

Source: MM/CSRM2

This table shows that, of the trip types predicted to use the A10 in the Future-Base scenario, there is a high probability of there being a viable alternative for 21% of the trips in the study area, while there is less likelihood of a viable mode choice for the remaining 79%. Within the high probability category, the following location pairs generate the highest proportion of trips:

- Cambridge – Ely: 7% of all trips (35% of Local-Local trips)
- Waterbeach – Ely: 5% of all trips (16% of Local-Local trips)

The above A10 development impact analysis suggests that the new development flows on the A10, without mitigation, could result in an overall background traffic flow displacement of about 39%.

Measures to encourage the mode shift of background traffic on the A10, and especially the 21% which have the greatest potential for shift, must therefore form an essential part of any strategy to mitigate development impact on this corridor. However, given the scale of shift required (39%), mode shift will be required from both background traffic and new development trips in the study area. This is considered in the next section.

2.3.2 New Development Trips

The following table isolates the new development trips highlighted in the Combined-Scenario difference matrix above in Table 4 above and converts them to a proportional distribution for those trips alone.

Table 7: A10 corridor average peak-hour new-development highway-trip distribution

		DESTINATION						
		Cambridge (Central + Outer)	CNFE + CSP	Waterbeach	New town north of Waterbeach	Ely	Other Local	External
ORIGIN	Cambridge (Central + Outer)		0%		8%			
	CNFE + CSP	0%	0%	-1%	2%	1%	0%	-1%
	Waterbeach		-1%		1%			
	New town north of Waterbeach	6%	2%	0%	0%	11%	3%	29%
	Ely		0%		10%			
	Other Local		0%		2%			
	External		-1%		28%			

Source: MM/CSRM2

As per the above analysis for background traffic, the above table is represented in the following table in terms of the distribution of these trips by trip-category, and the mode-shift potential in each case.

Table 8: New-development A10 trip-category distribution and non-car mode-availability characteristic

Trip Category	Potential Non-Car Modes	Probability of Availability	Proportion of A10 Trips
Local-Local	Rail, bus, P&R, cycle, walk	High probability	45%
Local-External	Rail, P&R, long-distance bus/coach	Lower probability	55%
External-External	Rail, long-distance bus/coach	Lowest probability	0%

Source: MM/CSRM2

This table shows that the new development trips predicted to use the A10 show greater potential for mode shift than does the A10 background traffic, with 45% of new development trips having a high probability of there being a viable alternative transport mode for completing the same journey, compared to the equivalent 21% of background traffic trips. Within this category, the following location pairs generate the highest proportion of trips:

- The New town north of Waterbeach – Ely: 21% of all new development trips
- The New town north of Waterbeach – Cambridge: 14% of all new development trips

However, nearly twice the proportion of new development trips as background traffic trips would need to shift modes to compensate for the 312 trips which the above analysis predicts the trips from the new developments will displace. This figure represents 78% of the new development trips compared to 39% of background traffic trips.

Delivering mode shift among both background traffic and new development trips are therefore both essential to the strategy for mitigating development impact on this corridor.

However, it is also indicated by this analysis that such measures alone will not be sufficient to fully address the potential traffic impact of the new developments on this corridor and that further supply-side measures will be required.

2.4 Summary

Analysis of the Combined-Scenario Do-Minimum modelling results compared to the Future-Base Do-Minimum modelling results reveals the following:

- The proposed new developments – and especially the new town north of Waterbeach – will have a significant impact on the study area which will require mitigation.
- This impact is most acute on the southern section of the A10, where total flows, new development flows and displaced background traffic flows are predicted to be greatest, but significant impacts are also evident on the full corridor route. On average across the corridor, the new development flows result in a 39% displacement of background traffic in an average peak-hour.
- Of the background traffic trips, an average of 21% show the greatest potential for mode-shift, with trips between Cambridge and Ely and between Waterbeach and Ely generating the highest proportions in this category.
- Of the new development trips, an average of 45% show the greatest potential for mode-shift, with trips between the new town north of Waterbeach and Ely and Cambridge generating the highest proportions in this category.

Overall, therefore, the measures considered by the proposed mitigation packages must:

3. Deliver mode shift for A10 background traffic, and particularly for trips between Cambridge and Ely and between Waterbeach and Ely.
4. Deliver mode shift for A10 new development trips, and particularly for trips between the new town north of Waterbeach and Ely and Cambridge.

5. Deliver supply-side measures to improve performance of the A10 corridor, and particularly for the mid and southern sections of corridor between the new town north of Waterbeach and Cambridge.
6. Deliver parallel route measures to deter any residual traffic flow increases as a result of new development pressures.

The development of packages is covered in the next section.

3 Do Something Package Development

The purpose of this section is to provide an overview of the process adopted to develop and test potential Do Something packages for the A10 study corridor.

3.1 Package Development Approach

The scope of Strand 1 of this study is described in the study brief as being *"to consider in detail the overall transport capacity requirements of the Ely to Cambridge corridor in the context of growth".*

The priority of this strand of the study is therefore to consider how to manage the performance of the Ely to Cambridge study area in the face of significant future development pressures. In accordance with prevailing transport policy, the need for mitigation on this corridor has been approached as follows:

7. Consider demand-side mitigation first, to minimise need to travel and to maximise trips by non-car modes
8. Consider supply-side mitigation second, to alleviate residual highway impacts of car demand

All Do Something packages developed by this study therefore include the same level of demand-side mitigation measures, and so differ only in the level and type of supply-side measures considered in addition.

The rationale for the identification of the different package elements is considered in the next two sections.

3.2 Demand-Side Measure Identification

3.2.1 New Town North of Waterbeach Measures

The development will incorporate the following site-based measures to minimise the site's generation of external highway trips:

- Car parking within the development will be provided to meet relevant policy at the time of the relevant reserved matters application, but will aim to provide a balance between providing for car users and encouraging non-car modes so as not to encourage excessive use of the private car to access the site.
- Direct links will be provided for buses, cycles and pedestrians between the development and the existing settlement of Waterbeach to encourage interaction by these modes, but no direct links will be provided for private vehicles in order to minimise development-related vehicular traffic impacts through the village and on the Horningsea Road route to the A14 and Cambridge.
- Pedestrian, cycle and public transport links will also be provided to key destinations such as CNFE/CSP and central Cambridge.

Of these measures, the latter two measures are reflected in the CSRM2 Do Something modelling assessment, as the model does not reflect parking restraint measures.

3.2.2 CNFE Development Mix

The exact scale and mix of development at the CNFE site is yet to be determined. In the 2014 'Cambridge Northern Fringe East Area Action Plan Issues and Options Report', four main development options are explored. All of these options are predominantly employment-led, with differing levels of development proposed. For modelling purposes, a development scale and mix based on Option 2a from that document was initially tested for this study.

That initial test showed significant external highway impacts due to the tidal nature of the trips generated by the predominantly employment led development. As a result, a further development mix option for CNFE was

devised which sought to maximise site internalisation, to thereby reduce the level of external trips generated by the site, and to better balance the levels of access and egress flows in the weekday peak hours. This option – labelled 'Scenario 3 Rebalanced' for this study – achieves this by proposing a greater residential component element to the development mix. Based on the Option 2a scale of site development, the following table highlights the changes in the residential mix and external trip generation between the Option 2a proposal and the Scenario 3 Rebalanced proposal.

Table 9: Comparison between 'Scenario 3 Rebalanced' and Option 2a CNFE proposals

Development Option	Residential Site Area Proportion	AM External Trips		PM External Trips	
		Arr	Dep	Arr	Dep
Option 2a	20%	4,916	1,118	872	4,383
Scenario 3 Rebalanced	75%	1,780	1,303	1,086	1,685
Change	**+55%**	**-3,136**	**+185**	**+214**	**-2,698**

Source: MM

This shows that a land use mix for CNFE where the proportion of residential uses is increased results in significantly fewer external vehicle trips and greater site internalisation.

The above scale of development has been used in the model as a proxy for the stringent parking restraint and travel plan initiatives to reduce the external vehicle trip generation from the site, as CSRM2 is not able to adequately model parking restraint.

The level of external vehicle trips indicated in Table 9 above is therefore the 'trip budget' for the CNFE site within which future development should be delivered. However, it is important to note that this development mix is used purely for modelling purposes and is not a development mix that is either proposed or necessarily desired. The development of the CNFE site will therefore need to look to innovative ways of delivering development so as to enable higher levels of development on the site whilst significantly reducing the car mode share from that which is currently seen at CNFE and CSP.

3.2.3 CNFE/CSP Parking Restraints

It is proposed that stringent parking standards will be applied to new development at both the CNFE and CSP sites, in order to minimise the future generation of external private vehicle trips by the two sites. Details of the potential standards to be applied and the intended impact of such measures are provided in the Strand 3 CNFE/CSP Development Focus report.

Due to the nature of the CSRM2 model, this measure is not reflected in the Do Something assessment.

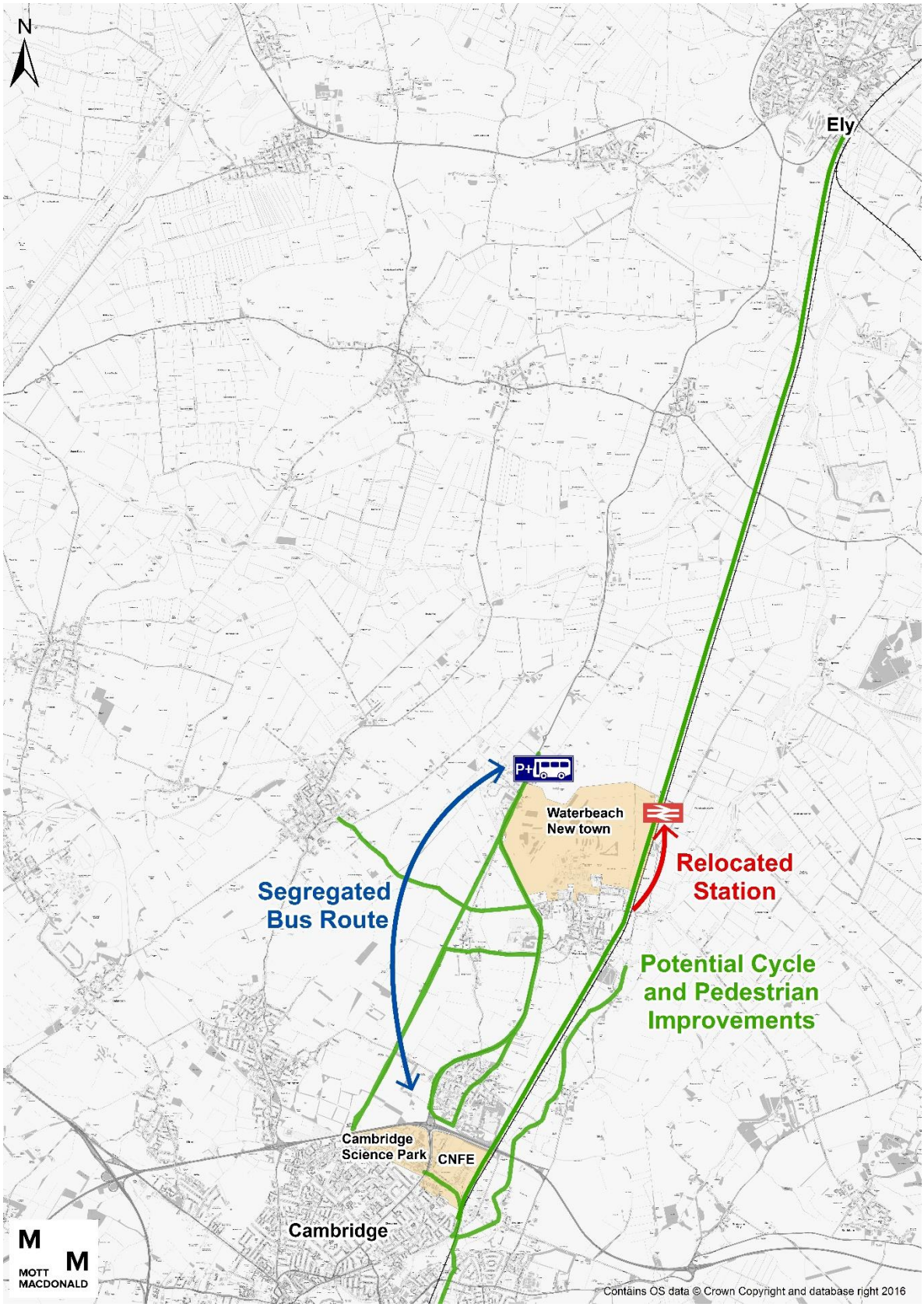
3.2.4 External Network Measures

Based on the above analysis of trips predicted to use the A10 study area and assessment of those trips most potentially susceptible to mode shift, the following table and figure summarise the external network non-car mode measures proposed to encourage the most sustainable use of the corridor. These measures have been agreed with the client team and are also those which already have some basis in either policy and/or developer aspirations.

Table 10: Proposed external-network non-car mode measures

Category	
Walking/cycle	New or improved walking/cycling routes between Ely, Waterbeach and Cambridge
Bus	New high-quality segregated bus provision (route TBC) between the new town north of Waterbeach and Cambridge
P&R	New bus and rail P&R sites at the new town north of Waterbeach, to remove car trips from southern section of A10
Rail	Existing Waterbeach station relocated closer to the new town north of Waterbeach

Figure 6: Proposed external-network non-car mode measures



Source: MM

In order to provide an indication of the proportion of A10 highway trips which would be positively affected by these measures, the following table shows the Combined-Scenario Do-Minimum trip distribution – based on Table 3 above – coloured according to the non-car mode improvement measures which are most applicable (see key under table).

Table 11: A10 corridor average peak-hour highway-flow distribution – Combined-Scenario Do-Min

		DESTINATION						
		Cambridge (Central + Outer)	CNFE + CSP	Waterbeach	New town north of Waterbeach	Ely	Other Local	External
ORIGIN	Cambridge (Central + Outer)	0%	0%	0%	3%	3%	0%	4%
	CNFE + CSP	0%	0%	0%	1%	1%	0%	1%
	Waterbeach	0%	0%	0%	0%	2%	0%	1%
	New town north of Waterbeach	2%	1%	0%	0%	5%	1%	12%
	Ely	2%	1%	0%	4%	0%	1%	4%
	Other Local	0%	0%	0%	1%	1%	0%	2%
	External	4%	1%	3%	12%	7%	2%	14%

Source: MM/CSRM2

Key and totals:

Improvement	Trips Affected
Rail, bus and cycle/walking improvements	16%
Bus and cycle/walking improvements	14%
Bus, P&R and cycle/walking improvements	3%
P&R improvements	8%
Rail improvements	24%
No improvement applicable	35%
All	**100%**

This data shows that the proposed non-car mode improvements are likely to be relevant to nearly two-thirds (65%) of the trips predicted to use the A10 highway route in the Combined-Scenario Do-Minimum, giving the measures a good range of coverage and a strong chance of delivering mode-shift for the corridor.

The following table summarises the above data in terms of the proportion of A10 trips affected by each type of mode improvement.

Table 12: Proportion of Combined-Scenario Do-Minimum A10 trips impacted by mode improvements

Mode Improvement	Rail	Bus	P&R	Cycle/walk
% of CS-DM A10 trips affected	40%	33%	11%	33%

Source: MM

This shows that rail improvements have the potential to impact 40% of A10 trips in the Combined-Scenario Do-Minimum case; bus, cycle and walk improvements a third of trips; and Park & Ride, 11%. All mode improvements are therefore considered necessary to maximise mode-shift potential on the route.

3.3 Supply-Side Measure Identification

A phased approach to A10 corridor highway improvements has been adopted in order to incrementally test the effect of greater levels of intervention. Based on the development traffic flow impact analysis in Section 2.2 above, the following table summarises the A10 highway intervention measures considered.

Table 13: A10 corridor highway measures considered

Measure Description	Rationale
Improvements to individual junctions along A10 corridor, including Milton Interchange	First level of highway improvements, to see if single-lane configuration can be retained if junction capacity restraints lifted
Junction improvements plus dualling of the A10 from the new town north of Waterbeach north access to Ely	Addition of capacity on north section of A10, to encourage use of the Waterbeach bus and rail P&R for the south section
Junction improvements plus dualling of the A10 from the south access of the new town north of Waterbeach to the A14	Addition of capacity on the south section, where above analysis shows demand is greatest
Junction improvements plus addition of tidal-flow lane on the A10 from the south access of the new town north of Waterbeach to the A14	A potentially more space-efficient way of adding capacity to the south section
Dualling of the A10 from the A14 to Ely	Addition of capacity along the full corridor

Source: MM

Where included in the short-listed Do Something mitigation packages, further detail on these measures is provided below.

3.4 Do Something Package Long-List

Based on the above package development approach of considering demand-side measures before supply-side measures, a long-list of Do Something packages has been developed which range from the non-highway intervention approach only to packages with an increasing level of complementary highway intervention. This range of packages and the rationale behind them is described in the following table.

Table 14: Do Something packages long-list

Package Name	Description	Rationale
Mode-shift	Do Minimum highway network plus the above non-highway measures to encourage mode shift	To test the impact of non-highway interventions only
Junction+	Mode-shift option measures, but with above 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 (alignment TBC) 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 P&R from the new town north of Waterbeach to Cambridge
South-dual	Junction+ option, but with the A10 dualled (alignment TBC) from the south access of the new town north of Waterbeach to the A14	To test the impact of upgrading capacity on the south half of the corridor, where it is most needed
Tidal-flow	Junction+ option, but with tidal-flow lane on the A10 from the south access of the new town north of Waterbeach to the A14	To test an alternative to the South-dual option which would require a reduced footprint
Full-dual	Junction+ option, but with the A10 dualled (alignment TBC) from the A14 to Ely	To test the impact of a full corridor upgrade

3.5 Do Something Package Short-List

3.5.1 Package Filtering

The above packages were each subjected to a first level of engineering design scrutiny and, at that stage, it was deemed that all packages are potentially feasible in construction and operating terms except for the 'Tidal-flow' option. The reasons for this are as follows:

- Too many junctions along section, which would interrupt tidal lane continuity
- Rural nature of route, which would be interrupted by high level of gantries required to operate scheme
- Once safety margins taken into account, footprint of scheme would not be appreciably less than an equivalent dualled option

On this basis, the Tidal-flow package option was not taken forward to the Do Something short-list.

3.5.2 Core Tests

The package short-list taken forward for modelling was as listed in the following table.

Table 15: Do Something packages short-list

Package Name	Description
Mode-shift	Do Minimum highway network plus the above non-highway measures to encourage mode shift
Junction+	Mode-shift option measures, but with above junction improvements to A10 corridor
North-dual	Junction+ option, but with the A10 dualled (alignment TBC) from the north access of the new town north of Waterbeach to Ely
South-dual	Junction+ option, but with the A10 dualled (alignment TBC) from the south access of the new town north of Waterbeach to the A14
Full-dual	Junction+ option, but with the A10 dualled (alignment TBC) from the A14 to Ely

Source: MM

3.5.3 Sensitivity Tests

In addition to the above Do Something packages which will directly affect the A10 corridor, this study also considers two potential future highway schemes which could indirectly affect the corridor. These schemes are:

- A potential A142-link – this would be a new highway link between the A10 and the A142 (west), in order to relieve pressure from the southern section of the Ely bypass
- A potential M11-link – this would be a new highway link between the A47 and the A14/M11, in order to relieve pressure on the A10 and A141 routes

These schemes are currently hypothetical and are being developed by separate studies to establish points of feasibility and detail. However, the degree to which they could potentially impact upon the performance of the study area for this project is considered here so that any benefits or conflicts with the above Do Something packages can be understood. These tests are described in Section 9 below.

3.6 Modelling Process

The Do Something modelling 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 built using mobile phone data

Investigations undertaken by CCC of model performance and journey times in this corridor confirm that the model is fit for purpose for use in the assessment of this phase of the project.

As noted above, the Do Something tests are based on the 2031 'Combined Scenario' model, which simulates the future scenario where Local Plan projected levels of population and employment growth have been achieved, full development is assumed at the new town north of Waterbeach, CNFE and CSP, and all planned transport schemes with a likelihood status of 'certain' or 'near certain' have been implemented (see Do Minimum Modelling report for more details).

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

All modelling results presented in this report are for the AM and PM weekday peak hours, which are:

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

3.7 Performance Indicators

In order to provide a summary quantification of package performance, each Do Something package model run is compared against the equivalent Do Minimum run across three key indicators, as listed in the following table.

These indicators relate most directly to the core performance objectives of the study, so provide a summary comparison between packages. However, for the purpose of full Option Appraisal in the Strategic Outline Business Case, packages are compared using a wider range of indicators through our INSET appraisal tool.

Table 16: Performance indicators description

Indicator	Scope	Definition	Rationale
Car mode share	Measured both for trips most likely to use the study corridor and for the whole modelled area	Absolute change from Future Base Do Min car mode share	This is a primary measure of the relative sustainability of trip making on and beyond the corridor, where the lower the result the better
Journey time	Measured on A10 between A14 and Ely bypass	% change from Future Base Do Min journey time	This is the primary measure of corridor performance, where the lower the result the better
Parallel route traffic level	Measured on B1049, B1047 and on Landbeach Road	% change from Future Base Do Min traffic levels	This is a second measure of route impact, where the lower the result the better

4 Mode-Shift Package Results

The purpose of this section is to describe and present the CSRM2 model results of the Mode-Shift Do-Something package option.

4.1 Package Description

The aim of this package test is to understand the potential impact of applying only non-highway measures. The package of measures applied is as described above in Section 3.2.4 above.

4.2 Trip Levels and Mode Choice Results

The purpose of this section is to present results from the demand model element of CSRM2, to understand the impact of this Do Something package on overall trip rates and modal choice. These results are presented at a study area-level and for the individual proposed new developments affecting the corridor.

4.2.1 Study Area-Level Analysis

The following charts present demand model output results for trip end pairings which can be considered most likely to use the study corridor. Based on the sectorisation shown above in Figure 2, the sector pairings used for this corridor-level analysis are as follows:

Table 17: Sector pairs used to represent study corridor trips from Demand Model output

		DESTINATION						
		Cambridge*	CNFE	Cambridge Science Park	Waterbeach	New town north of Waterbeach	Ely	External
ORIGIN	Cambridge*				✓	✓	✓	
	CNFE				✓	✓	✓	
	Cambridge Science Park				✓	✓	✓	
	Waterbeach	✓	✓	✓			✓	✓
	New town north of Waterbeach	✓	✓	✓			✓	✓
	Ely	✓	✓	✓	✓	✓		
	External				✓	✓		

* Represents ‘Cambridge Central’ and ‘Cambridge Outer’ combined

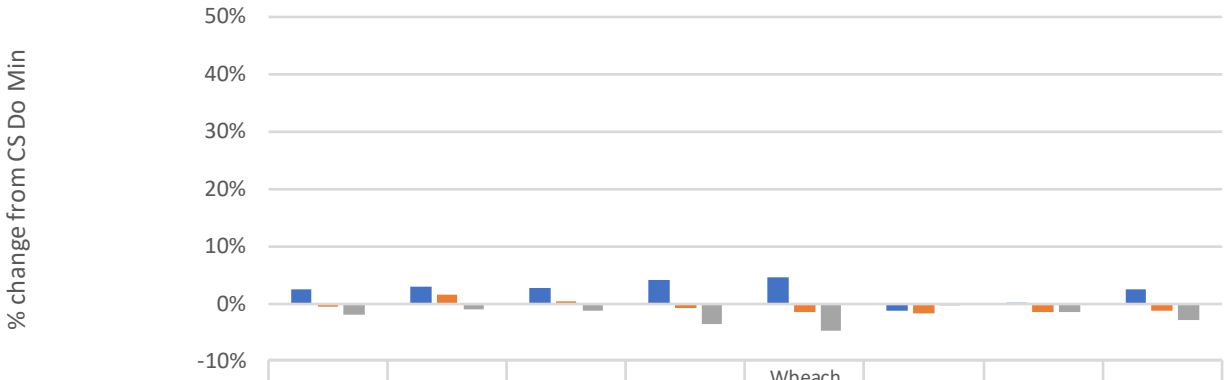
It is noted from this matrix that trips to and from locations external to the corridor are only represented for trips to and from Waterbeach and the new town north of Waterbeach, as these are the only external trips guaranteed to use the corridor. External trips to all the other locations shown will comprise a mix of those which do and do not use the corridor, so these have not been included in this corridor-level analysis. This means that the analysis is not based on all trips which would potentially use the corridor, but a reasonable understanding of corridor behaviour can nonetheless be gained from the above pairings and is appropriate for comparison purposes between packages.

All results in this section are for all weekday trips between 7am and 7pm.

For the above A10 sectors and corridor, the following chart (scaled to be consistent for all Do Something package results) shows how the Combined-Scenario Mode-Shift package differs from the Combined-Scenario Do-Minimum situation in terms of:

- Total person trips
- Total car trips
- Car mode share (which is a function of the difference between the above two results)

Figure 7: Change in corridor trips and car mode share by sector, CS Mode-Shift package vs CS DM



	Cambridge	CNFE	CSP	Wbeach	Wbeach New Town	Ely	External	A10
Change in person trips	2.5%	2.9%	2.7%	4.0%	4.6%	-1.2%	0.0%	2.5%
Change in car trips	-0.5%	1.4%	0.2%	-0.8%	-1.5%	-1.7%	-1.6%	-1.2%
Change in car mode share	-2.0%	-1.0%	-1.3%	-3.7%	-4.8%	-0.4%	-1.5%	-2.9%

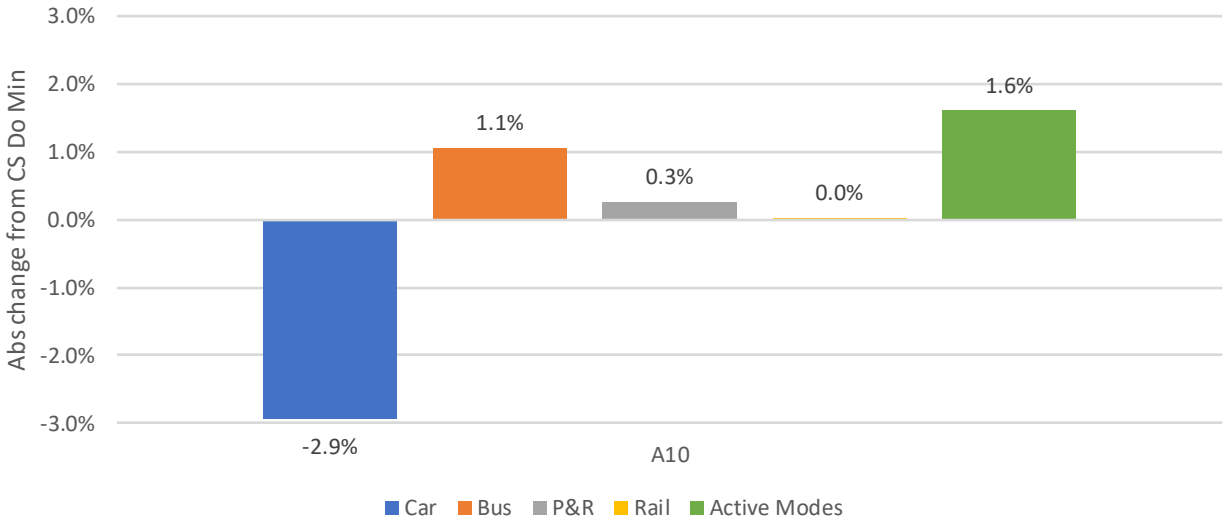
Source: CSRM2

This chart shows that:

- This package increases person trips on the corridor by 2.5% by increasing the corridor's overall transport capacity. However, because in this package the capacity increase is for public transport and active travel modes only, the person trip increase is accompanied by a 1.2% drop in overall car trips on the corridor, which is a result of mode shift from car of 2.9%.
- The person trip increases are mainly seen on the southern half of the corridor, which is where the majority of measures are focussed. It is also for these locations that the greatest car mode share drops are seen; particularly for the existing Waterbeach settlement and the new town north of Waterbeach. However, *all* sectors show a drop in car mode share.

In terms of the modes shifted to, the following chart shows mode shift levels for the Combined-Scenario Mode-Shift package compared to the Combined-Scenario Do-Minimum situation at the study area level.

Figure 8: Study area mode shift by mode, CS Mode-Shift package vs CS Do Min

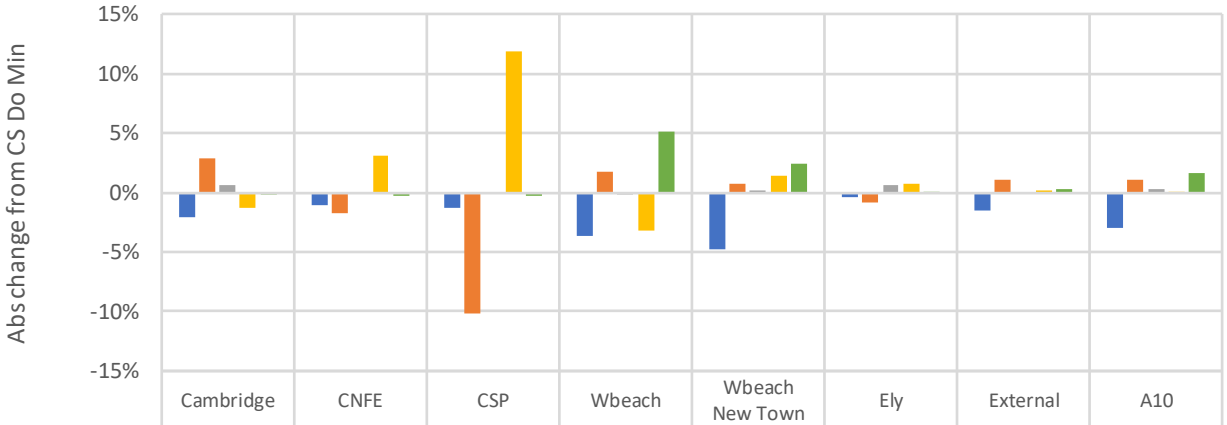


Source: CSRM2

This chart shows that, at a study area level, and compared to the equivalent Do Minimum scenario, the Mode-Shift package results in a substantial overall decrease in car mode share, which is mainly transferred to bus and active modes.

The following chart expands this same result to show how it is distributed across the study area's component sectors:

Figure 9: Mode shift by mode and sector for study area trips, CS Mode-Shift package vs CS Do Min



	Cambridge	CNFE	CSP	Wbeach	Wbeach New Town	Ely	External	A10
Car	-2.0%	-1.0%	-1.3%	-3.7%	-4.8%	-0.4%	-1.5%	-2.9%
Bus	2.9%	-1.8%	-10.2%	1.8%	0.8%	-0.9%	1.0%	1.1%
P&R	0.6%	0.0%	0.0%	0.0%	0.2%	0.6%	0.0%	0.3%
Rail	-1.3%	3.1%	11.8%	-3.2%	1.4%	0.7%	0.2%	0.0%
Active Modes	-0.2%	-0.2%	-0.3%	5.1%	2.4%	0.0%	0.3%	1.6%

Source: CSRM2

This chart shows that:

- Car users shift to bus for corridor trips to and from Cambridge, but to rail for trips to and from CNFE and CSP. Conversely, the rail mode share decreases for trips to and from Cambridge, and the bus mode share decreases for trips to and from CNFE and CSP.
- Moving the existing Waterbeach rail station closer to the Waterbeach new town development results in a drop in rail mode share for Waterbeach but an increase for the development. In terms of trip numbers, this shift represents a gain in absolute terms.
- The main increase in the active-travel mode share is seen in trips to and from Waterbeach and the new town north of Waterbeach, where most of the measures for these modes are focussed.
- The main increases in use of P&R is seen for trips to and from Cambridge and Ely.

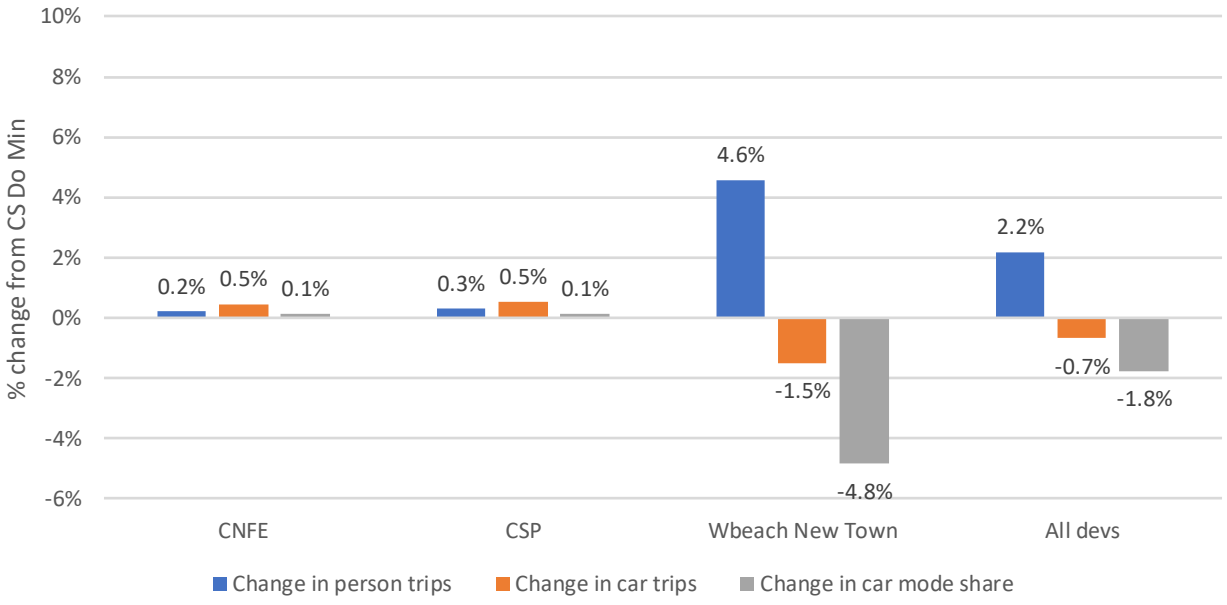
4.2.2 Development-Level Analysis

The following charts present demand model output results for the new developments proposed for the A10 corridor in terms of all external trips which serve them, and not just those which interact with the A10. These results allow the full impact of the Do Something package on each development to be understood.

For each development, the following chart (scaled to be consistent for all Do Something package results) shows how the Combined-Scenario Mode-Shift package differs from the Combined-Scenario Do-Minimum situation in terms of:

- Total person trips
- Total car trips
- Car mode share (which is related to the difference between the above two results)

Figure 10: Change in all external trips and car mode share by dev, CS Mode-Shift vs CS Do Min



Source: CSRM2

This chart shows:

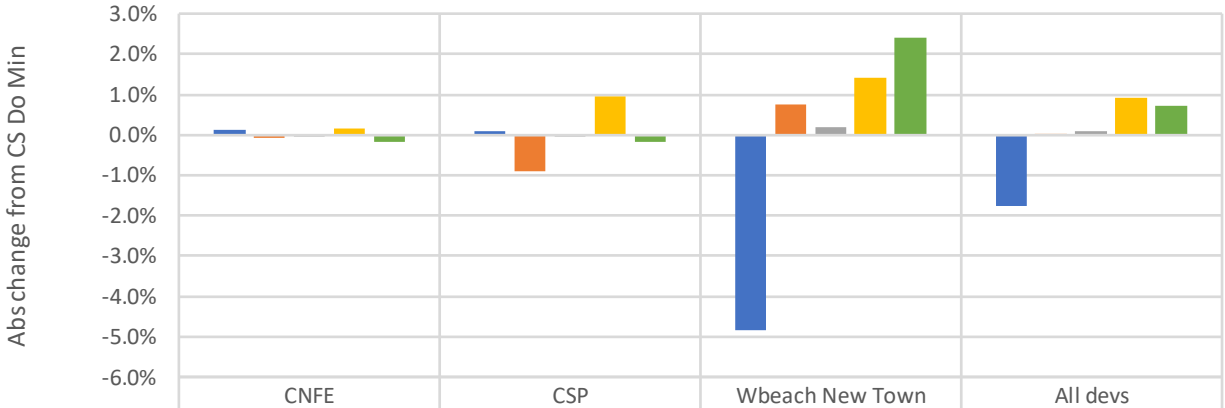
- The same results for the new town north of Waterbeach as shown above in the study area-level results. This is because all external trips to and from this development must use the A10. These results show a

relatively significant increase in person trips, but a decrease in car trips due to an overall decrease it the car mode share.

- Negligible change in trips and mode share to and from the CNFE and CSP developments, but car mode share change a little higher than in the study area-level results. This reflects that the measures proposed in this package are focussed mainly on the A10 corridor and not on other routes serving these developments.
- Overall, across all three new developments, the results show a net increase in person trips, but a net reduction in car trips and car mode share.

In terms of the modes shifted to for each development, the following chart (scaled to be consistent for all Do Something package results) shows mode shift levels for the Combined-Scenario Mode-Shift package compared to the Combined-Scenario Do-Minimum situation.

Figure 11: Development-level external-trip mode shift by mode, CS Mode-Shift package vs CS Do Min



	CNFE	CSP	Wbeach New Town	All devs
Car	0.1%	0.1%	-4.8%	-1.8%
Bus	-0.1%	-0.9%	0.8%	0.0%
P&R	0.0%	0.0%	0.2%	0.1%
Rail	0.2%	1.0%	1.4%	0.9%
Active Modes	-0.2%	-0.2%	2.4%	0.7%

Source: CSRM2

This chart shows:

- The same results for the new town north of Waterbeach as shown above in the study area-level results. This is because all external trips to and from this development must use the corridor. However, these results show that the greatest shift from the car is to active modes, followed by rail, bus and park & ride.
- Both CNFE and CSP have a decrease in mode share for bus and active modes, with trips shifting to rail and car. However, these changes are negligible at CNFE. At CSP the largest changes consist of a 1.0% increase in rail mode share and a 0.9% decrease in bus. However, all changes are relatively minor.
- Over all three new developments, car users shift to P&R, rail and active modes, with rail having the largest increase in mode share at 0.9%, followed by active modes at 0.7%.

4.2.3 Trip Levels and Mode Choice Summary

Overall, the Mode-Shift package has a positive impact on travel behaviour within the study corridor and its environs, when measured against the equivalent Do Minimum situation.

4.3 Highway Network Performance

4.3.1 Flow and Delay

For each peak hour, the following figures show:

- Predicted traffic flows and total junction delays for the Mode-Shift option
- The difference in traffic flows and total junction delays between the Mode-Shift option and the Combined-Scenario Do-Minimum situation

Traffic flow data is shown as scaled bands, where the width and colour reflect the flow level, while junction delays are shown as scaled circles, where the size and colour reflect delay levels.

The results are compared in this section against the Combined-Scenario Do-Minimum instead of against the Future-Base Do-Minimum in order to isolate the impacts of the mitigation measures.

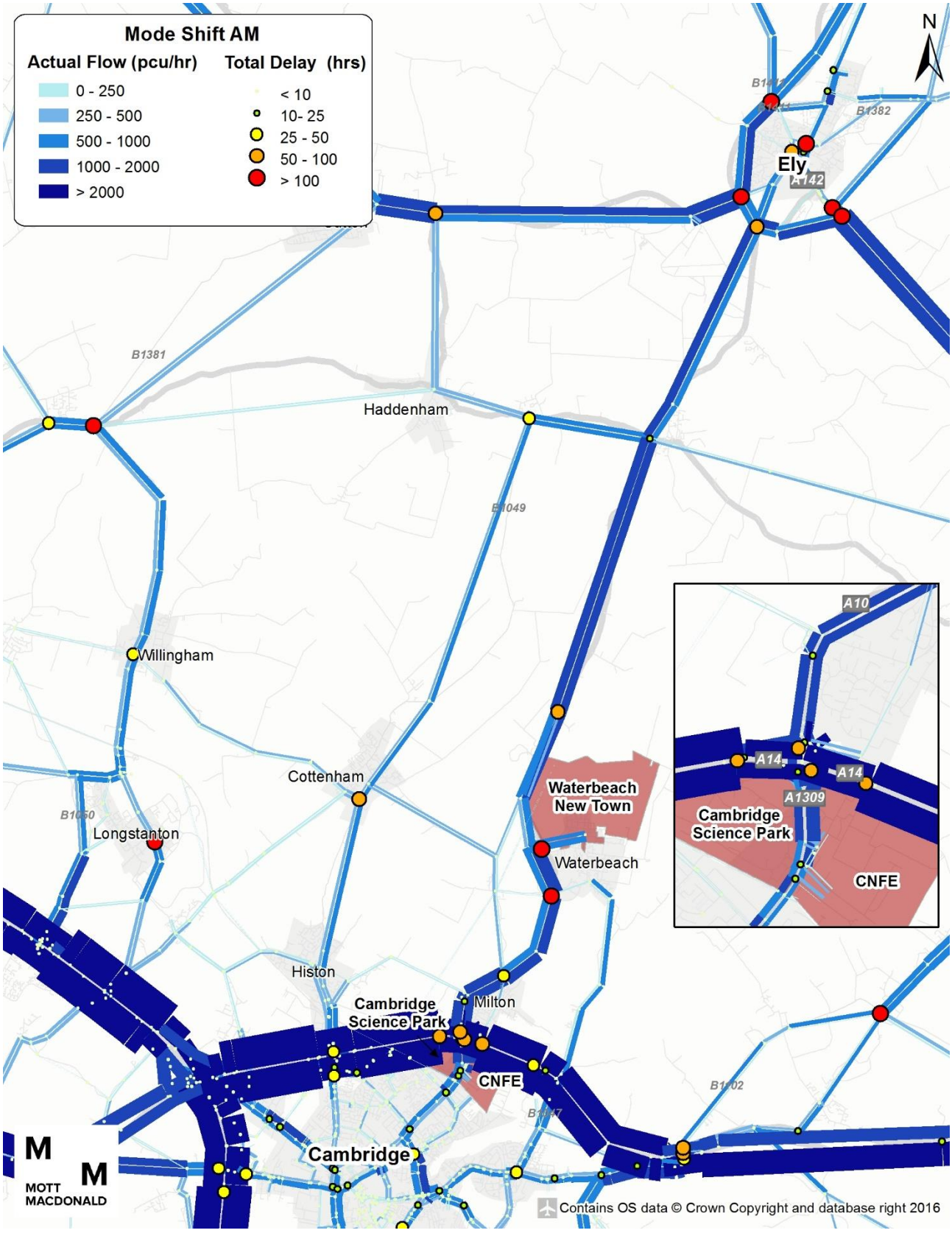
These figures for the AM peak show:

- High levels of junction delay around Ely and on the A10 route to Milton Interchange, but nonetheless an improvement in most cases over the Combined-Scenario Do-Minimum situation. This is largely due to a small reduction in traffic on the busiest southern section of the A10. The notable exception is the northern access of the new town north of Waterbeach where an increase in delay is observed. This is due to a small increase in flows on the northern section which is now no longer so constrained by congestion on the southern section, and would be mitigated in practice by further improvements to the access design. Overall, however, the delay impact of this option is positive.
- The impact is also positive on parallel routes, with flows on the B1047 and B1049 showing small reductions compared to the Combined-Scenario Do-Minimum situation.

These figures for the PM peak show:

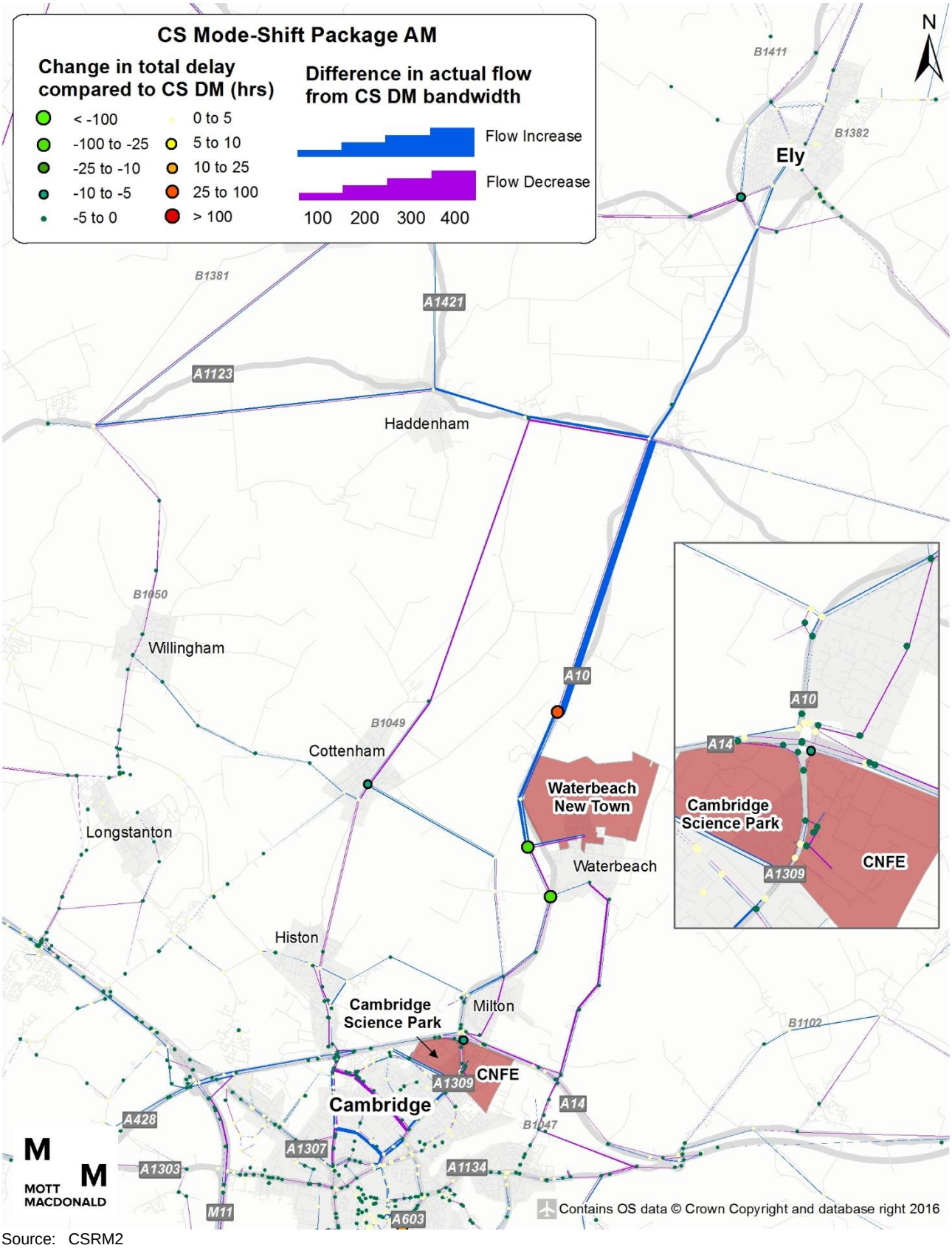
- As with the AM, high levels of junction delay around Ely and on the A10 route, particularly on the southern section and at Milton Interchange, but nonetheless a general improvement in these areas compared to the Combined-Scenario Do-Minimum situation. A small increase in delay is seen at Stretham roundabout and at the junction of Green End and the A10, due to the small traffic increases on the north section which are enabled by the capacity released on the southern section.
- Flows on parallel routes show small changes, with small reductions evident on the B1047 and a very small increase on the B1049.

Figure 12: Mode-Shift package flow and delay distribution – AM peak



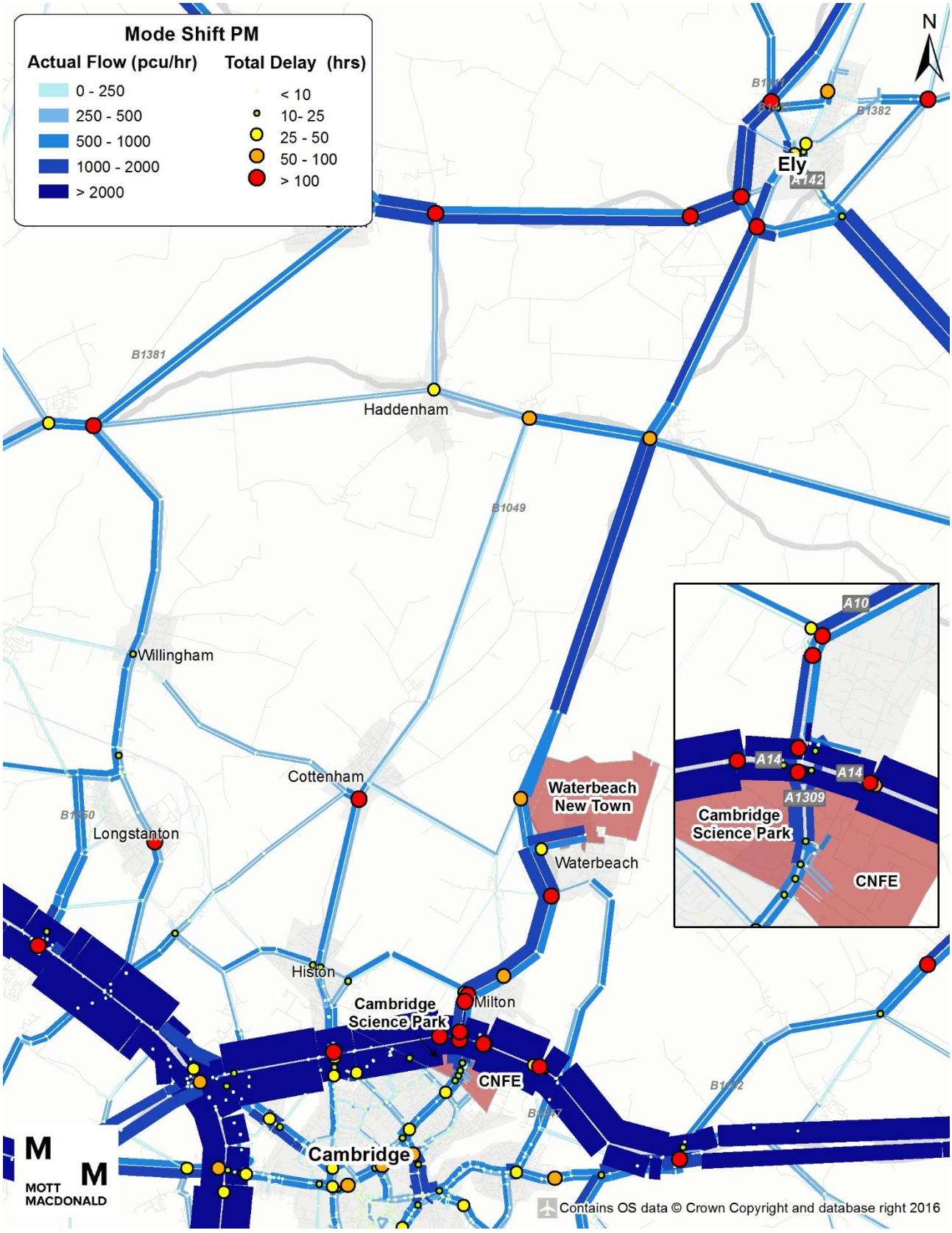
Source: CSRM2

Figure 13: Mode-Shift package flow and delay difference vs Combined Scenario Do Min – AM peak



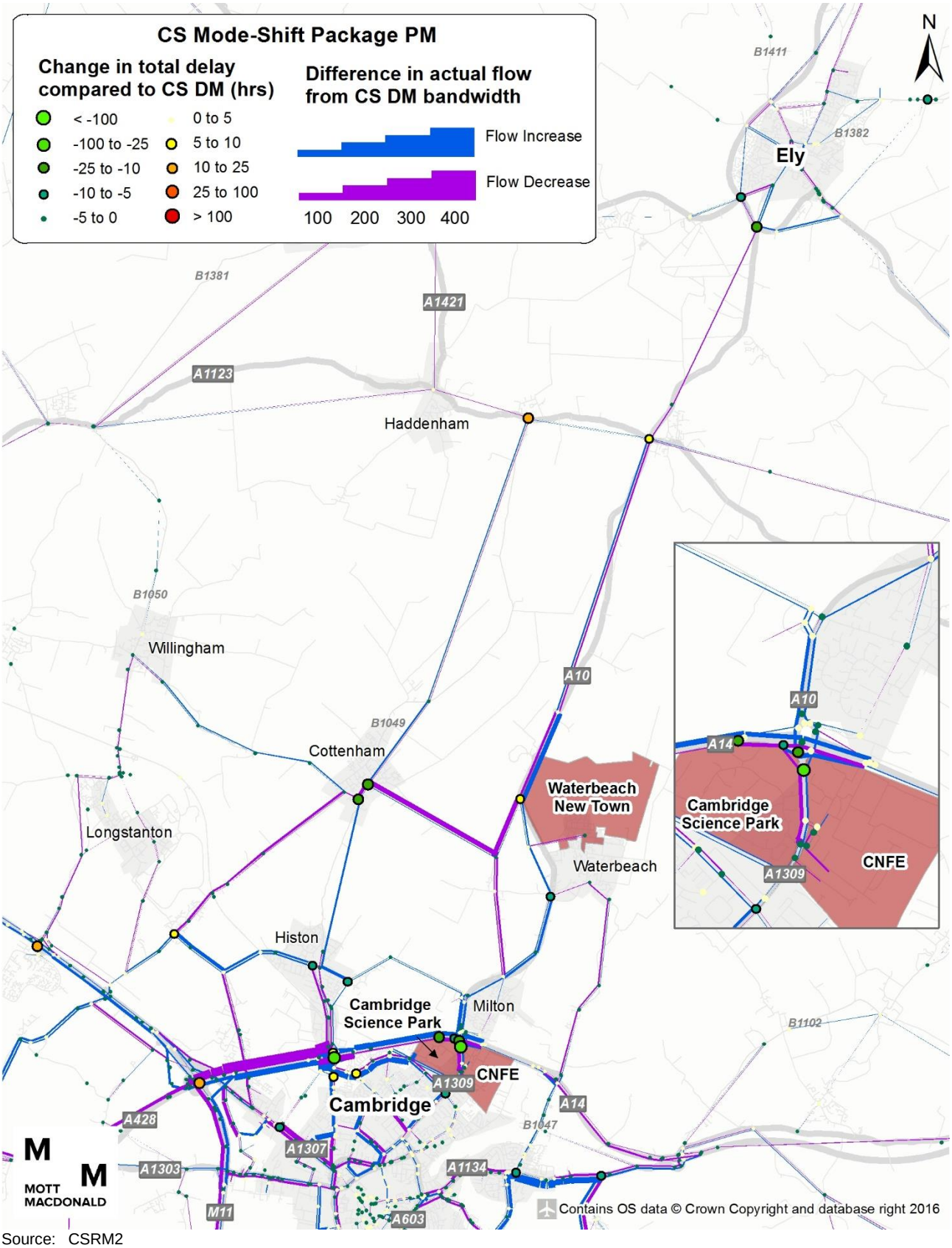
Source: CSRM2

Figure 14: Mode-Shift package flow and delay distribution – PM peak



Source: CSRM2

Figure 15: Mode-Shift package flow and delay difference vs Combined Scenario Do Min – PM peak



Source: CSRM2

4.3.2 Journey Time

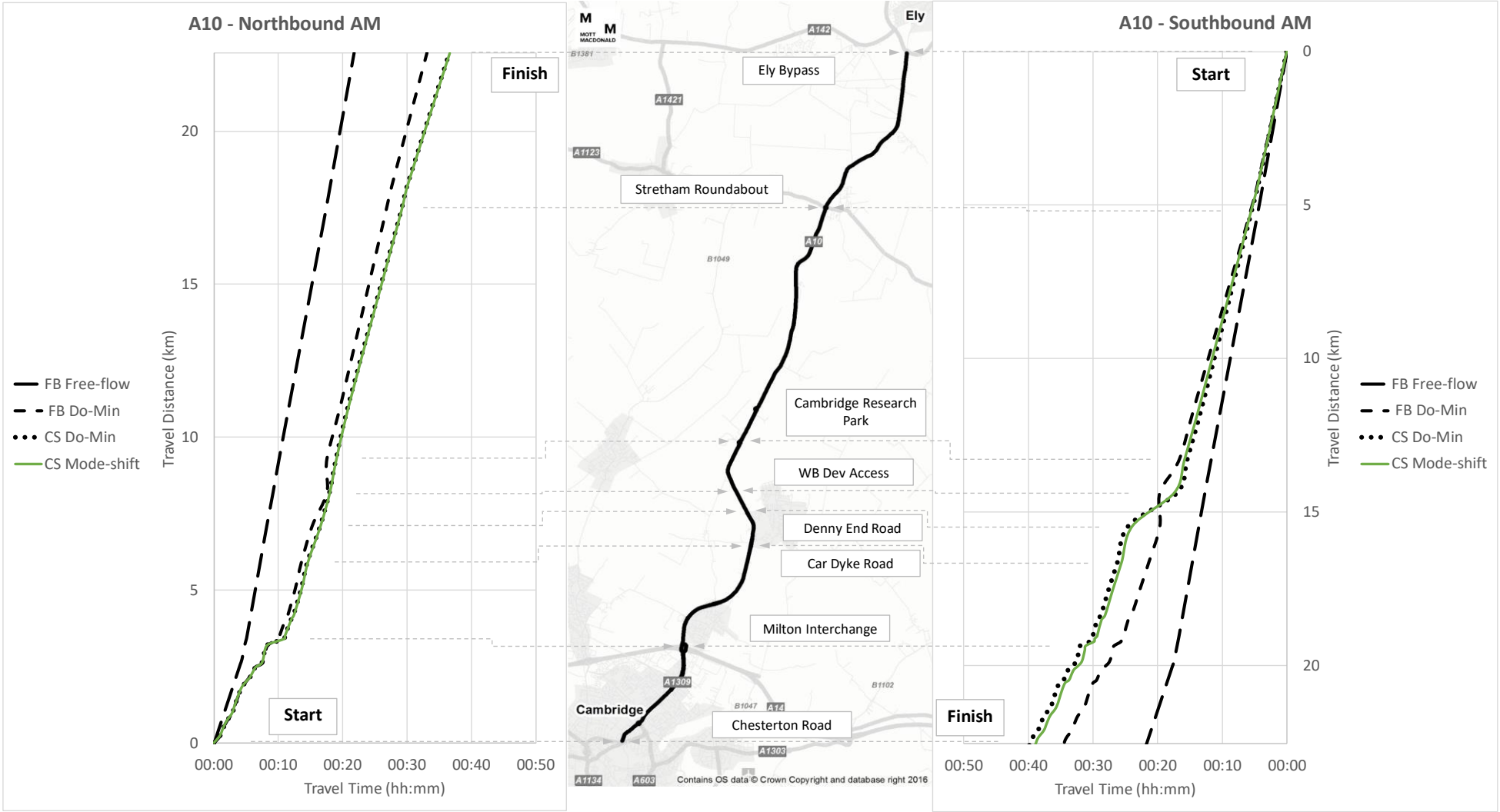
The following two figures show, for the AM and PM peak, modelled journey times along the A10 corridor between Chesterton Road and Ely bypass for the following scenarios:

- Future-Base Scenario Do-Minimum
- Combined-Scenario Do-Minimum
- Combined-Scenario Do-Something:
  - Mode-Shift package

These charts show that:

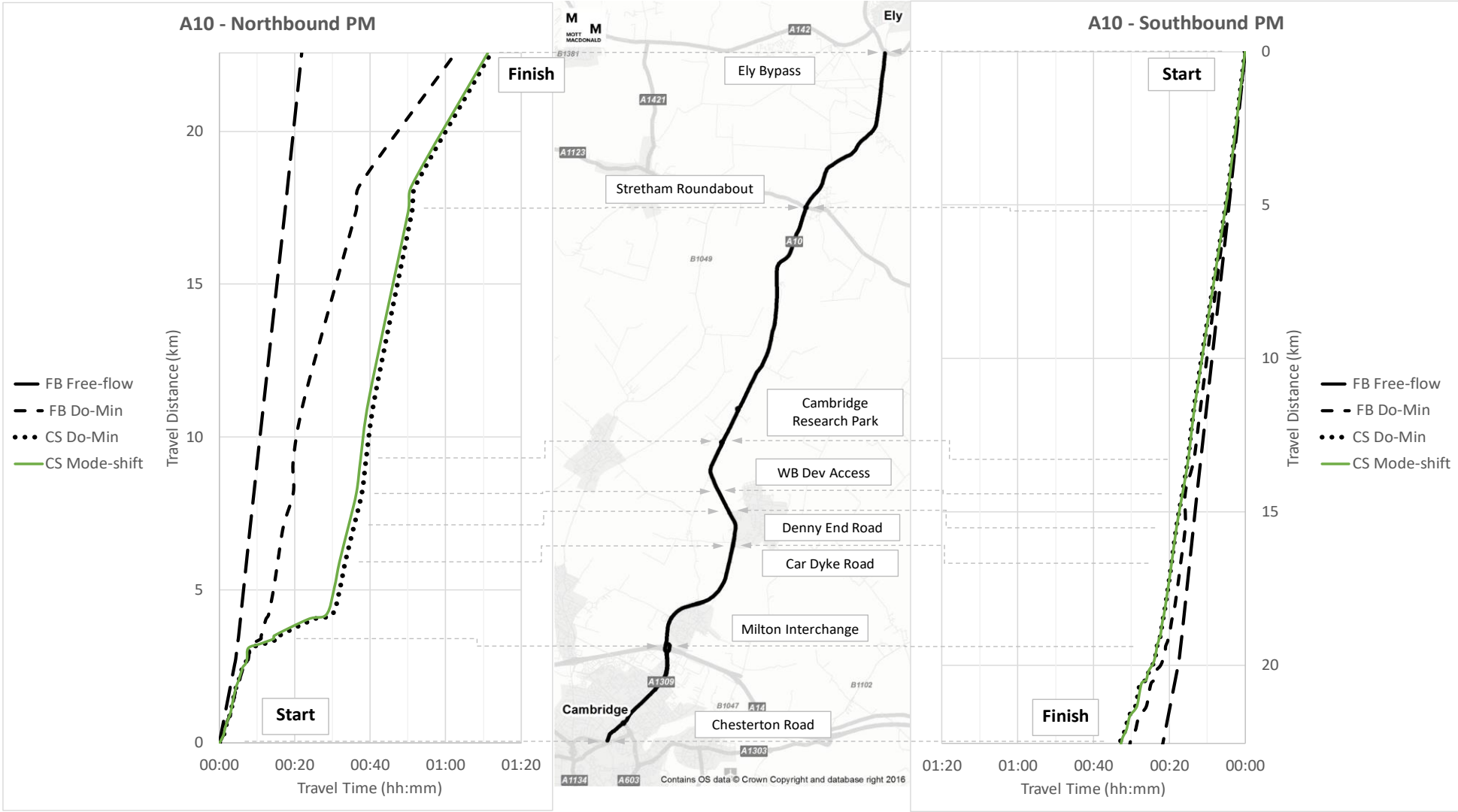
- In both directions in the AM peak, the Future-Base Do-Minimum journey times are predicted to be about 50% longer than in modelled free-flow conditions. In the PM peak, northbound journey times are nearly three times greater than modelled free-flow conditions.
- Compared to the Future-Base Do-Minimum, the Combined-Scenario Do-Minimum results in a deterioration in journey times along the route in both peak hours.
- The Mode-Shift package delivers small journey time improvements along most of the route in both directions and in both peak hours, which reflects the junction delay improvements highlighted in the flow and delay figures above. The resulting journey time is still longer than in the Future-Base Do-Minimum situation, however.

Figure 16: A10 corridor modelled journey times – 2031 AM peak



Source: CSRM2

Figure 17: A10 corridor modelled journey times – 2031 PM peak



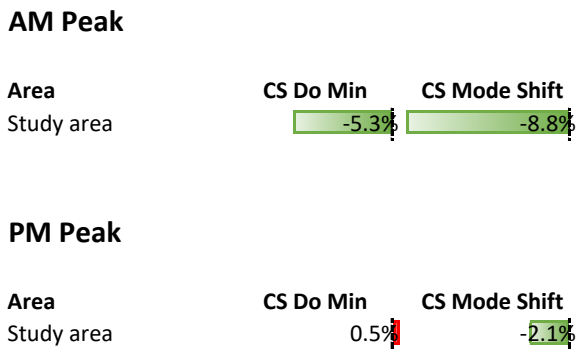
Source: CSRM2

4.4 Performance Indicator Summary

4.4.1 Car Mode Share

The following figure shows the modelled change in car mode share levels for the Combined-Scenario Mode-Shift package and the Combined-Scenario Do-Minimum situation compared to the Future-Base Do-Minimum situation. The results listed are taken from the above analysis and are based on all weekday AM and PM peak hour trips between sectors most likely to use the study area (see Section 4.2.1 above)

Figure 18: Change in car mode share levels compared to Future-Base Do-Minimum



Source: CSRM2

These results show that:

- In the study area, the Combined-Scenario Do-Minimum results show a relatively significant drop in car mode share in the AM peak compared to the Future-Base Do-Minimum, ie the 'without development' scenario, but not in the PM peak where there is a small increase.
- Compared to the Combined-Scenario Do-Minimum, however, the Mode-Shift package delivers mode share improvements on the study corridor in both peak hours

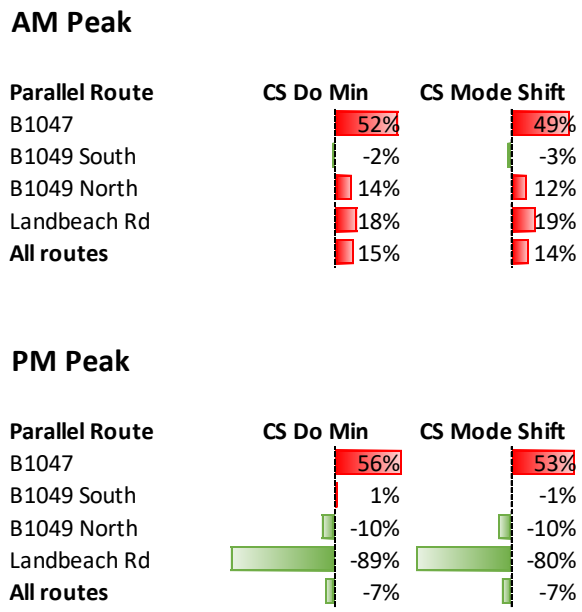
4.4.2 Parallel Route Traffic Levels

The following figure shows the change in modelled traffic levels on routes parallel to the A10 for the Combined-Scenario Mode-Shift package and the Combined-Scenario Do-Minimum situation compared to the Future-Base Do-Minimum situation.

The routes listed correspond to the analysis points shown in Figure 3 above as follows:

- B1047 (Horningsea Road) – point 6
- B1049 South (Histon Road) – point 4
- B1049 North (Twenty Pence Road) – point 8
- Landbeach Road – point 3

Figure 19: Change in parallel route traffic levels compared to Future-Base Do-Minimum



Source: CSRM2

These results show that:

- In the AM, traffic flows on parallel routes are generally greater in the Combined-Scenario Do-Minimum than in the Future-Base Do-Minimum, but this impact is slightly reduced with the Mode-Shift package.
- In the PM, the picture is mixed, with increases predicted for the B1047 compared to decreases on the other routes. The Mode-Shift package, however, either improves on the Combined-Scenario Do-Minimum results or maintains an improvement over the Future-Base Do-Minimum result.

Overall, this package has a generally positive impact on parallel route traffic levels, either improving on the Combined-Scenario Do-Minimum situation or maintaining the improvement over the Future-Base Do-Minimum result.

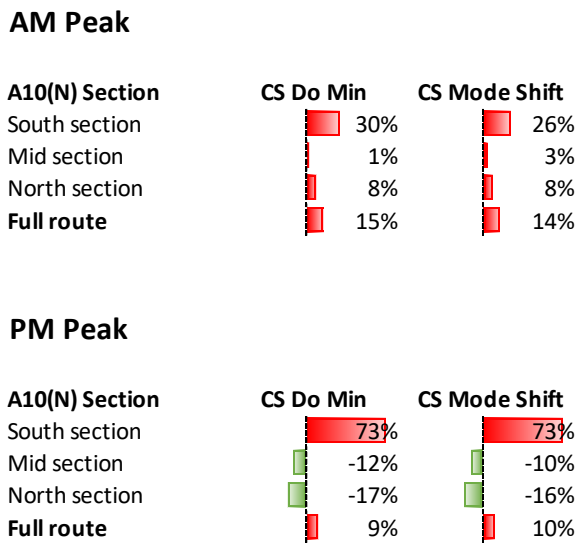
4.4.3 Journey Time

The following figure shows the change in modelled two-way highway journey times on the A10(N) corridor for the Combined-Scenario Mode-Shift package and the Combined-Scenario Do-Minimum situation compared to the Future-Base Do-Minimum situation.

The journey times are shown by route section and for the full route, where the sections are as follows:

- South section – Milton Interchange to Cambridge Research Park
- Mid section – Cambridge Research Park to Stretham roundabout
- North section – Stretham roundabout to Ely bypass

Figure 20: Change in A10 corridor journey time compared to Future-Base Do-Minimum



Source: CSRM2

These results show that:

- Compared to the Future-Base Do-Minimum, the Combined-Scenario Do-Minimum results in longer journey times on the corridor in both peak hours. This is particularly evident on the southern section where development demands are greatest.
- Compared to the Combined-Scenario Do-Minimum, the Mode-Shift package delivers small improvements overall in the AM peak and a small deterioration overall in the PM peak, but a mix of both on the individual route sections.

Overall, the journey times between both Combined-Scenario results are very similar, showing the Mode-Shift option has little impact on corridor highway journey times.

4.5 Results Summary

Overall, the Mode-Shift package shows positive impacts on mode choice for trips using the study corridor. This results in increased trip making in the study area, a reduction in the car mode share and an increase in the use of all non-car modes. However, despite these benefits, the improvement in highway performance is limited. This outcome therefore confirms the above Do-Minimum demand analysis conclusion that the Do Something packages will need to incorporate highway supply-side as well as demand-side measures (see Section 2.4). Different approaches to this are considered in the following sections.

5 Junction+ Package Results

The purpose of this section is to describe and present the CSRM2 model results of the Junction+ Do-Something package option.

5.1 Package Description

The above results for the Mode-Shift package suggest that non-car improvements alone will not be sufficient to allow the study area to perform as well in the Combined Scenario as in the Future-Base Scenario. This confirms the conclusion of the Do Minimum demand analysis above in Section 2.4.

The aim of the Junction+ package, therefore, is to test the effectiveness of some moderate improvements to the A10 in addition to the Mode-Shift measures listed in Section 3.2.4 above. These improvements are in the form of upgrading any under-performing junctions along the A10 where the modelling shows such measures would be beneficial. No link capacity improvements are included at this stage.

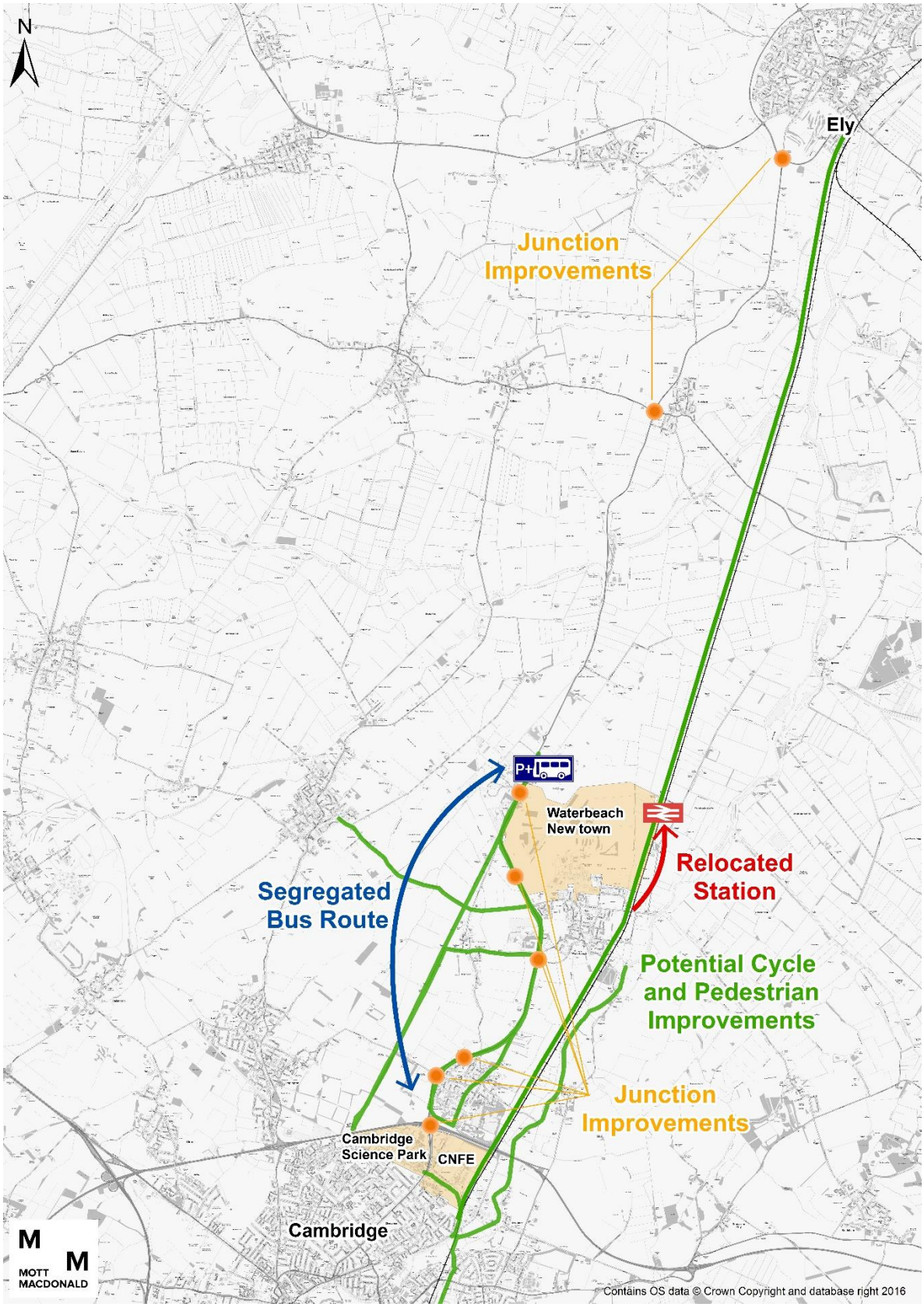
The junctions improved in the model for this option are shown in Figure 21 below and listed in the following table.

Table 18: Summary of modelled A10 junction improvements

Location	Existing junction type
Milton Interchange	Roundabout connecting the A14 with the A10, Cambridge Road and Milton Road.
Milton P&R Southern Access off A10	Signalised junction with both left and right turning lanes out of western arm at the P&R site. There is a left hand turning lane on the southern A10 arm which is not signalised.
A10 / Butt Lane	Signalised junction with both one straight ahead and one turning lane on the northern and southern A10 arms. Only left turns are allowed on the Butt Lane arm, with a one lane approach.
A10 / Landbeach Road / Humphries Way	Priority junction with ghost islands for vehicles turning right onto Landbeach Road and Humphries Way. One lane entries with flares on Landbeach Road and Humphries Way.
A10 / Car Dyke Road / Waterbeach Road	Priority junction with ghost islands for vehicles turning right onto Car Dyke Road and Waterbeach Road. One lane approaches on Car Dyke Road and Waterbeach Road, with a flare on Car Dyke Road.
New town north of Waterbeach southern access	Roundabout with three arms, of which all are two lane approaches. Two arms on the A10 and one arm to the site.
A10 / Green End	Priority junction consisting of a one lane approach with a flare from Green End and a ghost island for vehicles turning right from the A10 towards Green End.
New town north of Waterbeach northern access	Roundabout with three arms, all with two lane approaches. Two arms on the A10 and one arm to the site.
Stretham Roundabout	Roundabout with four arms, all with one lane approaches. Two arms for both the A10 and Wilburton Road.
A10 / A142 / Cambridge Road	Roundabout with four arms. Single lane entry from the western A10 arm and on the A142 arm. Two lane entry from the southern A10 arm and from Cambridge Road.

Source: MM

Figure 21: Junction+ package measures



Source: MM

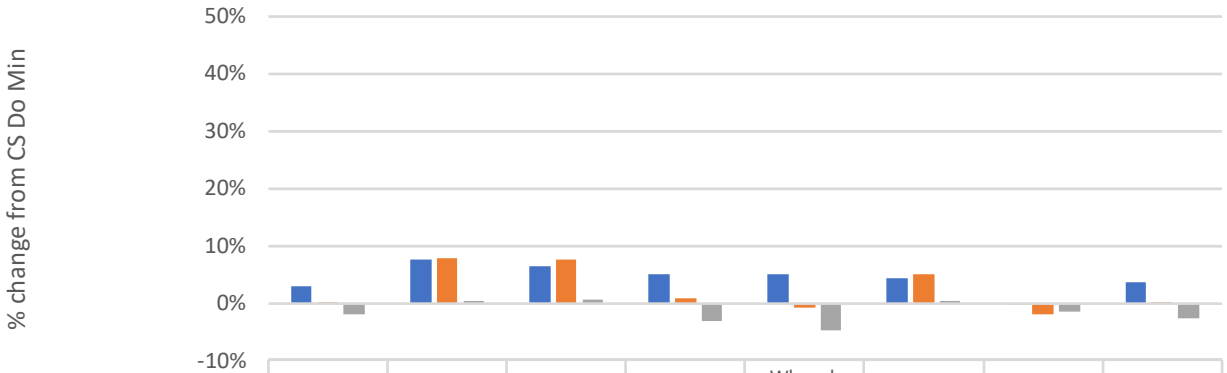
5.2 Trip Levels and Mode Choice

5.2.1 Study Area-Level Analysis

Using the same analysis method described above in Section 4.2.1 for the Mode-Shift package, the following chart (scaled to be consistent for all Do Something package results) shows how the Combined-Scenario Junction+ package differs from the Combined-Scenario Do-Minimum situation, at both the study area level and corridor-using sector level, in terms of:

- Total person trips
- Total car trips
- Car mode share (which is a function of the difference between the above two results)

Figure 22: Change in corridor trips and car mode share by sector, CS Junction+ package vs CS DM



	Cambridge	CNFE	CSP	Wbeach	Wbeach New Town	Ely	External	A10
Change in person trips	2.8%	7.5%	6.5%	4.9%	5.1%	4.4%	-0.2%	3.5%
Change in car trips	0.1%	7.9%	7.5%	0.8%	-0.9%	5.0%	-1.9%	0.0%
Change in car mode share	-1.9%	0.2%	0.5%	-3.1%	-4.8%	0.4%	-1.6%	-2.7%

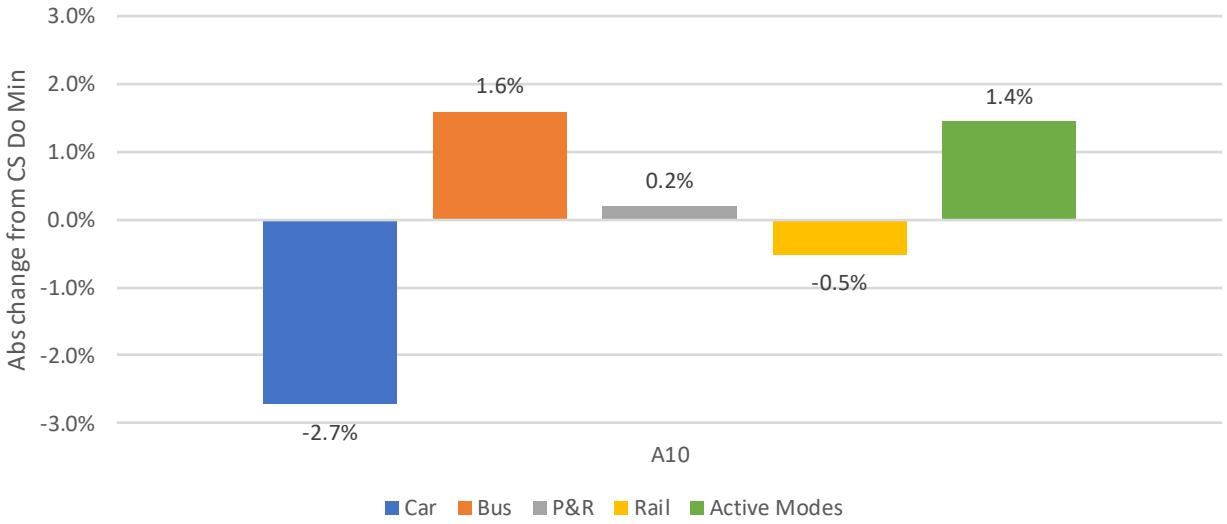
Source: CSRM2

This chart shows that:

- By increasing the study area's overall transport capacity across both non-highway and highway modes, this package increases person trips on the corridor by 3.5%, compared to the 2.5% increase with the Mode-Shift package, while also not increasing car trip levels. This is enabled by a mode shift of 2.7% from car.
- In terms of the distribution of changes, it is similar to the Mode-Shift option, but with greater person-trip, car-trip and car mode share increases for corridor trips to and from CNFE, CSP and Ely. This is a response to improved junction capacity on the route reducing congestion constraints for these locations.

In terms of the modes shifted to, the following chart shows mode shift levels for the Combined-Scenario Junction+ package compared to the Combined-Scenario Do-Minimum situation at the study area level.

Figure 23: Study area mode shift by mode, CS Junction+ package vs CS Do Min

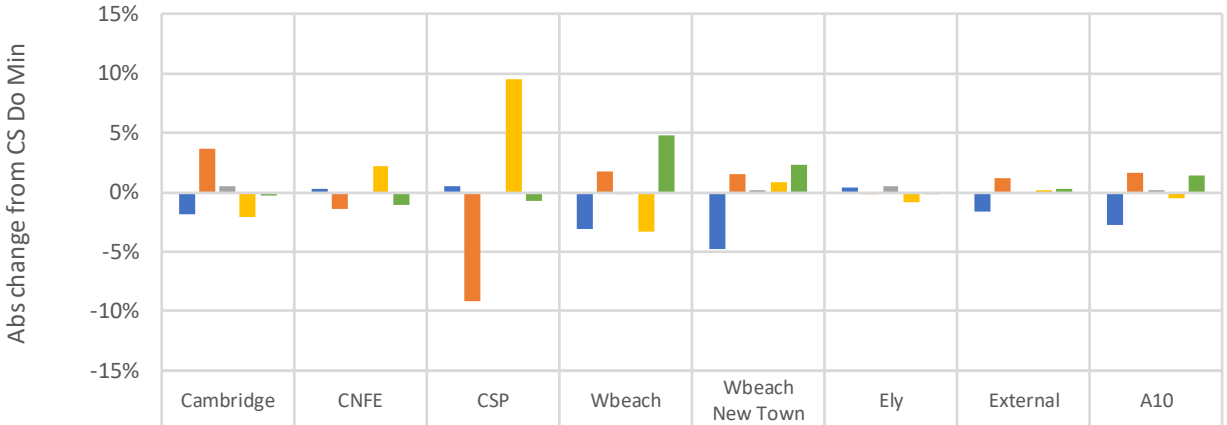


Source: CSRM2

This chart shows that, at a study area level, and compared to the equivalent Do Minimum scenario, the Junction+ package results in an overall decrease in car mode share, which is mainly transferred to bus and active modes. Some is also transferred to park & ride but, unlike with the Mode-Shift option, rail usage drops a little.

The following chart expands this same result to show how it is distributed across the study area's component sectors:

Figure 24: Mode shift by mode and sector for study area trips, CS Junction+ package vs CS Do Min



	Cambridge	CNFE	CSP	Wbeach	Wbeach New Town	Ely	External	A10
Car	-1.9%	0.2%	0.5%	-3.1%	-4.8%	0.4%	-1.6%	-2.7%
Bus	3.7%	-1.4%	-9.2%	1.8%	1.5%	-0.1%	1.2%	1.6%
P&R	0.5%	0.0%	0.0%	-0.1%	0.1%	0.5%	0.0%	0.2%
Rail	-2.1%	2.2%	9.5%	-3.3%	0.8%	-0.8%	0.2%	-0.5%
Active Modes	-0.3%	-1.1%	-0.8%	4.7%	2.3%	0.0%	0.3%	1.4%

Source: CSRM2

This chart shows a very similar distribution of results to the Mode-Shift option, except that:

- The car mode share for study area-trips to and from CNFE, CSP and Ely is slightly increased compared to the Combined-Scenario Do-Minimum rather than decreased. This is a response to the increasing of highway capacity along the A10 to serve these locations.

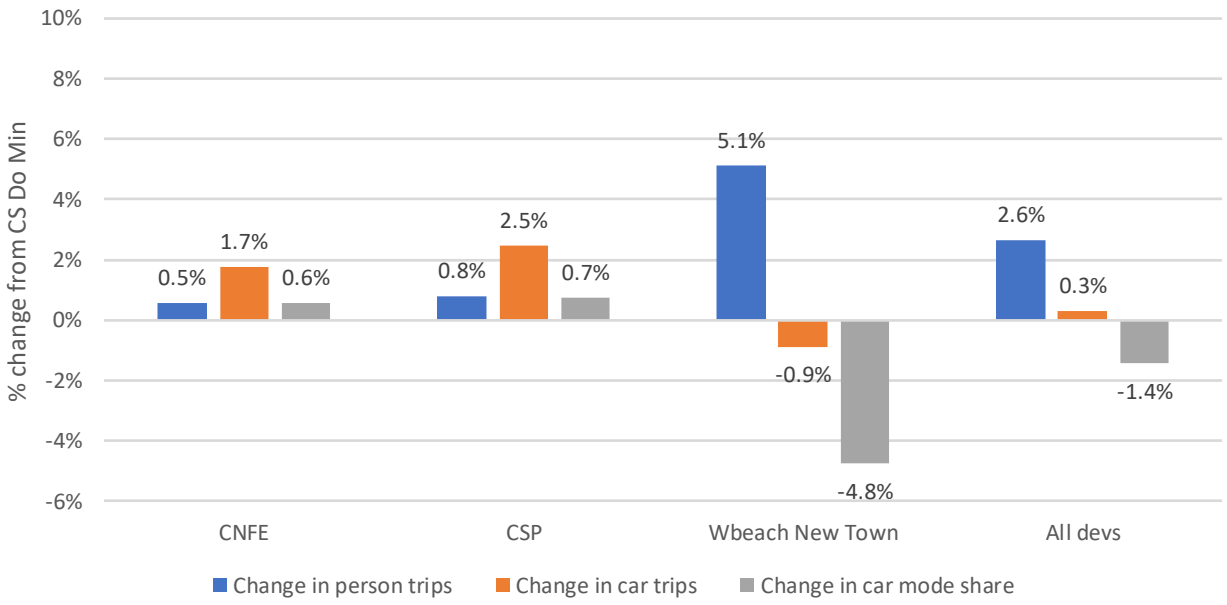
5.2.2 Development-Level Analysis

The following charts present demand model output results for the new developments proposed for the study area in terms of all external trips which serve them, and not just those which interact with the A10. These results allow the full impact of the Do Something package on each development to be understood.

For each development, the following chart (scaled to be consistent for all Do Something package results) shows how the Combined-Scenario Junction+ package differs from the Combined-Scenario Do-Minimum situation in terms of:

- Total person trips
- Total car trips
- Car mode share (which is related to the difference between the above two results)

Figure 25: Change in all external trips and car mode share by dev, CS Junction+ package vs CS DM



Source: CSRM2

This chart shows:

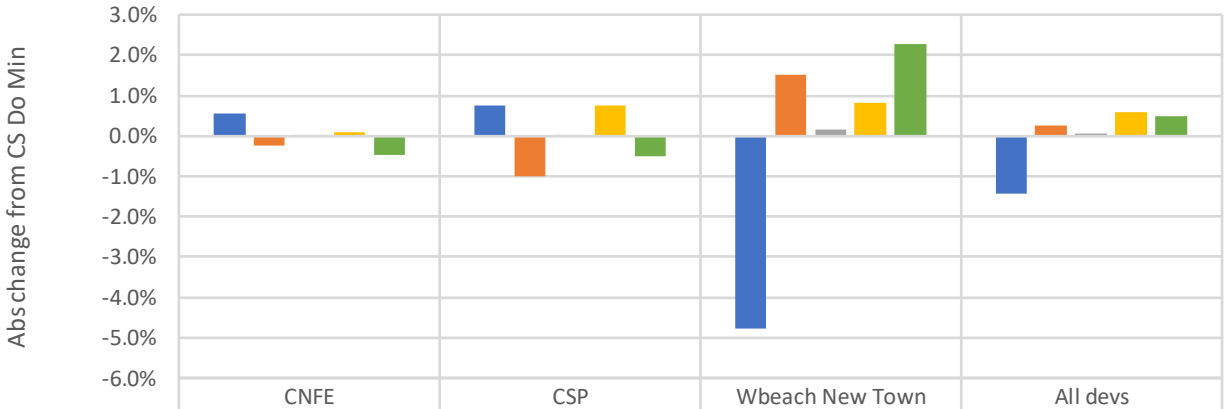
- The same results for the new town north of Waterbeach as shown above in the study area-level results. This is because all external trips to and from this development must use the corridor. These results show an even greater increase in person trips than for the Mode-Shift option as highway capacity improvements permit more trips to be released from the site. However, due to the same level of car mode share decrease, this increase still does not result in an increase in car trips generated by the site.
- Little change in person trips and car mode share to and from the CNFE and CSP developments, but car mode share change nonetheless a little higher than in the study area-level results. This reflects that the

measures proposed in this package are focussed mainly on the A10 and not on other routes serving these developments.

- Overall, across all three new developments, the results show a net increase in person trips, a negligible change in car trips and a decrease in car mode share.

In terms of the modes shifted to for each development, the following chart (scaled to be consistent for all Do Something package results) shows mode shift levels for the Combined-Scenario Junction+ package compared to the Combined-Scenario Do-Minimum situation.

Figure 26: Development-level external-trip mode shift by mode, CS Junction+ package vs CS Do Min



	CNFE	CSP	Wbeach New Town	All devs
Car	0.6%	0.7%	-4.8%	-1.43%
Bus	-0.2%	-1.0%	1.5%	0.27%
P&R	0.0%	0.0%	0.1%	0.08%
Rail	0.1%	0.8%	0.8%	0.58%
Active Modes	-0.5%	-0.5%	2.3%	0.50%

Source: CSRM2

This chart shows:

- The same results for the new town north of Waterbeach as shown above in the study area-level results. This is because all external trips to and from this development must use the A10. However, these results show that the greatest shift from the car is to active modes, followed by bus, rail and park & ride. The shift to bus is greater than in the Mode-Shift package, which shows that the highway improvements are generating bus performance improvements which helps to increase use of this mode.
- A decline in mode share for bus and active modes at both CNFE and CSP, shifting to rail and car. There is a greater increase in rail mode share at CSP compared to CNFE, at 0.8% rather than 0.1%, with the car mode share being the main increase at CNFE. The increase in car mode share to both sites is a consequence of extra highway capacity releasing more development trips onto the A10. However, all changes are relatively minor.
- Across the three developments, there is an overall decrease in car mode share and an increase in bus, P&R, rail and active modes. The largest increases in mode share are for rail and active modes.

5.2.3 Trip Levels and Mode Choice Summary

Overall, the Junction+ package has a generally positive impact on travel behaviour within the study area, when measured against the equivalent Do Minimum situation.

5.3 Highway Network Performance

5.3.1 Flow and Delay

For each peak hour, the following figures show:

- Predicted traffic flows and total junction delays for the Junction+ option
- The difference in traffic flows and total junction delays between the Junction+ option and the Combined-Scenario Do-Minimum situation

Traffic flow data is shown as scaled bands, where the width and colour reflect the flow level, while junction delays are shown as scaled circles, where the size and colour reflect delay levels.

The results are compared in this section against the Combined-Scenario Do-Minimum instead of against the Future-Base Do-Minimum in order to isolate the impacts of the mitigation measures.

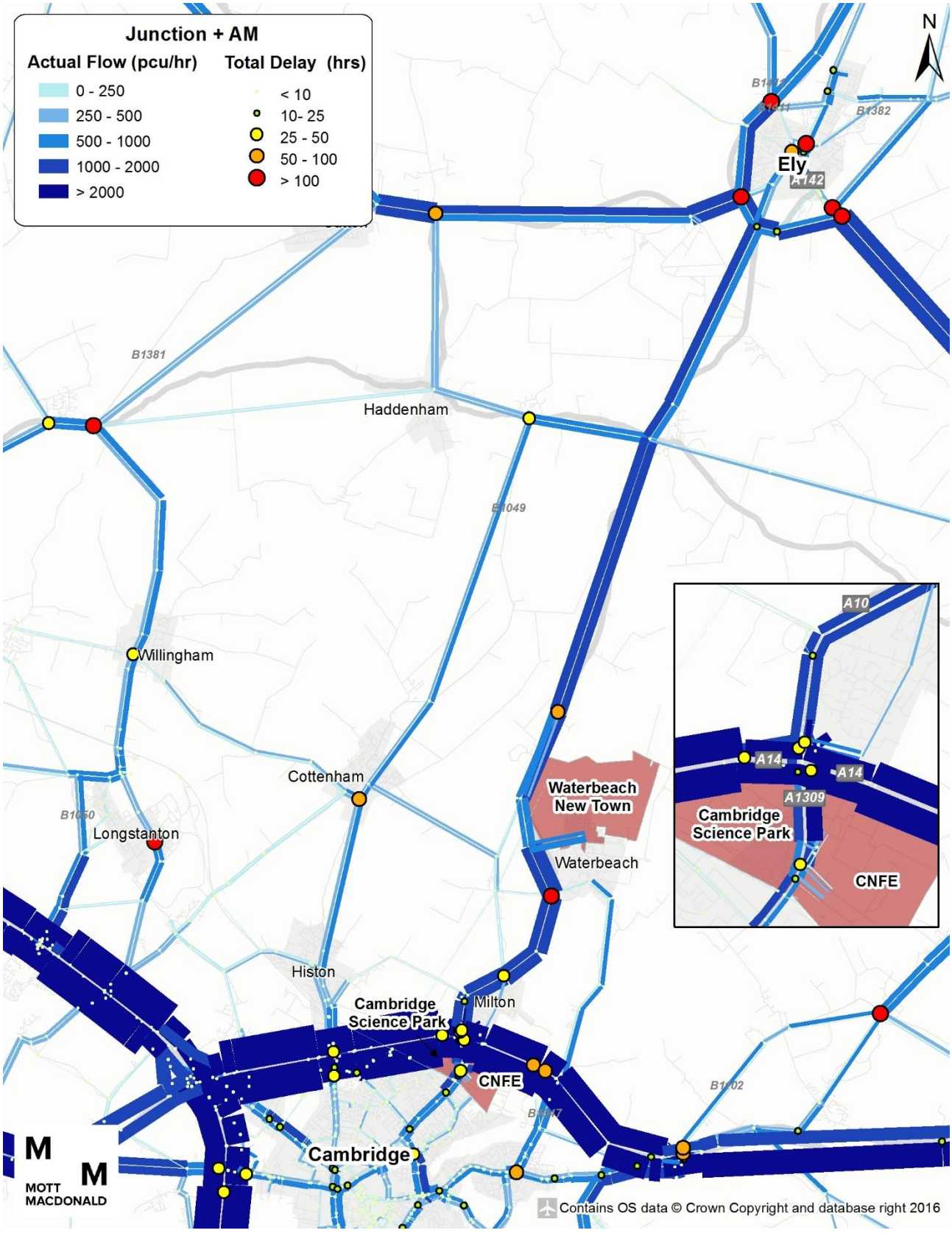
These figures for the AM peak show:

- As with the Mode-Shift package, high levels of junction delay around Ely and on the A10 at Car Dyke Road, but less so at Milton Interchange which is improved in this option, and generally less so than in the Combined-Scenario Do-Minimum situation. This is despite a general increase in flows on the A10 corridor, as a response to the lifting of junction capacity constraints.
- Flows on parallel routes are generally reduced compared to the Combined-Scenario Do-Minimum situation, except for southbound on Landbeach Road. This is because traffic is avoiding the delays at Car Dyke Road junction, so mitigation would be required to correct this. Likewise, the plan also shows an increase in southbound traffic through Milton, which could be to avoid A10 queueing for Milton Interchange. This response would also require mitigation.

These figures for the PM peak show:

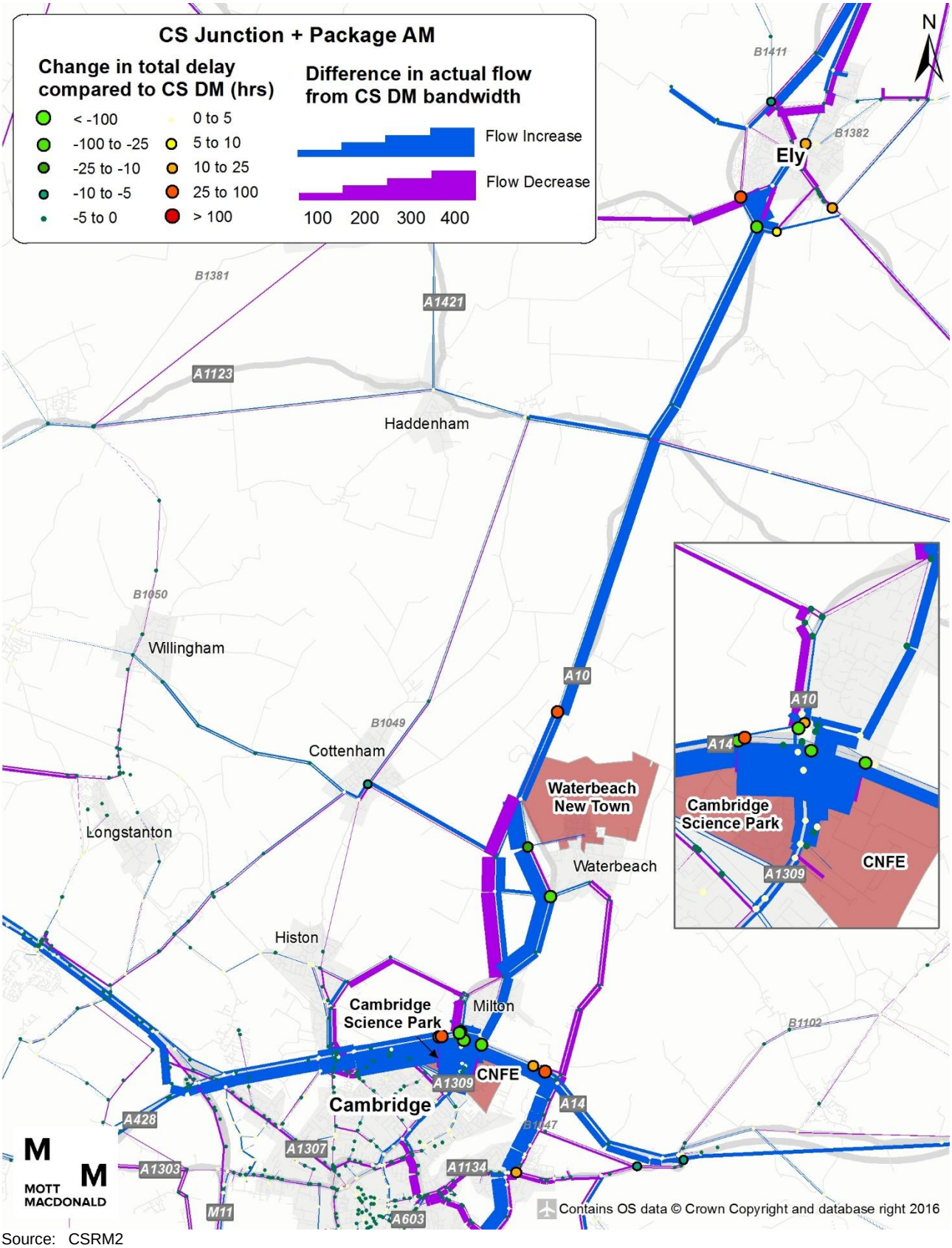
- As with the AM, high levels of junction delay around Ely and on the A10 route, but less so than in the Mode-Shift option and a general improvement in these areas compared to the Combined-Scenario Do-Minimum situation – particularly at Milton Interchange.
- Flows on the parallel B1047 and B1049 routes show small changes, with small reductions evident on the B1047 and on the northern section of the B1049, but a small increase on the southern section. Through Milton, however, and on Landbeach Road, larger increases are seen, which is a response to delays at the Butt Road and Car Dyke Road junctions. This response would require mitigation.

Figure 27: Junction+ package flow and delay distribution – AM peak



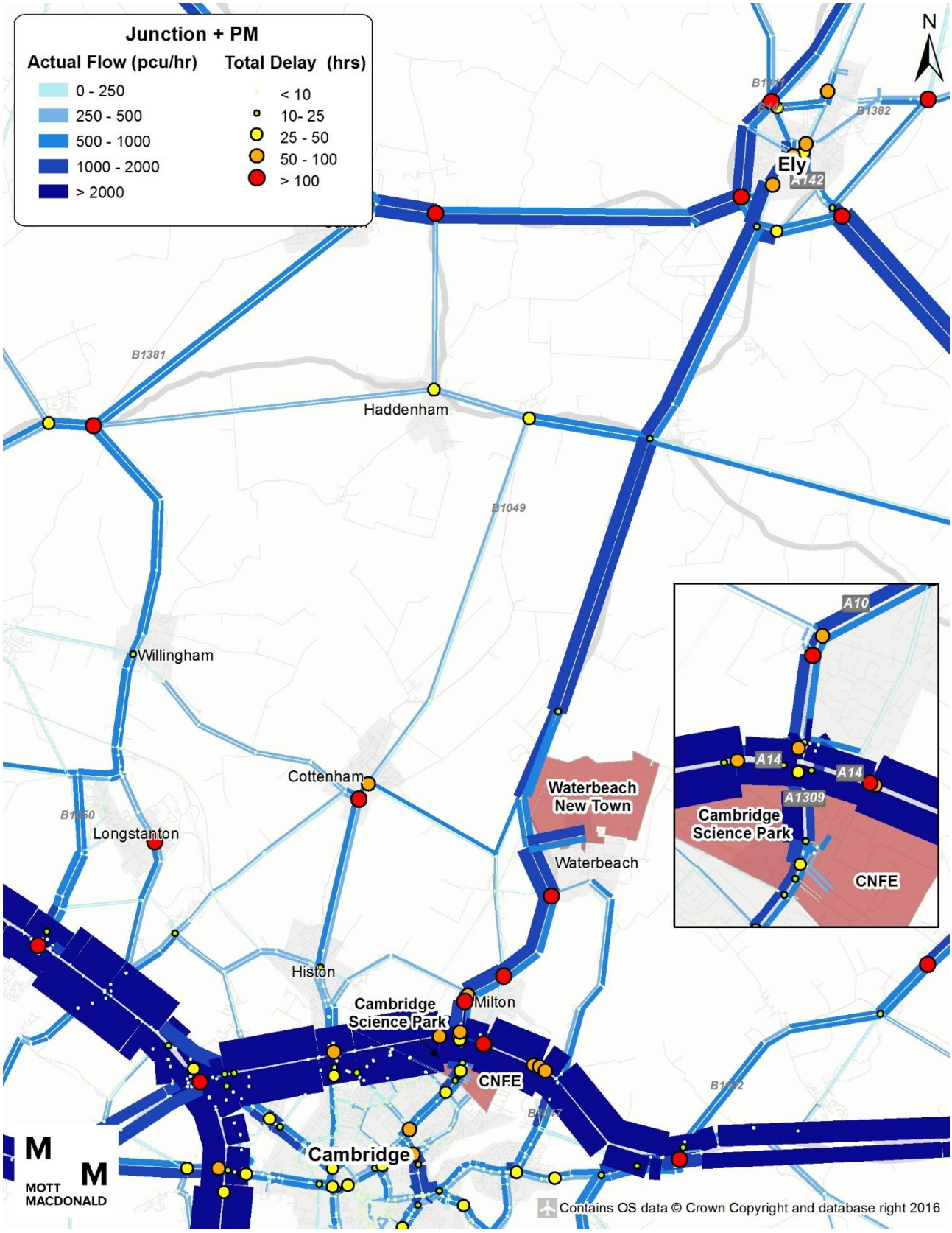
Source: CSRM2

Figure 28: Junction+ package flow and delay difference vs Combined Scenario Do Min – AM peak



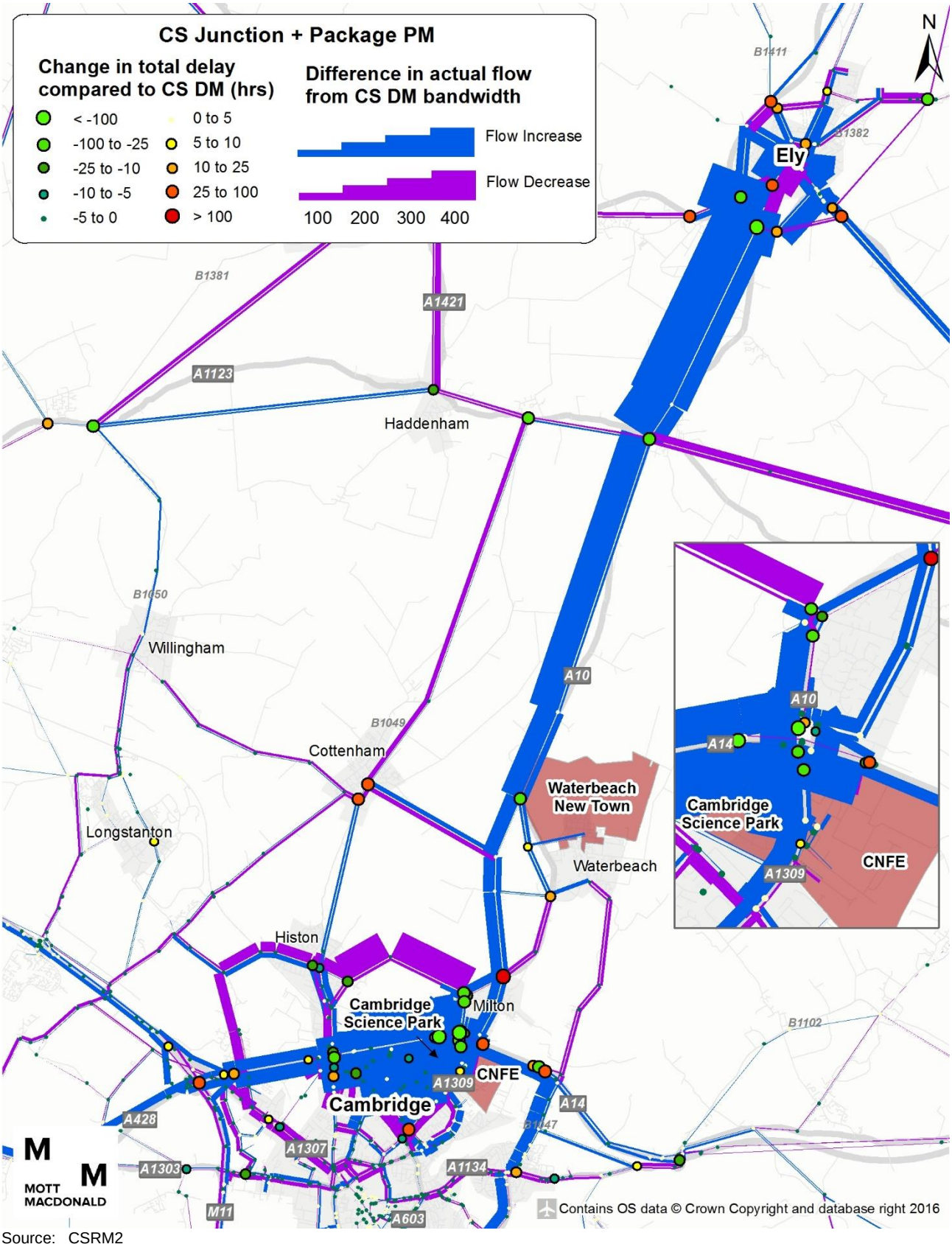
Source: CSRM2

Figure 29: Junction+ package flow and delay distribution – PM peak



Source: CSRM2

Figure 30: Junction+ package flow and delay difference vs Combined Scenario Do Min – PM peak



Source: CSRM2

5.3.2 Journey Time

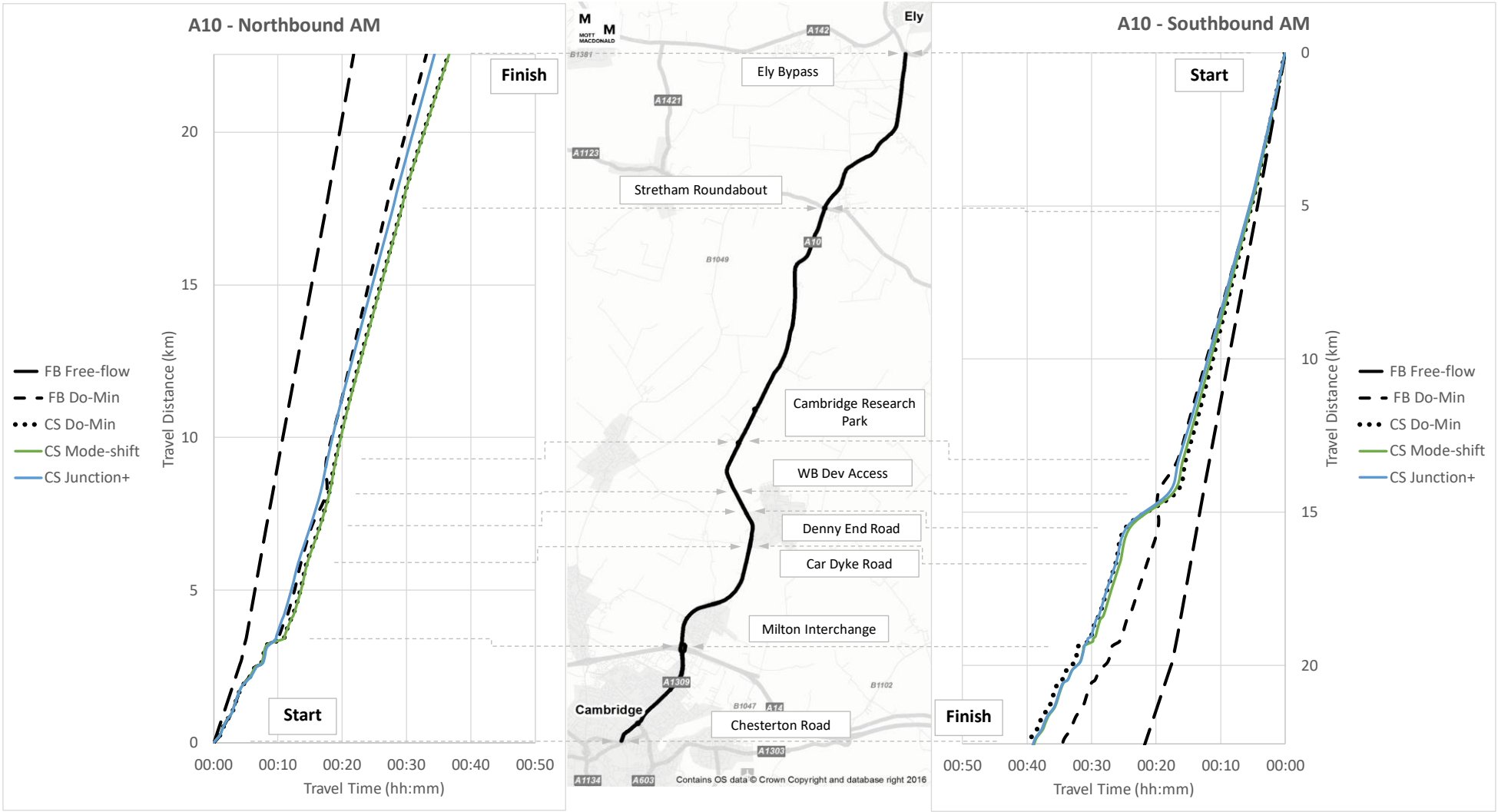
The following two figures show, for the AM and PM peak, modelled journey times along the A10 corridor between Chesterton Road and Ely bypass for the following scenarios:

- Future-Base Scenario Do-Minimum
- Combined-Scenario Do-Minimum
- Combined-Scenario Do-Something:
  - Mode-Shift package
  - Junction+ package

These charts show that:

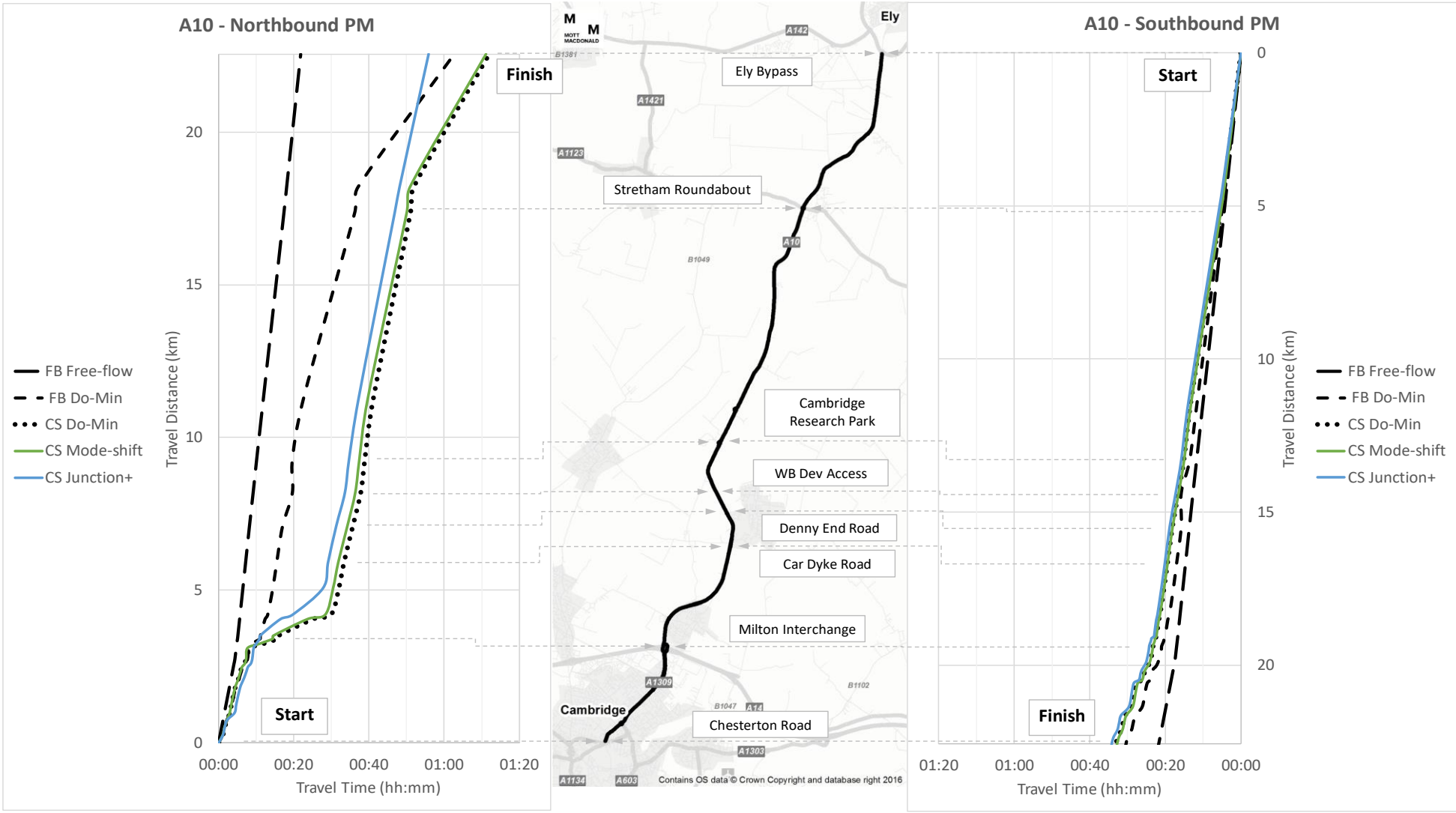
- In the AM peak, the Junction+ package delivers an overall improvement compared to the Combined-Scenario Do-Minimum situation over the length of the corridor in both directions. In the northbound direction, this improvement moves the journey time for this package quite close to the Future-Base Do-Minimum journey time, but in the southbound direction the difference is greater. Most of the delay increase in the latter case occurs on the southern section of the study area where flow increases are greatest.
- In the PM peak, the Junction+ package improves on the northbound journey time over the Combined Scenario Do-Minimum, Mode-Shift and Future-Base Do-Minimum scenarios. This is primarily achieved on the northern-most section, between Stretham and Ely, where the junction improvements reduce delay levels. In the southbound direction, this package shows little benefit, but delay levels in this direction are already relatively low for all options.

Figure 31: A10 corridor modelled journey times – 2031 AM peak



Source: CSRM2

Figure 32: A10 corridor modelled journey times – 2031 PM peak



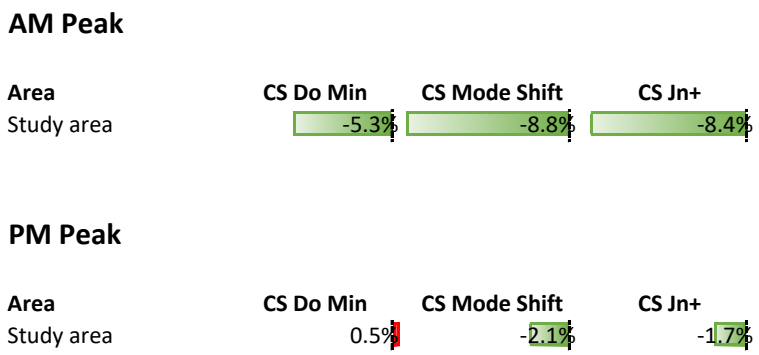
Source: CSRM2

5.4 Performance Indicator Summary

5.4.1 Car Mode Share

The following figure shows the modelled change in car mode share levels for the Combined-Scenario Junction+ package and the Combined-Scenario Do-Minimum situation compared to the Future-Base Do-Minimum situation. The Mode-Shift option is also shown for reference. The results listed are taken from the above analysis and are based on all weekday AM and PM peak hour trips between sectors most likely to use the study area (see Section 4.2.1 above).

Figure 33: Change in car mode share levels compared to Future-Base Do-Minimum



Source: CSRM2

These results show that:

- Compared to both the Future-Base Do-Minimum and the Combined-Scenario Do-Minimum, the Junction+ package delivers a car mode-share improvement in both peak hours, but not to the same extent as the Mode-Shift package.

5.4.2 Parallel Route Traffic Levels

The following figure shows the change in modelled traffic levels on routes parallel to the A10 for the Combined-Scenario Junction+ package and the Combined-Scenario Do-Minimum situation compared to the Future-Base Do-Minimum situation. The Mode-Shift option is also shown for reference.

The routes listed correspond to the analysis points shown in Figure 3 above as follows:

- B1047 (Horningsea Road) – point 6
- B1049 South (Histon Road) – point 4
- B1049 North (Twenty Pence Road) – point 8
- Landbeach Road – point 3

Figure 34: Change in parallel route traffic levels compared to Future-Base Do-Minimum

AM Peak

Parallel Route	CS Do Min	CS Mode Shift	CS Jn+
B1047	52%	49%	40%
B1049 South	-2%	-3%	-2%
B1049 North	14%	12%	14%
Landbeach Rd	18%	19%	8%
All routes	15%	14%	11%

PM Peak

Parallel Route	CS Do Min	CS Mode Shift	CS Jn+
B1047	56%	53%	50%
B1049 South	1%	-1%	1%
B1049 North	-10%	-10%	-11%
Landbeach Rd	-89%	-80%	-30%
All routes	-7%	-7%	3%

Source: CSRM2

These results show that:

- In the AM, traffic flows on parallel routes are generally greater with the Junction+ package than in the Future-Base Do-Minimum, but not as great as in the Combined-Scenario Do-Minimum situation or with the Mode-Shift package.
- In the PM, the Junction+ package improves upon the results for the other two scenarios shown for all routes except Landbeach Road, though flows on this route are still lower than in the Future-Base Do-Minimum scenario.

Overall, this package has a slightly negative impact on parallel route traffic levels, improving on the Combined-Scenario Do-Minimum situation in the AM peak but not in the PM peak, and resulting in an overall increase in traffic compared to the Future-Base Do-Minimum situation in both peaks. However, with appropriate mitigation, this impact could be effectively managed through the detailed design process.

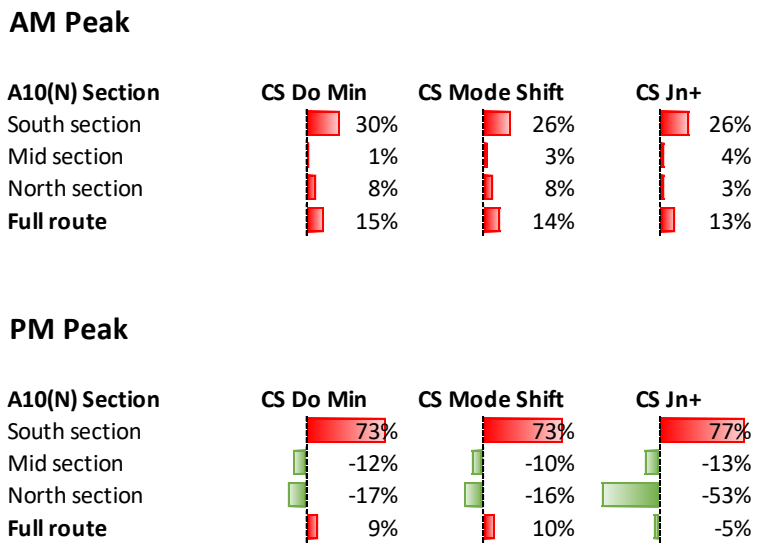
5.4.3 Journey Time

The following figure shows the change in modelled two-way highway journey times on the A10for the Combined-Scenario Junction+ package and the Combined-Scenario Do-Minimum situation compared to the Future-Base Do-Minimum situation. The Mode-Shift option is also shown for reference.

The journey times are shown by route section and for the full route, where the sections are as follows:

- South section – Milton Interchange to Cambridge Research Park
- Mid section – Cambridge Research Park to Stretham roundabout
- North section - Stretham roundabout to Ely bypass

Figure 35: Change in A10 journey time compared to Future-Base Do-Minimum



Source: CSRM2

These results show that:

- Compared to the Combined-Scenario Do-Minimum and Mode-Shift package, the Junction+ package delivers a small improvement overall in the AM peak and a larger improvement in the PM peak, where it also improves over the Future-Base Do-Minimum situation. In both peaks, the greatest benefits are seen on the north section of the corridor.

Overall, the Junction+ package results in improved journey times compared to the Combined-Scenario Do-Minimum, but not on every route section.

5.5 Results Summary

Overall, the Junction+ package shows positive impacts on mode choice for trips using the study area. This results in increased trip making in the study area and an overall reduction in the car mode share. In addition, and unlike the Mode-Shift option, this package also generates tangible journey time benefits on the A10 highway corridor. These results therefore further confirm the above Do-Minimum demand analysis conclusion that the Do Something packages will need to incorporate highway supply-side as well as demand-side measures (see Section 2.4), though it is noted that this package does not restore journey times to Future-Base levels. Further approaches to improving network performance are therefore considered in the following sections.

6 North-Dual Package Results

The purpose of this section is to describe and present the CSRM2 model results of the North-Dual Do-Something package option.

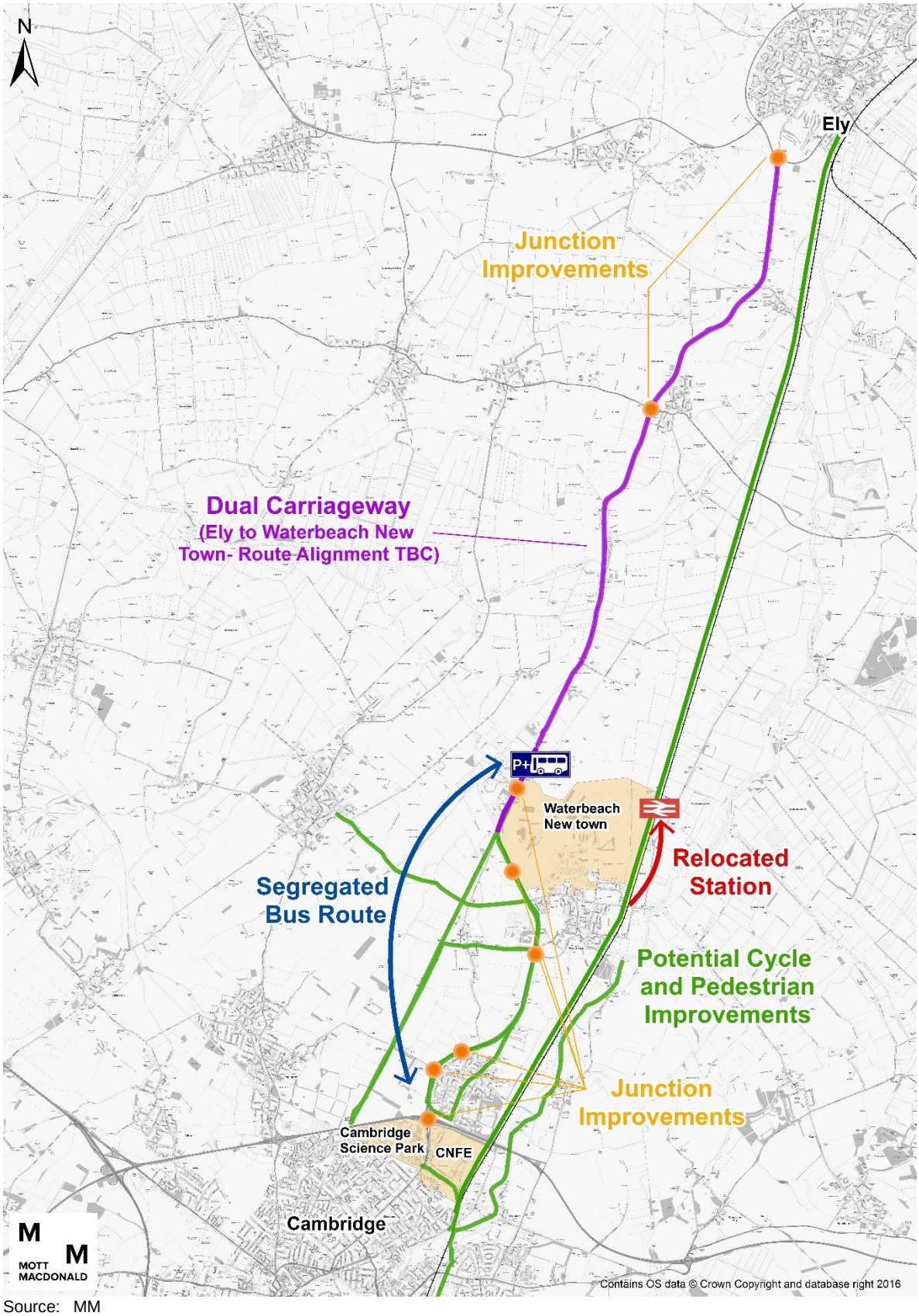
6.1 Package Description

The above results for the Junction+ package suggest that non-car improvements plus junction improvements alone will not be sufficient to allow the study area to perform as well in the Combined Scenario as in the Future-Base Scenario. The aim of the North-Dual package, therefore, is to test the effectiveness of some link capacity improvements to the A10(N) corridor in addition to the Mode-Shift and Junction+ measures. These improvements are in the form of dualling the A10 from the north access of the new town north of Waterbeach (Cambridge Research Park roundabout) to the Ely bypass.

The concept of this test is that, by not adding link capacity between the new Waterbeach P&R site and Cambridge, drivers will be more inclined to use the P&R site for this final element of their trip.

A summary of the measures included in this option is shown in Figure 36 below.

Figure 36: North-Dual package measures



Source: MM

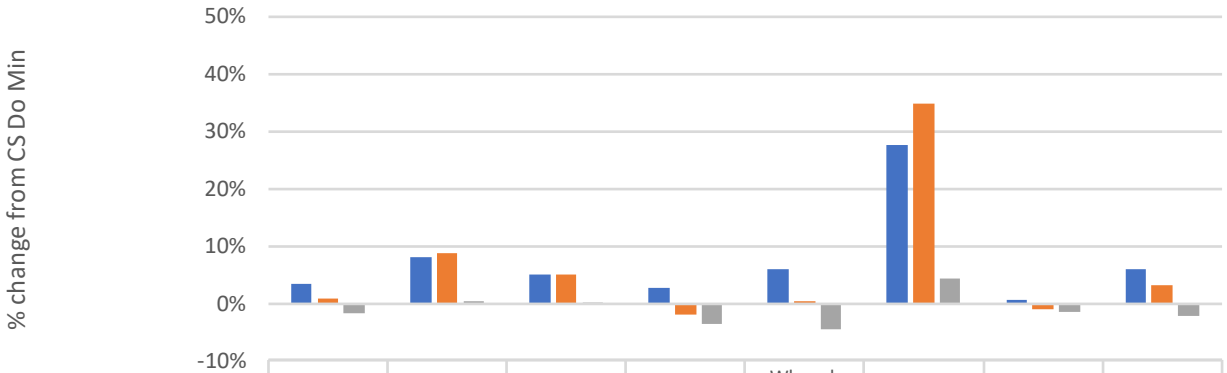
6.2 Trip Levels and Mode Choice

6.2.1 Study Area-Level Analysis

Using the same analysis method described above in Section 4.2.1 for the Mode-Shift package, the following chart shows how the Combined-Scenario North-Dual package differs from the Combined-Scenario Do-Minimum situation, at both the study area level and A10 highway corridor-using sector level, in terms of:

- Total person trips
- Total car trips
- Car mode share (which is a function of the difference between the above two results)

Figure 37: Change in corridor trips and car mode share by sector, CS North-Dual package vs CS DM



	Cambridge	CNFE	CSP	Wbeach	Wbeach New Town	Ely	External	A10
Change in person trips	3.4%	8.1%	4.9%	2.8%	6.0%	27.6%	0.5%	6.0%
Change in car trips	0.7%	8.7%	5.0%	-1.9%	0.2%	34.9%	-1.1%	3.2%
Change in car mode share	-1.8%	0.4%	0.0%	-3.6%	-4.5%	4.4%	-1.5%	-2.2%

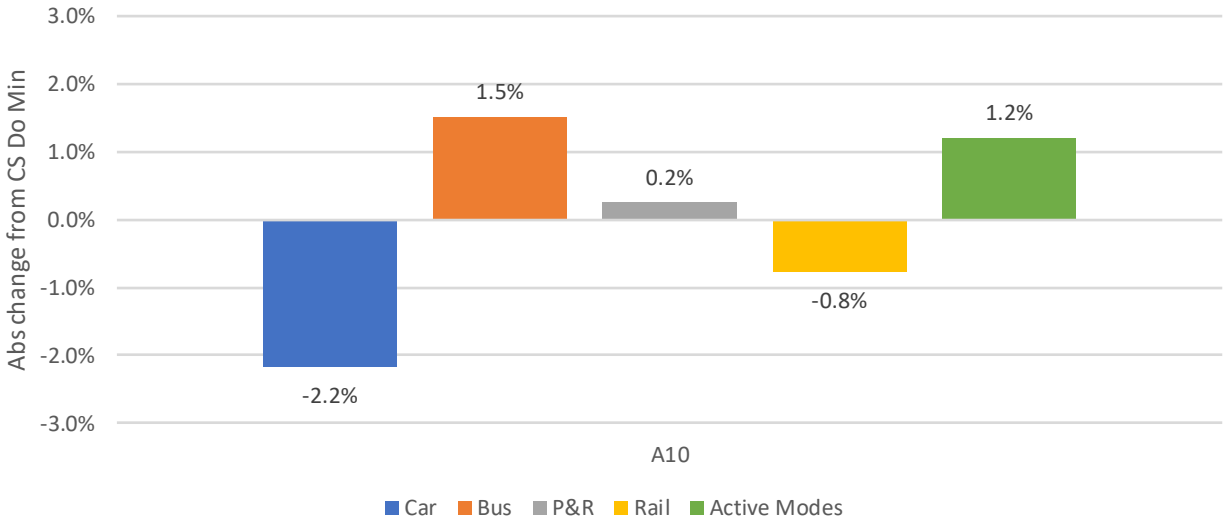
Source: CSRM2

This chart shows that:

- By further increasing the study area's overall transport capacity across both non-highway and highway modes, this package increases person trips on the A10 Highway corridor by 6.0%, compared to the 3.5% increase with the Junction+ package. As a result, car trips increase overall, but the car mode share is still 2.2% lower than in the Combined-Scenario Do-Minimum.
- In terms of the distribution of changes, it is similar to the Junction+ option, except with significantly greater person-trip, car-trip and car mode share increases for trips to and from Ely. This is a response to considerable link capacity increases on the north section between Ely and Waterbeach. As a result, the car mode share of trips to and from this location increases by 4.4%.

In terms of the modes shifted to from the car, the following chart shows mode shift levels for the Combined-Scenario North-Dual package compared to the Combined-Scenario Do-Minimum situation at the study area level.

Figure 38: Study area mode shift by mode, CS North-Dual package vs CS Do Min



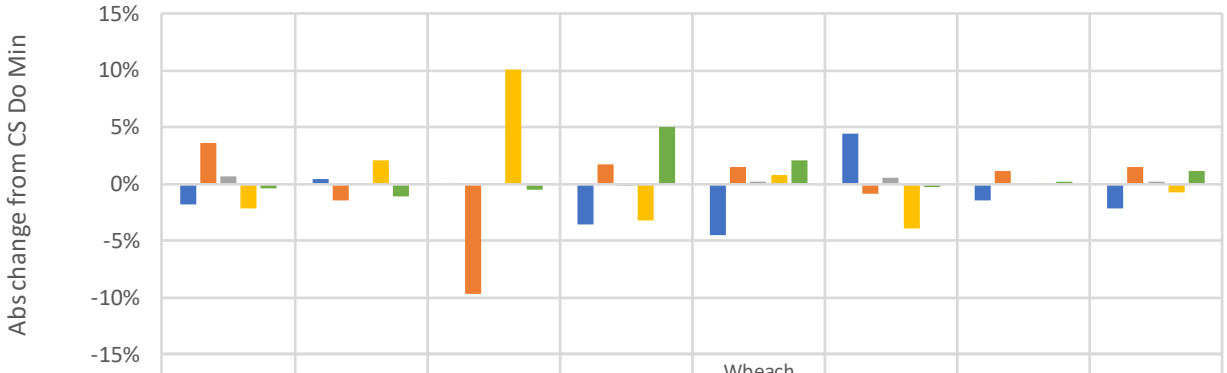
Source: CSRM2

This chart shows a similar mode-shift profile to the Junction+ result, but with a slightly lower drop in car mode share and a greater drop in rail mode share. This transfer shows that use of the rail mode is directly affected by improvements for highway users.

It is also noted that the park & ride mode share increase for this package is no greater than for the Junction+ package, which suggests that the concept of adding capacity to the upstream approaches but not to the downstream links is not delivering the results intended.

The following chart expands this same result to show how it is distributed across the corridor's component sectors:

Figure 39: Mode shift by mode and sector for study area trips, CS North-Dual package vs CS Do Min



	Cambridge	CNFE	CSP	Wbeach	Wbeach New Town	Ely	External	A10
Car	-1.8%	0.4%	0.0%	-3.6%	-4.5%	4.4%	-1.5%	-2.2%
Bus	3.7%	-1.4%	-9.6%	1.8%	1.5%	-0.9%	1.2%	1.5%
P&R	0.7%	0.0%	0.0%	-0.1%	0.2%	0.6%	0.0%	0.2%
Rail	-2.2%	2.1%	10.1%	-3.2%	0.8%	-3.9%	0.1%	-0.8%
Active Modes	-0.4%	-1.1%	-0.5%	5.0%	2.1%	-0.2%	0.2%	1.2%

Source: CSRM2

This chart shows a very similar distribution of results to the Junction+ option, except that:

- The increase in car mode share for trips to and from Ely has come largely at the expense of the rail mode share, which mainly accounts for the overall corridor-level rail mode shift result shown above.

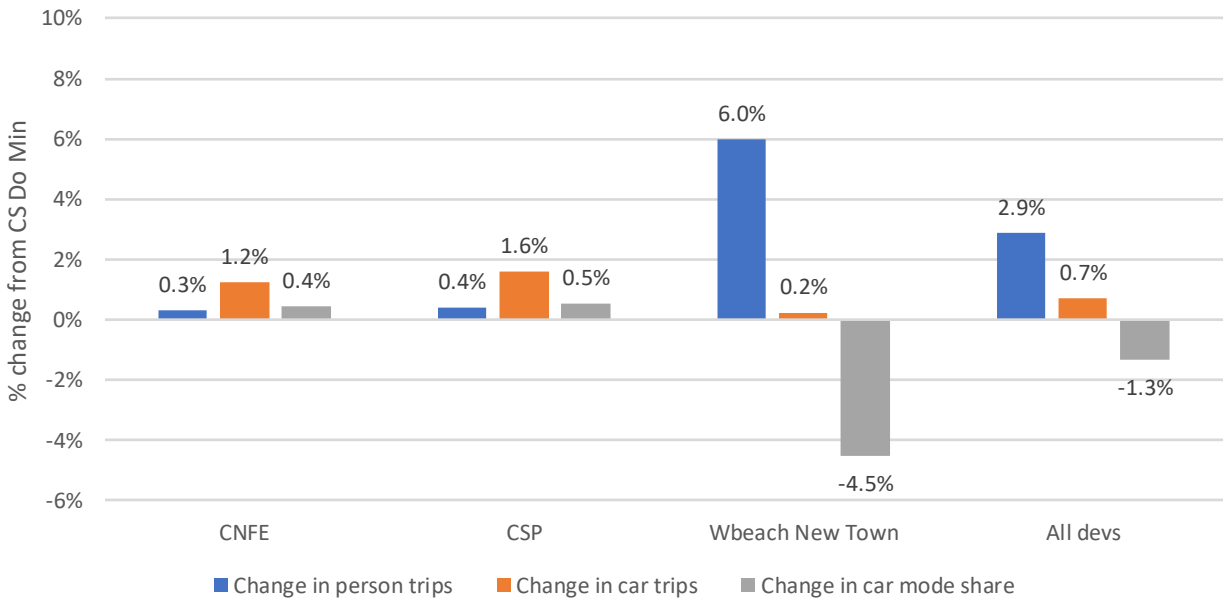
6.2.2 Development-Level Analysis

The following charts present demand model output results for the new developments proposed for the study area in terms of all external trips which serve them, and not just those which interact with the A10. These results allow the full impact of the Do Something package on each development to be understood.

For each development, the following chart (scaled to be consistent for all Do Something package results) shows how the Combined-Scenario North-Dual package differs from the Combined-Scenario Do-Minimum situation in terms of:

- Total person trips
- Total car trips
- Car mode share (which is related to the difference between the above two results)

Figure 40: Change in all external trips and car mode share by dev, CS North-Dual package vs CS DM



Source: CSRM2

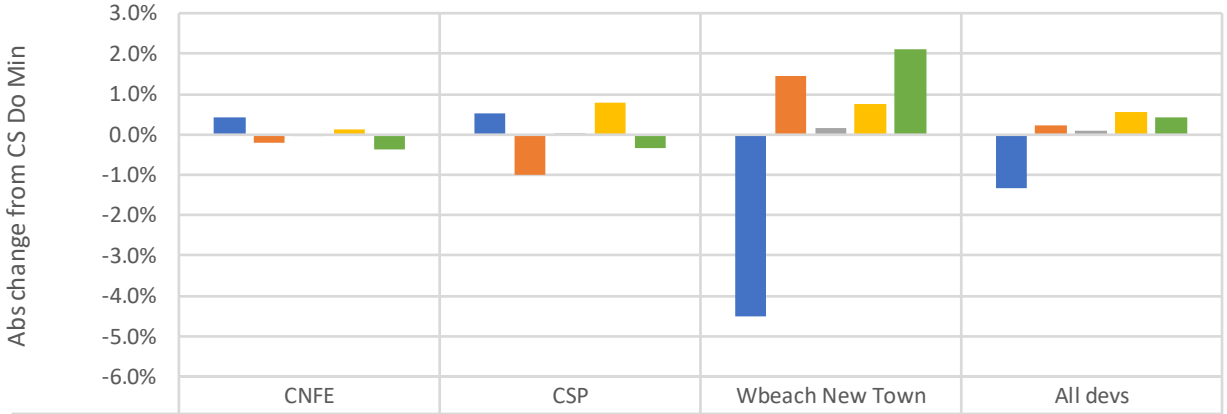
This chart shows that:

- The same results for the new town north of Waterbeach as shown above in the study area-level results. This is because all external trips to and from this development must use the A10 Highway corridor. These results show an even greater increase in person trips than for the Junction+ option as further highway capacity improvements permit more trips to be released from the site. However, due to nearly the same level of car mode share decrease, this increase only results in a negligible increase in car trips generated by the site.
- Little change in trips and mode share to and from the CNFE and CSP developments, but car mode share change a little higher than in the study area-level results. This reflects that the measures proposed in this package are focussed mainly on the A10 corridor and not on other routes serving these developments.

- Overall, across all three new developments, the results show a net increase in person trips, a small change in car trips and a decrease in car mode share.

In terms of the modes shifted to for each development, the following chart (scaled to be consistent for all Do Something package results) shows mode shift levels for the Combined-Scenario North-Dual package compared to the Combined-Scenario Do-Minimum situation.

Figure 41: Development-level external-trip mode shift by mode, CS North-Dual package vs CS Do Min



	CNFE	CSP	Wbeach New Town	All devs
Car	0.4%	0.5%	-4.5%	-1.32%
Bus	-0.2%	-1.0%	1.5%	0.24%
P&R	0.0%	0.0%	0.2%	0.08%
Rail	0.1%	0.8%	0.8%	0.57%
Active Modes	-0.4%	-0.3%	2.1%	0.43%

Source: CSRM2

This chart shows that:

- The same results for the new town north of Waterbeach as shown above in the study area-level results. This is because all external trips to and from this development must use the A10. However, these results show that the greatest shift from the car is to active modes, followed by bus, rail and park & ride. The shift to bus is greater than in the Mode-Shift package, which shows that the highway improvements are generating bus performance improvements which helps to increase use of this mode.
- A decline in mode share for bus and active modes at both CNFE and CSP, shifting to rail and car. There is a greater increase in rail mode share at CSP compared to CNFE, at 0.8% rather than 0.1%, with the car mode share being the main increase at CNFE. However, all changes are relatively minor.
- Across the three developments, there is an overall decrease in car mode share and an increase in bus, P&R, rail and active modes. The largest increases in mode share are for rail and active modes.

6.2.3 Trip Levels and Mode Choice Summary

Overall, the North-Dual package has a mixed impact on travel behaviour within the study area and its environs when measured against the equivalent Do Minimum situation, with the car mode share reducing on average for the study area and for the new developments, but with car trips and mode share increasing significantly for trips to and from Ely on the improved north section of the A10 highway corridor.

6.3 Highway Network Performance

6.3.1 Flow and Delay

For each peak hour, the following figures show:

- Predicted traffic flows and total junction delays for the North-Dual option
- The difference in traffic flows and total junction delays between the North-Dual option and the Combined-Scenario Do-Minimum situation

Traffic flow data is shown as scaled bands, where the width and colour reflect the flow level, while junction delays are shown as scaled circles, where the size and colour reflect delay levels.

The results are compared in this section against the Combined-Scenario Do-Minimum instead of against the Future-Base Do-Minimum in order to isolate the impacts of the mitigation measures.

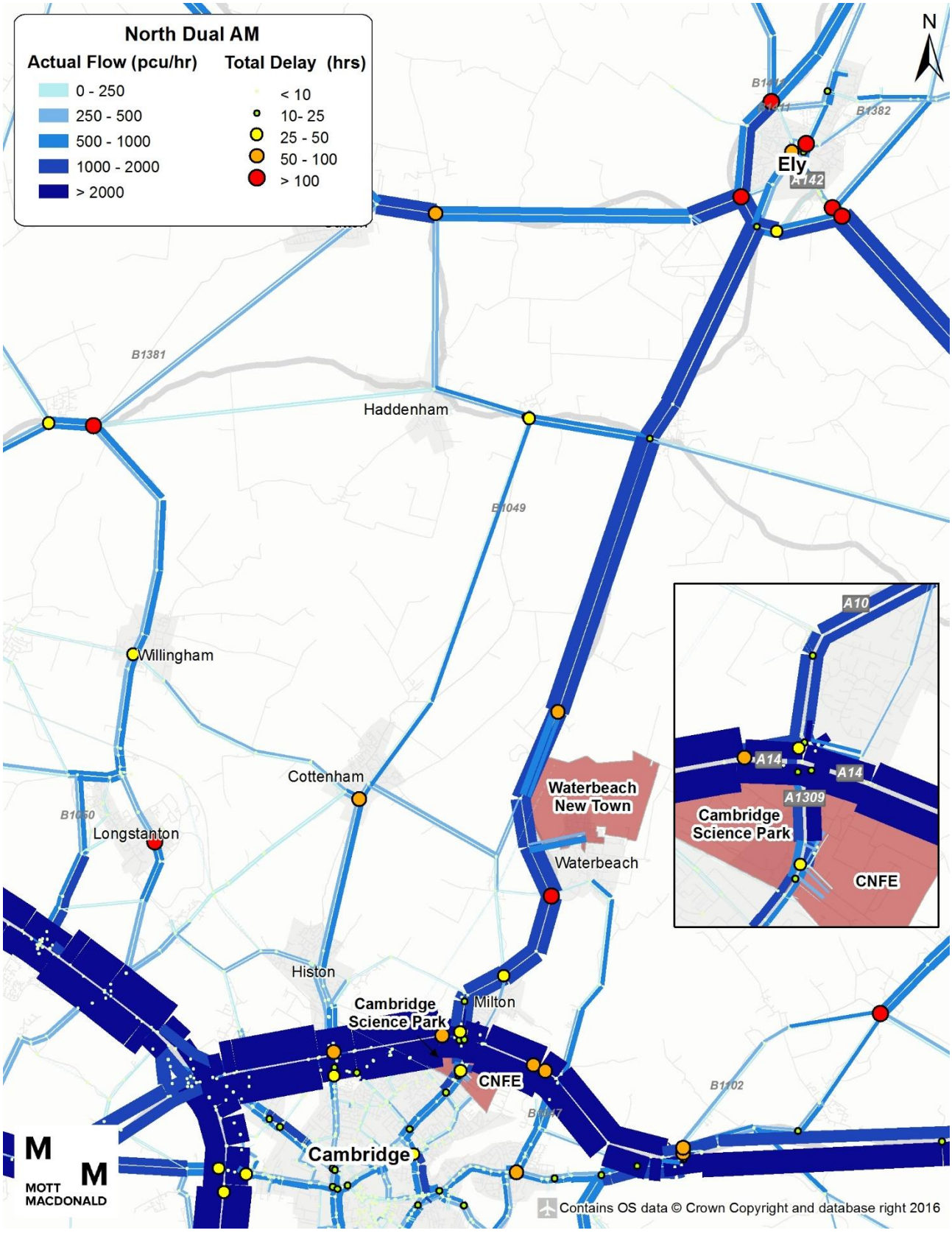
These figures for the AM peak show:

- Compared to the Combined-Scenario Do-Minimum situation, the northern dualled section shows a high increase in demand, which increases northbound demand on the southern section. This, in turn, leads to some total delay increases at junctions north and south of new town north of Waterbeach, which would require mitigation through further detailed design.
- Flows on parallel routes are generally reduced compared to the Combined-Scenario Do-Minimum situation, except for southbound on Landbeach Road and through Milton. This is because traffic is avoiding the delays at Car Dyke Road junction and queueing for Milton Interchange, and would require further mitigation. This situation is improved over the Junction+ scenario, however.

These figures for the PM peak show:

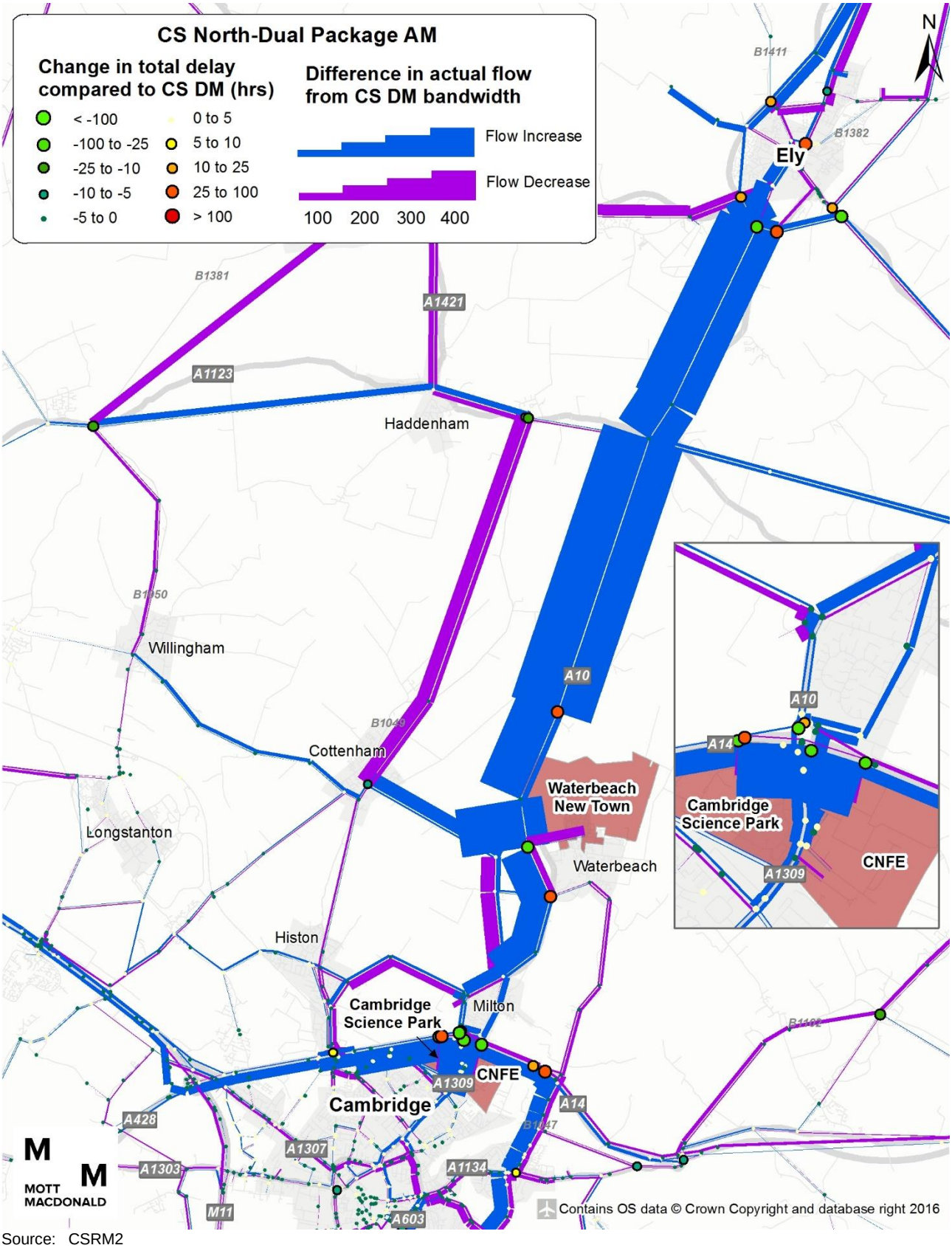
- As with the AM, significant increases in demand on the northern dualled section which increases delays around Ely. The added demand also increases pressure and total delays on the southern section.
- Flows on the parallel B1047 and B1049 routes show small changes, with small reductions evident on the B1047 and on the northern section of the B1049, but increases on the southern section. Through Milton, however, and on Landbeach Road, larger increases are seen, which is a response to delays at the Butt Road and Car Dyke Road junctions. This response would require mitigation.

Figure 42: North-Dual package flow and delay distribution – AM peak



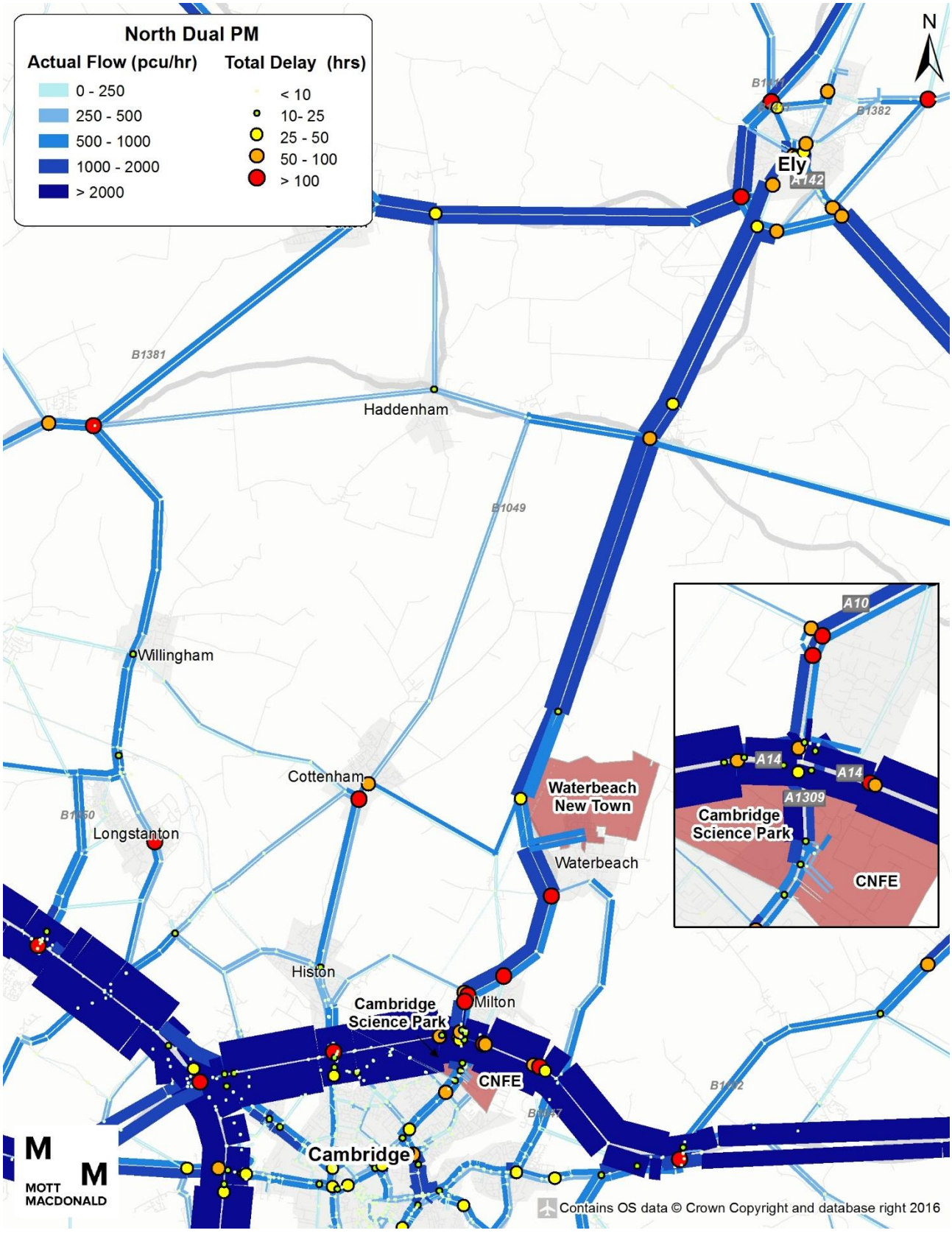
Source: CSRM2

Figure 43: North-Dual package flow and delay difference vs Combined Scenario Do Min – AM peak



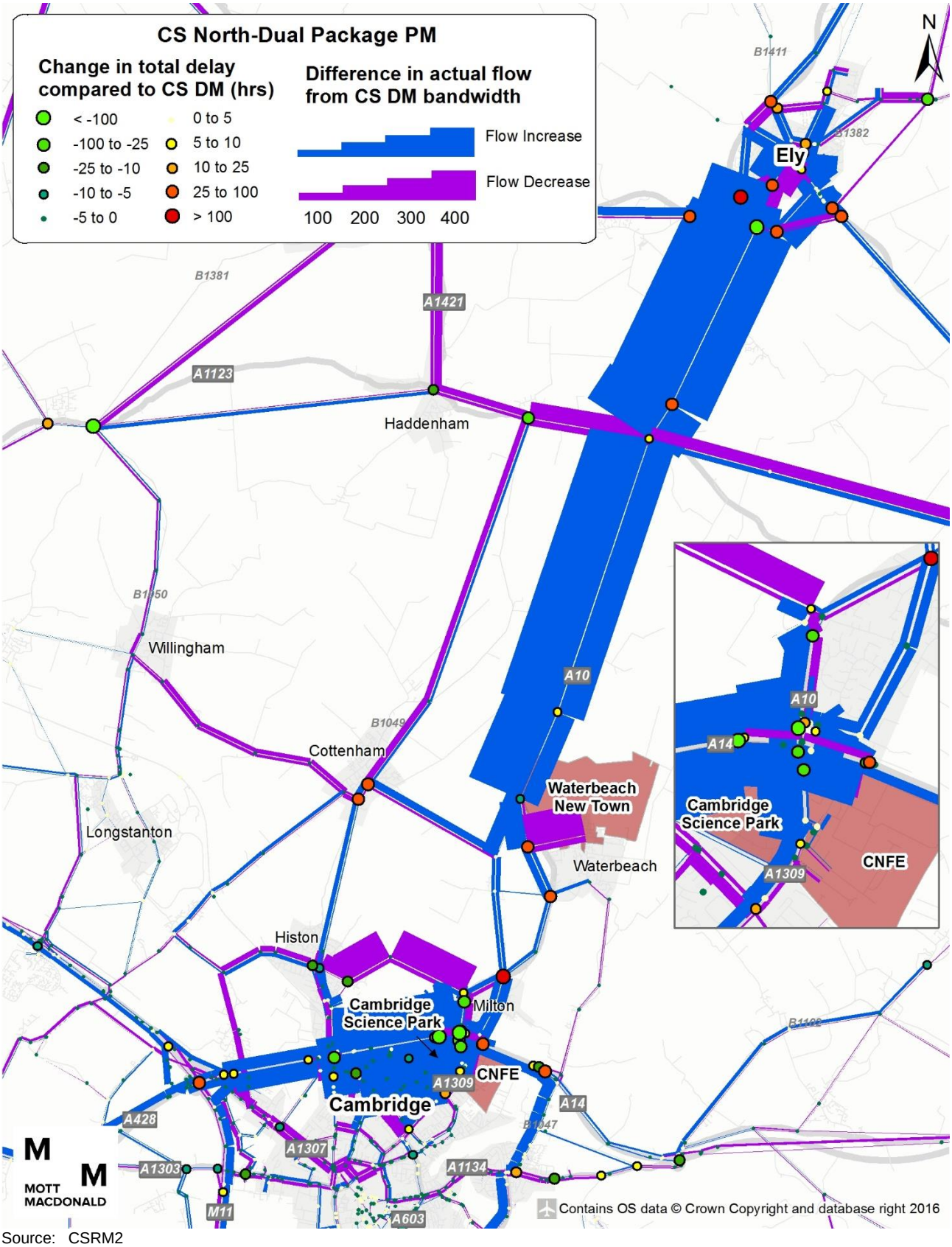
Source: CSRM2

Figure 44: North-Dual package flow and delay distribution – PM peak



Source: CSRM2

Figure 45: North-Dual package flow and delay difference vs Combined Scenario Do Min – PM peak



Source: CSRM2

6.3.2 Journey Time

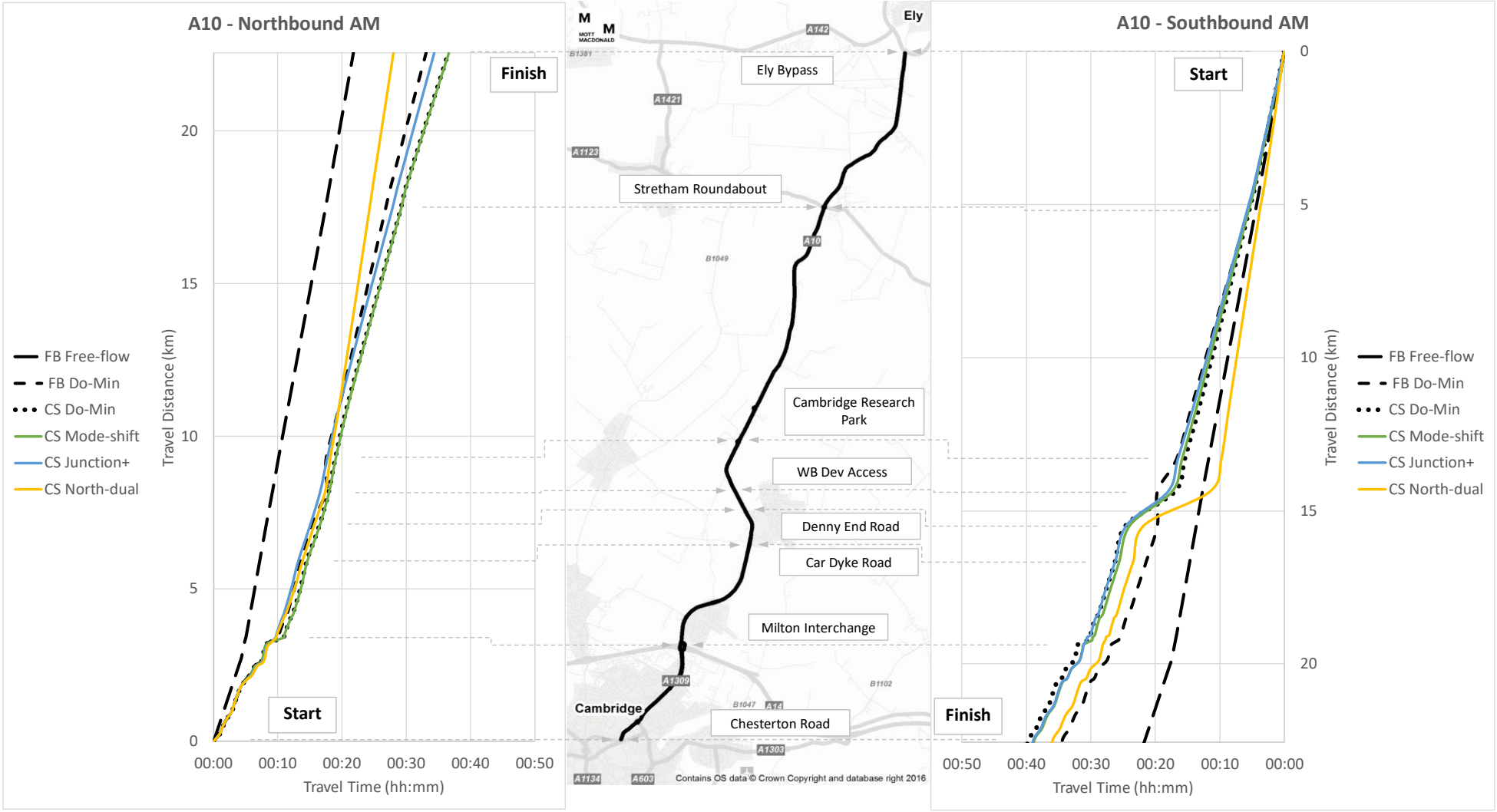
The following two figures show, for the AM and PM peak, modelled journey times along the A10 highway corridor between Chesterton Road and Ely bypass for the following scenarios:

- Future-Base Scenario Do-Minimum
- Combined-Scenario Do-Minimum
- Combined-Scenario Do-Something:
  - Mode-Shift package
  - Junction+ package
  - North-Dual package

These charts show that:

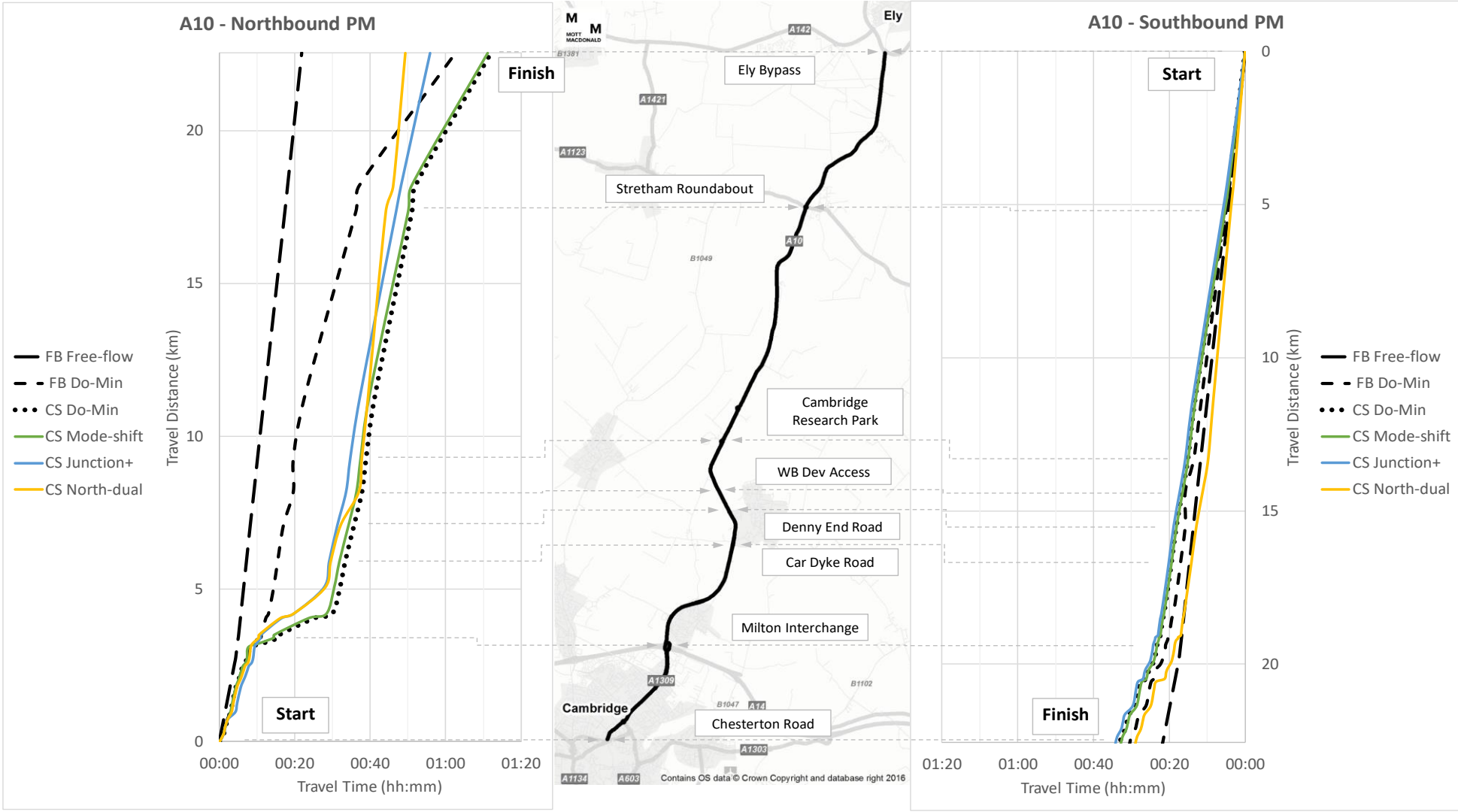
- In the AM peak, the North-Dual package delivers an overall improvement compared to the Combined-Scenario Do-Minimum situation over the length of the A10 highway corridor in both directions, and compared to the Future-Base Do-Minimum in the northbound direction. In the southbound direction, this package delivers an improved journey time than the Future-Base Do-Minimum for the dualled section of the route, but then loses all the gains through delays associated with the merge to single carriageway. Overall, however, the combined journey time in both directions is improved over both Do-Minimum options.
- In the PM peak, the North-Dual package improves on the full-corridor journey time over both the Future-Base and Combined Scenario Do-Minimum situations in both directions. In the northbound direction, this is primarily achieved on the northern-most section, between Stretham and Ely, where the dualling reduces delay levels.

Figure 46: A10 corridor modelled journey times – 2031 AM peak



Source: CSRM2

Figure 47: A10 corridor modelled journey times – 2031 PM peak



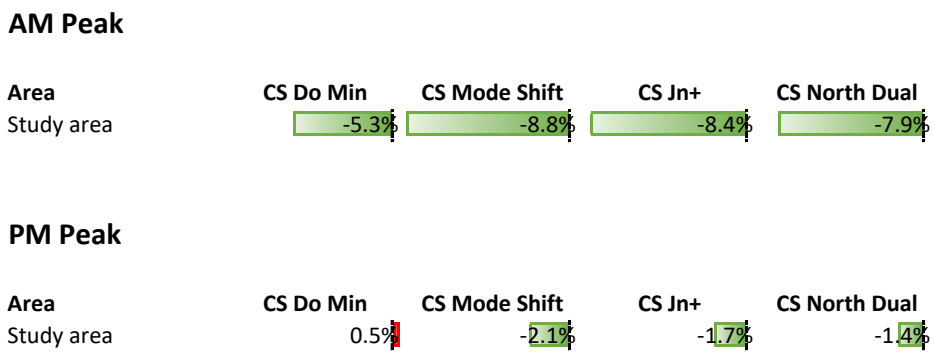
Source: CSRM2

6.4 Performance Indicator Summary

6.4.1 Car Mode Share

The following figure shows the modelled change in car mode share levels for the Combined-Scenario North-Dual package and the Combined-Scenario Do-Minimum situation compared to the Future-Base Do-Minimum situation. The Mode-Shift and Junction+ options are also shown for reference. The results listed are taken from the above analysis and are based on all weekday AM and PM peak hour trips between sectors most likely to use the study area (see Section 4.2.1 above)

Figure 48: Change in car mode share levels compared to Future-Base Do-Minimum



Source: CSRM2

These results show that:

- Compared to both the Future-Base Do-Minimum and the Combined-Scenario Do-Minimum, the North-Dual package delivers a car mode-share improvement in both peak hours, but not to the same extent as the Mode-Shift and Junction+ packages.

6.4.2 Parallel Route Traffic Levels

The following figure shows the change in modelled traffic levels on routes parallel to the A10 for the Combined-Scenario North-Dual package and the Combined-Scenario Do-Minimum situation compared to the Future-Base Do-Minimum situation. The Mode-Shift and Junction+ options are also shown for reference.

The routes listed correspond to the analysis points shown in Figure 3 above as follows:

- B1047 (Horningsea Road) – point 6
- B1049 South (Histon Road) – point 4
- B1049 North (Twenty Pence Road) – point 8
- Landbeach Road – point 3

Figure 49: Change in parallel route traffic levels compared to Future-Base Do-Minimum

AM Peak

Parallel Route	CS Do Min	CS Mode Shift	CS Jn+	CS North Dual
B1047	52%	49%	40%	43%
B1049 South	-2%	-3%	-2%	-4%
B1049 North	14%	12%	14%	-18%
Landbeach Rd	18%	19%	8%	-10%
All routes	15%	14%	11%	0%

PM Peak

Parallel Route	CS Do Min	CS Mode Shift	CS Jn+	CS North Dual
B1047	56%	53%	50%	55%
B1049 South	1%	-1%	1%	-2%
B1049 North	-10%	-10%	-11%	-5%
Landbeach Rd	-89%	-80%	-30%	-48%
All routes	-7%	-7%	3%	1%

Source: CSRM2

These results show that:

- In the AM, traffic flows on parallel routes are generally equivalent to those in the Future-Base Do-Minimum, and improved compared to the other Combined-Scenario situations.
- In the PM, the North-Dual package gives similar results to the Junction+ package. Overall, it does not give the improvement of the Combined-Scenario Do-Minimum or Mode-Shift options, but provides a similar result to the Future-Base Do-Minimum.
- In both peak hours, flow increases on the B1047 will require further mitigation.

Overall, this package has a generally neutral impact on parallel route traffic levels, improving on the Combined-Scenario Do-Minimum situation in the AM peak but not in the PM peak, and resulting in an overall no improvement in traffic compared to the Future-Base Do-Minimum situation in both peaks. However, with appropriate mitigation, these impacts could be effectively managed through the detailed design process.

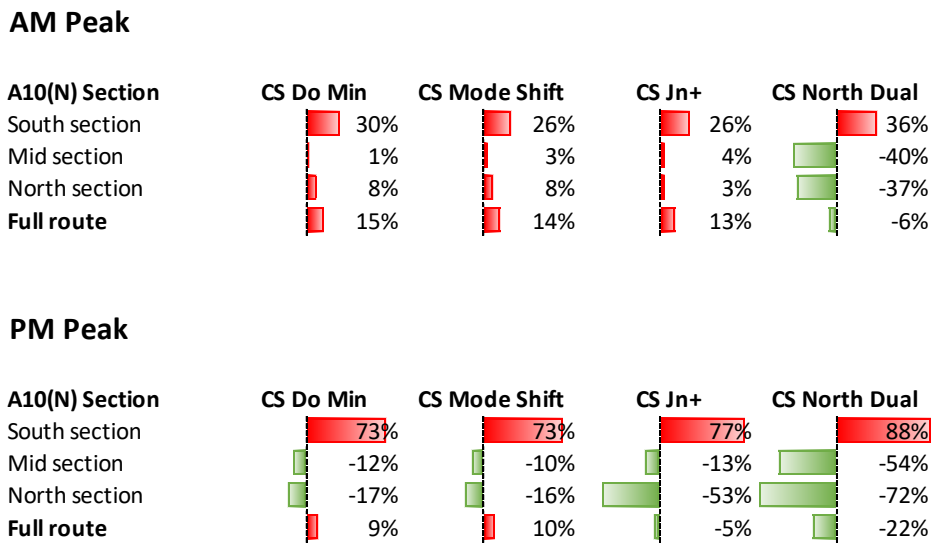
6.4.3 Journey Time

The following figure shows the change in modelled two-way highway journey times on the A10for the Combined-Scenario North-Dual package and the Combined-Scenario Do-Minimum situation compared to the Future-Base Do-Minimum situation. The Mode-Shift and Junction+ options are also shown for reference.

The journey times are shown by route section and for the full route, where the sections are as follows:

- South section – Milton Interchange to Cambridge Research Park
- Mid section – Cambridge Research Park to Stretham roundabout
- North section - Stretham roundabout to Ely bypass

Figure 50: Change in A10 corridor journey time compared to Future-Base Do-Minimum



Source: CSRM2

These results show that:

- Compared to the Future-Base and the other Combined-Scenario results, the North-Dual package delivers journey time improvements in both peak hours. This is due to significant improvements on the mid and north sections where the dualling is applied, but it is noted that journey times deteriorate on the south section in both peaks. This is due to there not being enough capacity on this section to accommodate the additional demand attracted by the north section.

Overall, the North-Dual package results in improved full-corridor journey times compared to both the Future-Base and Combined-Scenario Do-Minimum situations, but not on the southern section.

6.5 Results Summary

Overall, the North-Dual package shows mixed impacts on mode choice. On the study area, this package results in increased trip making and an overall reduction in the car mode share compared to both the Future-Base and the Combined-Scenario Do-Minimum situations. However, both car trip and car mode share levels are significantly increased to and from Ely because of the increased capacity serving this location. Use of park & ride is also not as increased as would be expected from the concept of this option.

In terms of journey time benefits on the A10 highway corridor, this package delivers improvements over the full route compared to both the Future-Base and Combined-Scenario Do-Minimum situations. This is due to improvements over the dualled section, but the extra traffic this puts onto the single-lane southern section results in a deterioration in performance there.

This Do Something option therefore establishes the potential benefits to the corridor of dualling in combination with non-highway improvements. The following two options consider variants on this theme.

7 South-Dual Package Results

The purpose of this section is to describe and present the CSRM2 model results of the South-Dual Do-Something package option.

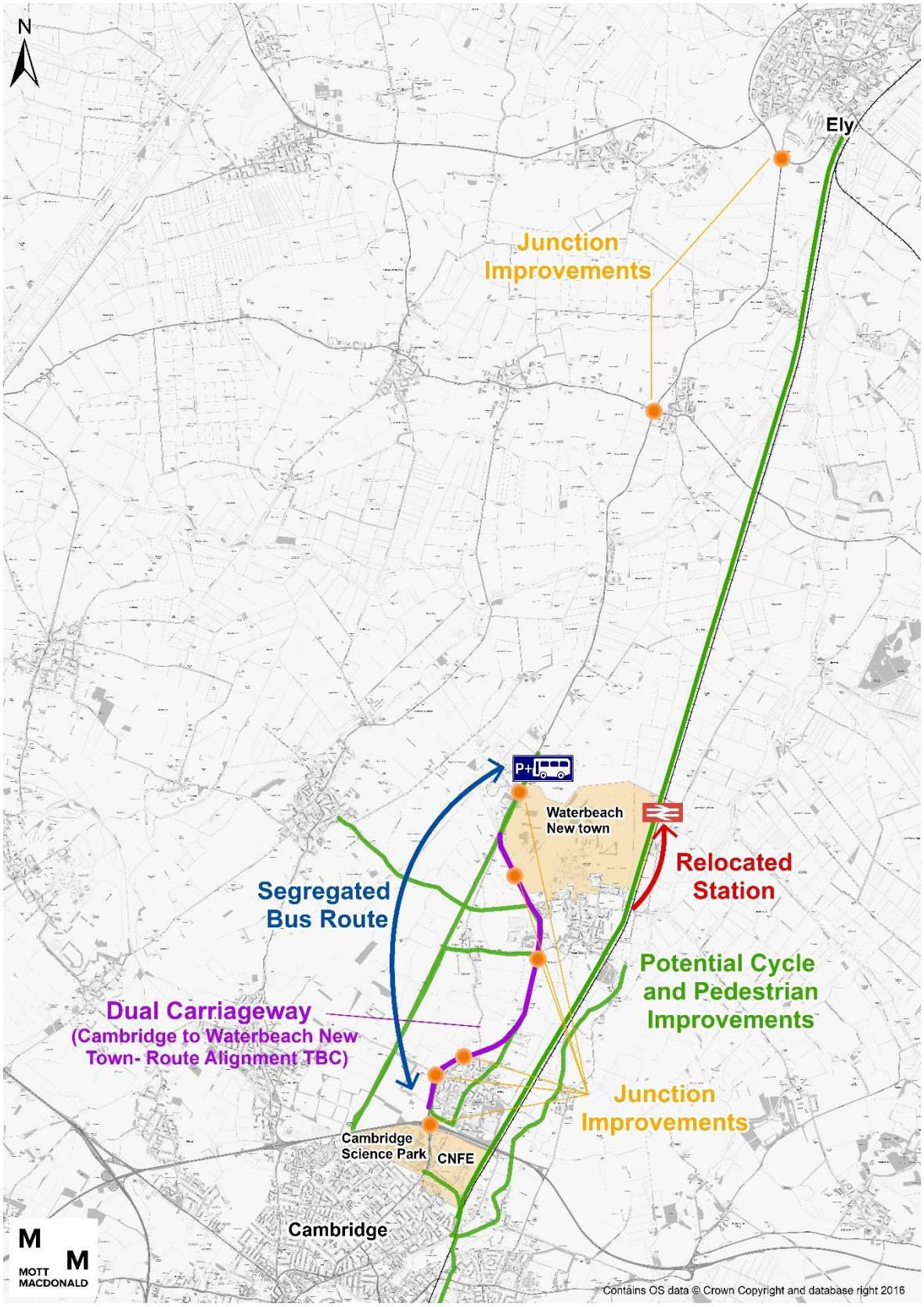
7.1 Package Description

The above results for the North-Dual package show an overall performance improvement for the study area compared with the Future-Base Scenario, but with worse performance on the southern undualled section.

Figure 4**Error! Reference source not found.** above shows that the new development flows, and therefore background traffic displacement levels, are predicted to be highest on the southern section of the A10(N) corridor. Figure 5 also predicts greatest parallel route traffic impacts on the B1049, which provides an alternative route for this section. The aim of this Do-Something package is therefore to complement the non-car and junction improvement measures of the Mode-Shift and Junction+ options with the dualling of the A10 between the southern access of the new town north of Waterbeach and the A14.

A summary of the measures included in this option is shown in Figure 51 below.

Figure 51: South-Dual package measures



Source: MM

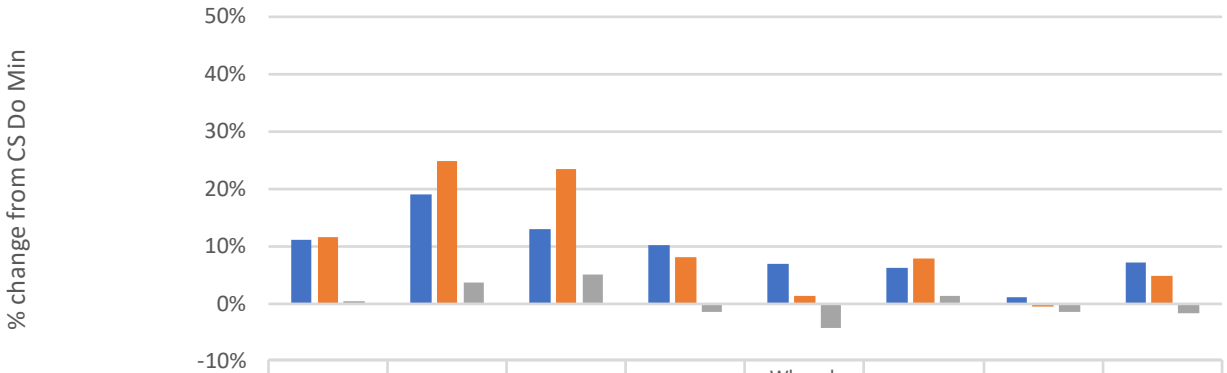
7.2 Trip Levels and Mode Choice

7.2.1 Study Area-Level Analysis

Using the same analysis method described above in Section 4.2.1 for the Mode-Shift package, the following chart shows how the Combined-Scenario South-Dual package differs from the Combined-Scenario Do-Minimum situation, at both the study area level and A10 Highway corridor-using sector level, in terms of:

- Total person trips
- Total car trips
- Car mode share (which is a function of the difference between the above two results)

Figure 52: Change in corridor trips and car mode share by sector, CS South-Dual package vs CS DM



	Cambridge	CNFE	CSP	Wbeach	Wbeach New Town	Ely	External	A10
Change in person trips	11.0%	19.0%	13.0%	10.1%	6.9%	6.1%	0.9%	7.2%
Change in car trips	11.4%	24.7%	23.4%	8.1%	1.3%	7.7%	-0.6%	4.8%
Change in car mode share	0.3%	3.6%	5.1%	-1.4%	-4.4%	1.2%	-1.4%	-1.8%

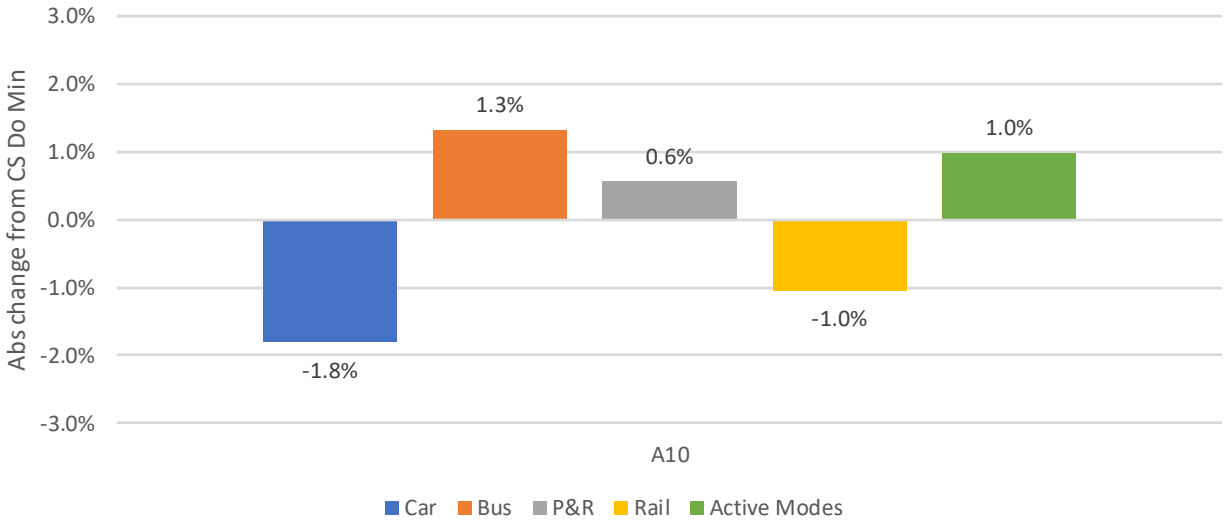
Source: CSRM2

This chart shows that:

- By increasing the corridor's overall transport capacity across both non-highway and highway modes where demand is highest, this package increases person trips by 7.2%, compared to the 6.0% increase with the North-Dual package. As a result, car trips increase overall, but the car mode share is still 1.8% lower than in the Combined-Scenario Do-Minimum.
- In terms of the distribution of changes, it is similar to the Junction+ option for the northern section of the A10 highway corridor, but showing significantly more growth for the mid-to-southern end of the A10 highway corridor. Trips to and from Cambridge increase by 11%, with car mode share increasing slightly by 0.3%. Trips to and from CNFE and CSP increase by greater margins, as do their car mode shares. The car mode share still decreases for trips to and from Waterbeach and the new town north of Waterbeach, however, while car trip to and from Ely to the north are significantly less than for the North-Dual package.

In terms of the modes shifted to from the car, the following chart shows mode shift levels for the Combined-Scenario South-Dual package compared to the Combined-Scenario Do-Minimum situation at the study area level.

Figure 53: Study area mode shift by mode, CS South-Dual package vs CS Do Min



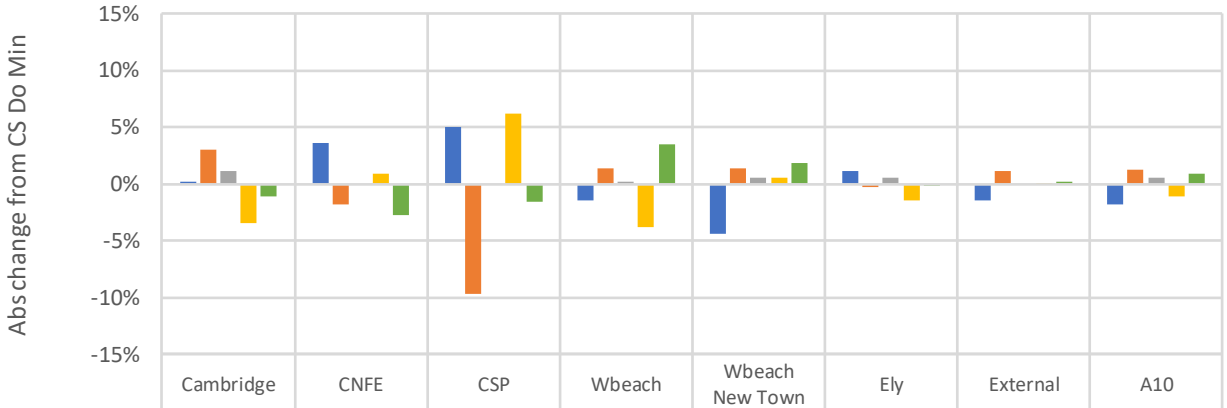
Source: CSRM2

This chart shows that, at a study area level, the increases in bus and park & ride mode share are greater than they are for the Mode-Shift, Junction+ and North-Dual options. This suggests that park & ride usage responds better to adding capacity to the downstream corridor used by the buses than it does to the North-Dual package's concept of adding it to the upstream car approach routes instead.

Like the North-Dual package, however, we see that the gain in bus, park & ride and active mode use is at the expense of rail use, but the car mode share is still 1.8% less than in the Combined-Scenario Do-Minimum.

The following chart expands this same result to show how it is distributed across the corridor's component sectors:

Figure 54: Mode shift by mode and sector for study area trips, CS South-Dual package vs CS Do Min



	Cambridge	CNFE	CSP	Wbeach	Wbeach New Town	Ely	External	A10
Car	0.3%	3.6%	5.1%	-1.4%	-4.4%	1.2%	-1.4%	-1.8%
Bus	3.0%	-1.8%	-9.6%	1.4%	1.4%	-0.3%	1.1%	1.3%
P&R	1.2%	0.0%	0.0%	0.3%	0.6%	0.6%	0.0%	0.6%
Rail	-3.4%	1.0%	6.2%	-3.8%	0.6%	-1.4%	0.1%	-1.0%
Active Modes	-1.1%	-2.7%	-1.6%	3.5%	1.9%	-0.1%	0.2%	1.0%

Source: CSRM2

This chart shows a similar distribution of results to the Junction+ option, except that:

- The increase in car mode share for trips to and from Cambridge, CNFE and CSP has come largely at the expense of the rail and active-travel mode shares, showing that these modes are most sensitive at these locations to competition from corridor highway improvements.
- The increase in the park & ride mode share is partly a result of an increase in its use for trips to and from Waterbeach and the new town north of Waterbeach with this package.

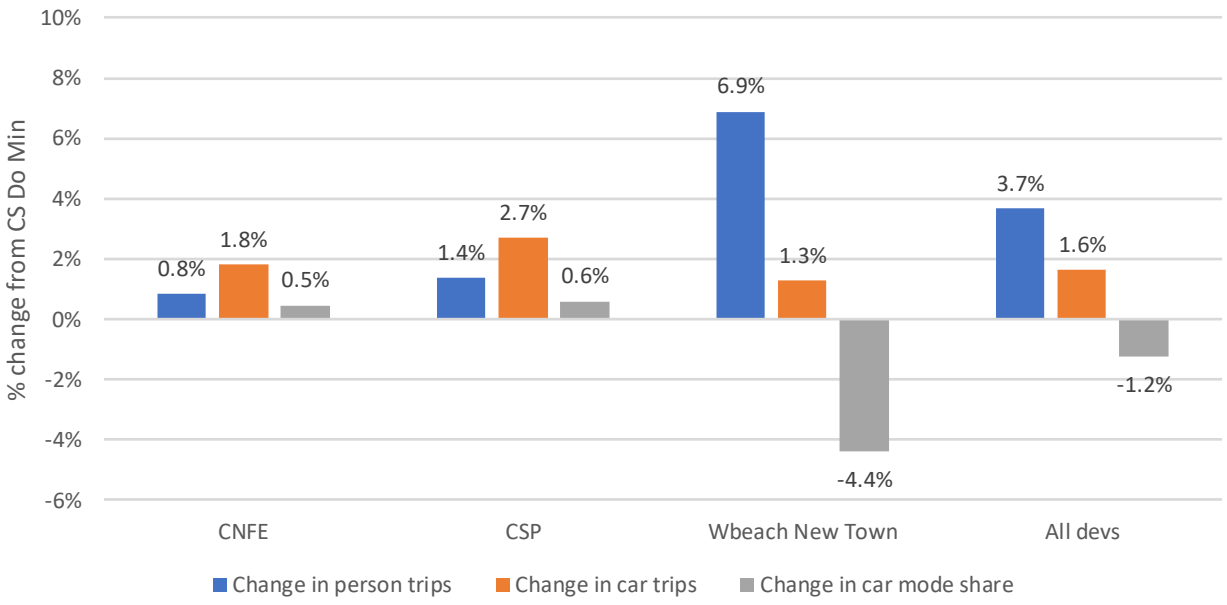
7.2.2 Development-Level Analysis

The following charts present demand model output results for the new developments proposed for the study area in terms of all external trips which serve them, and not just those which interact with the A10. These results allow the full impact of the Do Something package on each development to be understood.

For each development, the following chart shows how the Combined-Scenario South-Dual package differs from the Combined-Scenario Do-Minimum situation in terms of:

- Total person trips
- Total car trips
- Car mode share (which is related to the difference between the above two results)

Figure 55: Change in all external trips and car mode share by dev, CS South-Dual package vs CS DM



Source: CSRM2

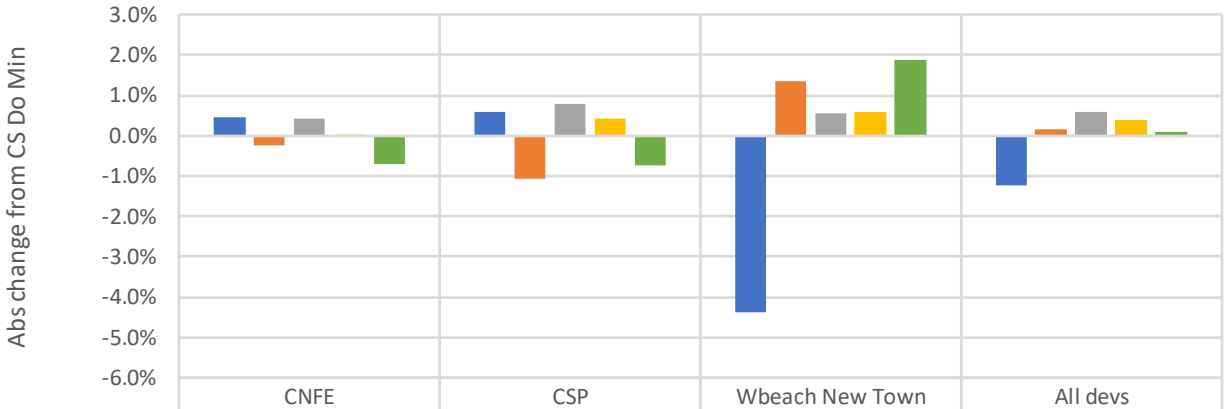
This chart shows that:

- The same results for the new town north of Waterbeach as shown above in the study area-level results. This is because all external trips to and from this development must use the A10. These results show an even greater increase in person trips than for the North-Dual option as highway capacity improvements to the most congested section of the study area permit more trips to be released from the site. However, due to nearly the same level of car mode share decrease, this increase only results in a small increase in car trips generated by the site, though more than for the North-Dual option.

- Small increases in trips and mode share to and from the CNFE and CSP developments, and smaller than in the study area-level results. This reflects that the greatest increases in car trips for these developments correspond with the measures proposed for the A10 highway corridor, as capacity is increased along this route.
- Overall, however, across all three new developments, the results show a net increase in person trips, a relatively small change in car trips and a decrease in car mode share.

In terms of the modes shifted to for each development, the following chart shows mode shift levels for the Combined-Scenario South-Dual package compared to the Combined-Scenario Do-Minimum situation.

Figure 56: Development-level external-trip mode shift by mode, CS South-Dual package vs CS Do Min



	CNFE	CSP	Wbeach New Town	All devs
Car	0.5%	0.6%	-4.4%	-1.23%
Bus	-0.2%	-1.1%	1.4%	0.16%
P&R	0.4%	0.8%	0.6%	0.59%
Rail	0.0%	0.4%	0.6%	0.38%
Active Modes	-0.7%	-0.7%	1.9%	0.11%

Source: CSRM2

This chart shows that:

- The same results for the new town north of Waterbeach as shown above in the study area-level results. This is because all external trips to and from this development must use the A10. However, these results show that the greatest shift from the car is to active modes, followed by bus, rail and park & ride. The shift to bus is greater than in the Mode-Shift package, which shows that the highway improvements are generating bus performance improvements which helps to increase use of this mode. The shift to park & ride is also greater than the previous packages.
- A decline in mode share for bus and active modes at both CNFE and CSP, shifting to park & ride, rail and car. Park & ride shows the greatest shift at CSP. However, all changes are relatively minor.
- Across the three developments, there is an overall decrease in car mode share and an increase in bus, park & ride, rail and active modes. The largest increases in mode share are for park & ride.

7.2.3 Trip Levels and Mode Choice Summary

Overall, therefore, the South-Dual package has a mixed impact on travel behaviour within the study area and its environs when measured against the equivalent Do Minimum situation, resulting in an overall decrease in car mode share and more park & ride, bus and active mode use, but also a bit less rail use, which shows this

mode to be the most sensitive to increases in highway capacity along the corridor. Car trips and mode share for journeys to and from locations at the south end of the study area are also increased.

7.3 Highway Network Performance

7.3.1 Flow and Delay

For each peak hour, the following figures show:

- Predicted traffic flows and total junction delays for the South-Dual option
- The difference in traffic flows and total junction delays between the South-Dual option and the Combined-Scenario Do-Minimum situation

Traffic flow data is shown as scaled bands, where the width and colour reflect the flow level, while junction delays are shown as scaled circles, where the size and colour reflect delay levels.

The results are compared in this section against the Combined-Scenario Do-Minimum instead of against the Future-Base Do-Minimum in order to isolate the impacts of the mitigation measures.

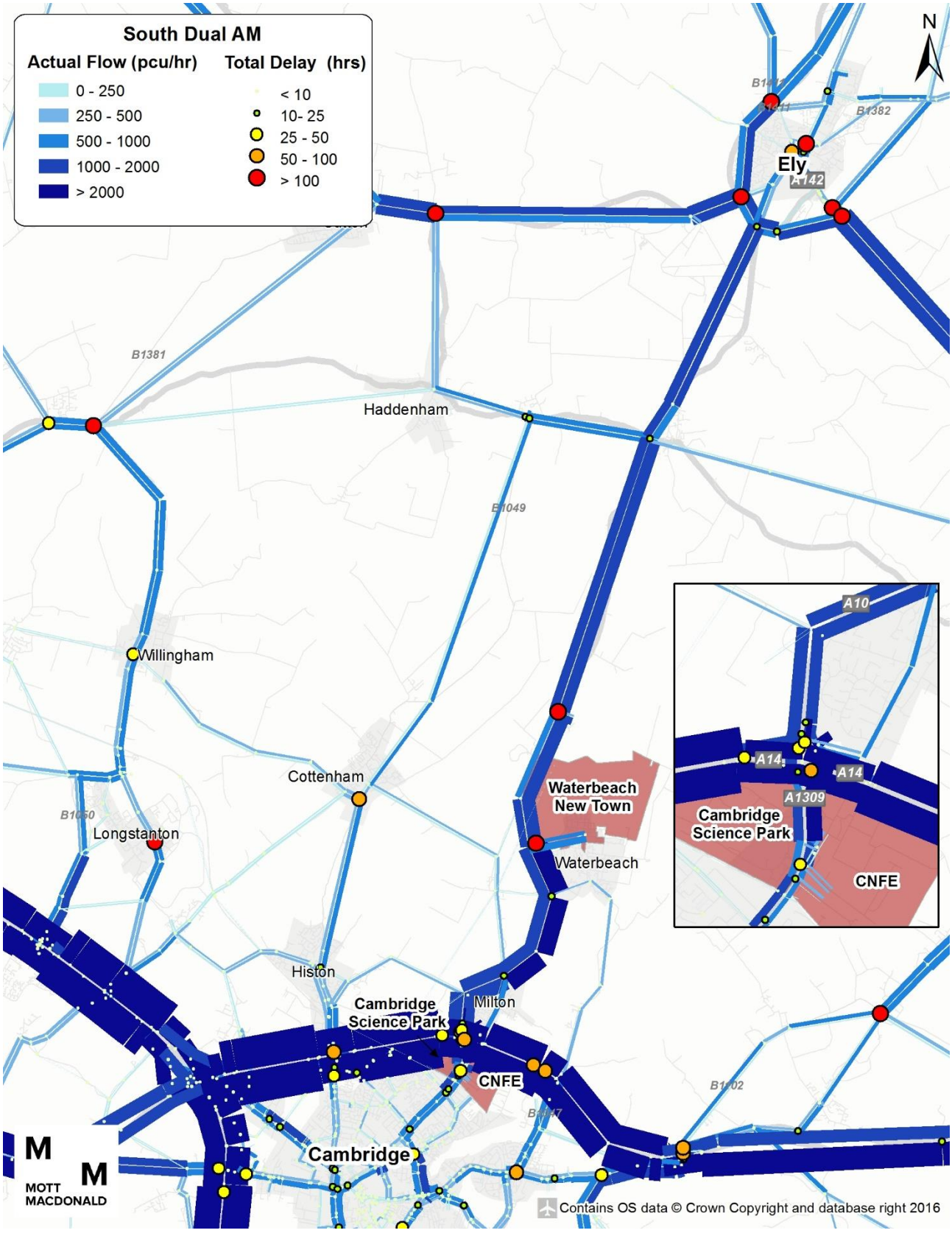
These figures for the AM peak show:

- Compared to the Combined-Scenario Do-Minimum situation, the southern dualled section shows a high increase in demand, which increases southbound demand on the northern section. This, in turn, leads to some total delay increases at junctions north and south of new town north of Waterbeach, which would require mitigation through further detailed design.
- Delays are also high around Ely, but nonetheless generally improved compared with the Combined-Scenario Do-Minimum situation. Delay reductions are also seen on most of the A10 route, including Milton Interchange, and on the parallel B1049 route.
- Flows on parallel routes are generally reduced compared to the Combined-Scenario Do-Minimum situation, except for southbound through Milton, which would require mitigation.

These figures for the PM peak show:

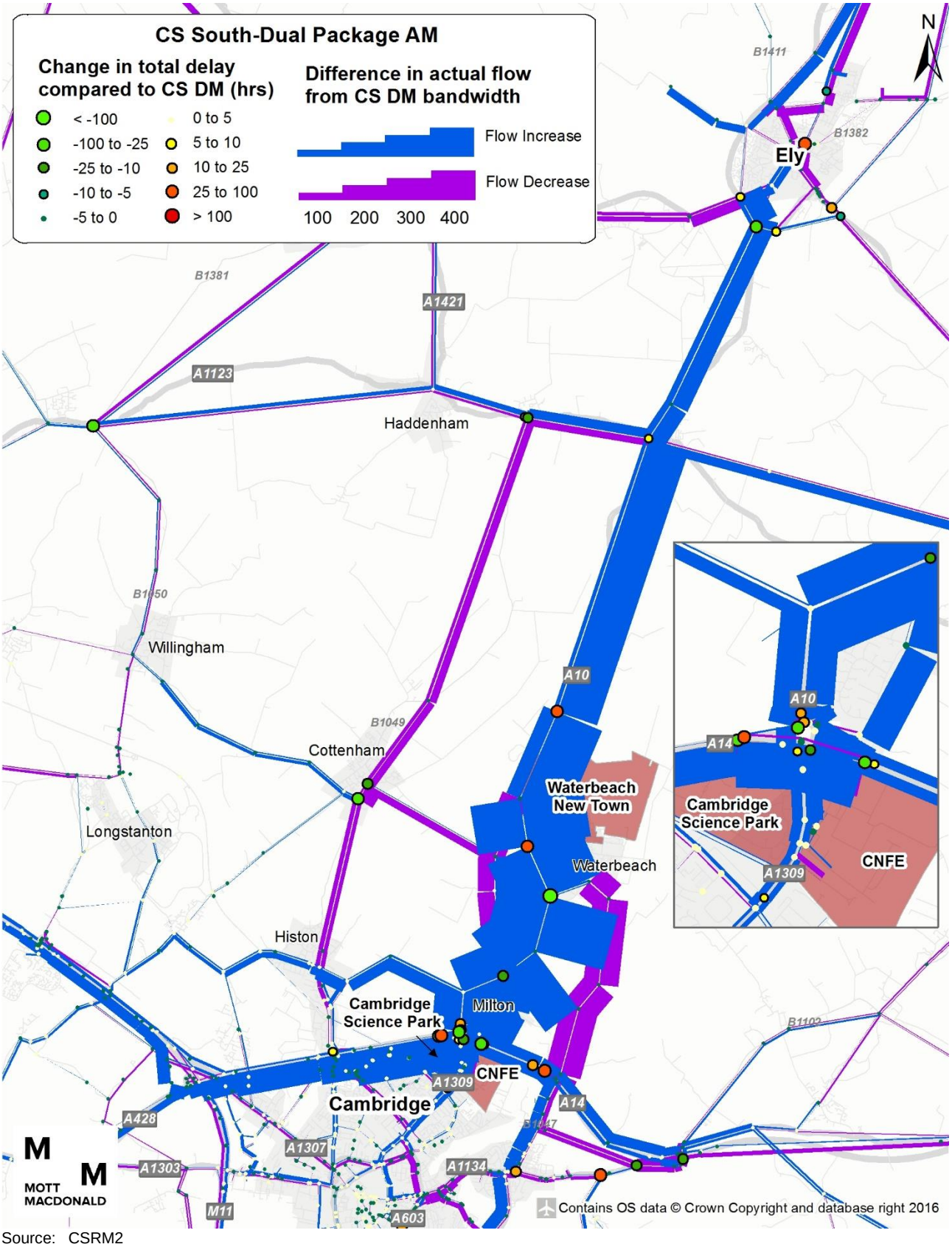
- As with the AM, significant increases in demand on the southern dualled section which increases delays at two junctions on the southern section of A10. The added demand also increases pressure and delays on the northern section at Stretham and around Ely. Delay reductions are seen at other junctions on the corridor, however, including Milton Interchange, and on the parallel B1049.
- Flows on the parallel B1047 and B1049 routes show small changes, with reductions evident on the B1047 and on the northern section of the B1049, but small increases on the southern section. Through Milton, however, larger increases are seen. This impact would require mitigation.

Figure 57: South-Dual package flow and delay distribution – AM peak



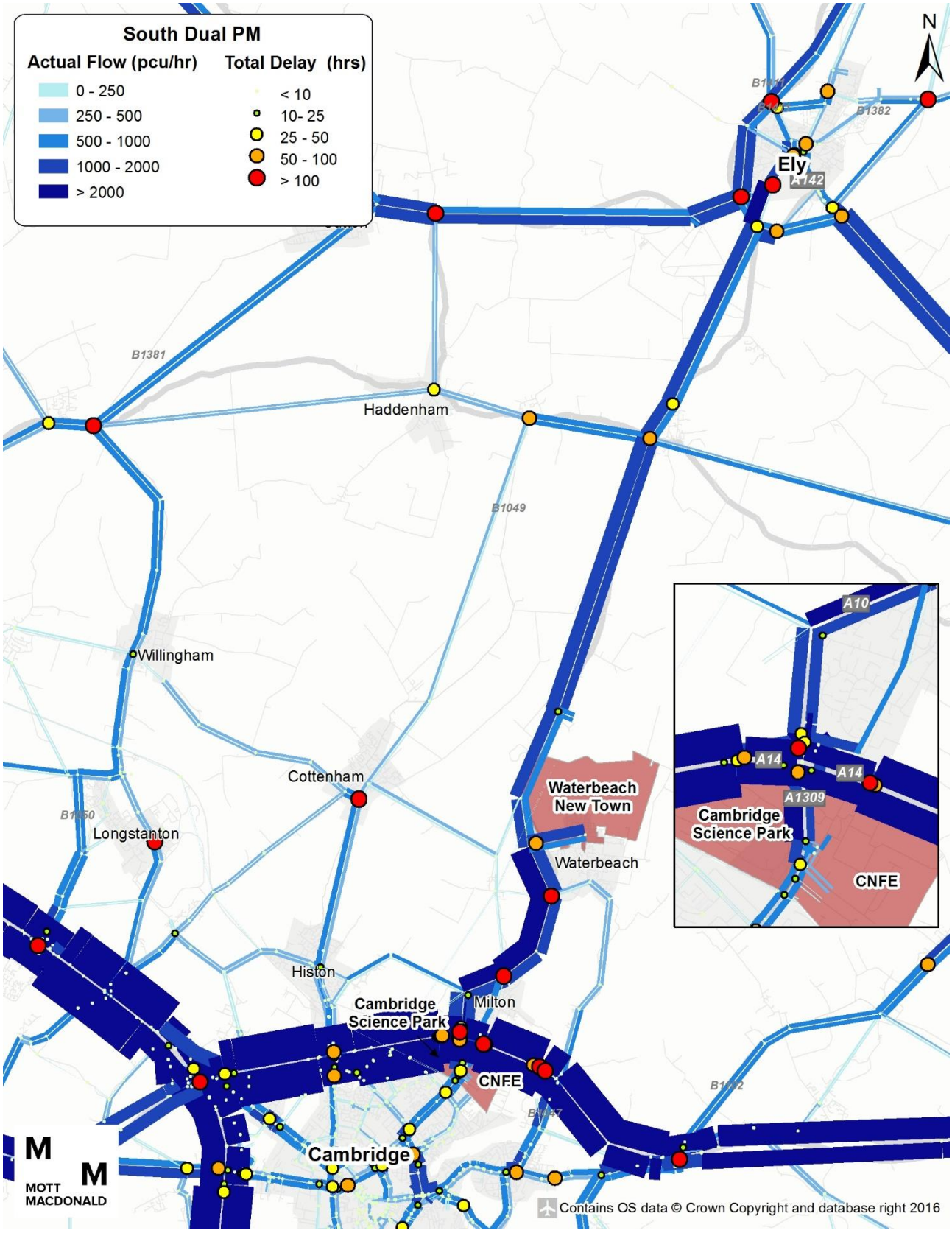
Source: CSRM2

Figure 58: South-Dual package flow and delay difference vs Combined Scenario Do Min – AM peak



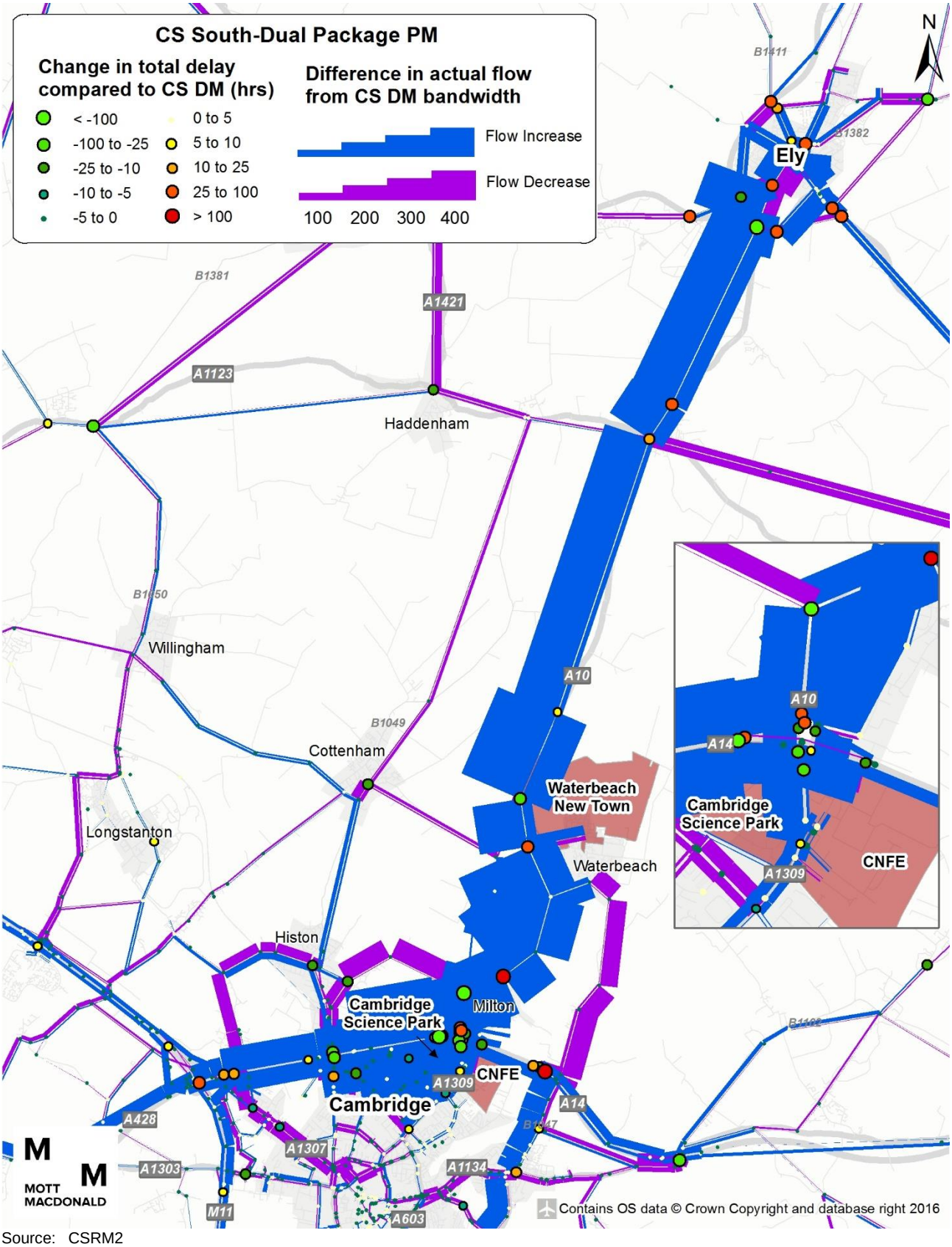
Source: CSRM2

Figure 59: South-Dual package flow and delay distribution – PM peak



Source: CSRM2

Figure 60: South-Dual package flow and delay difference vs Combined Scenario Do Min – PM peak



Source: CSRM2

7.3.2 Journey Time

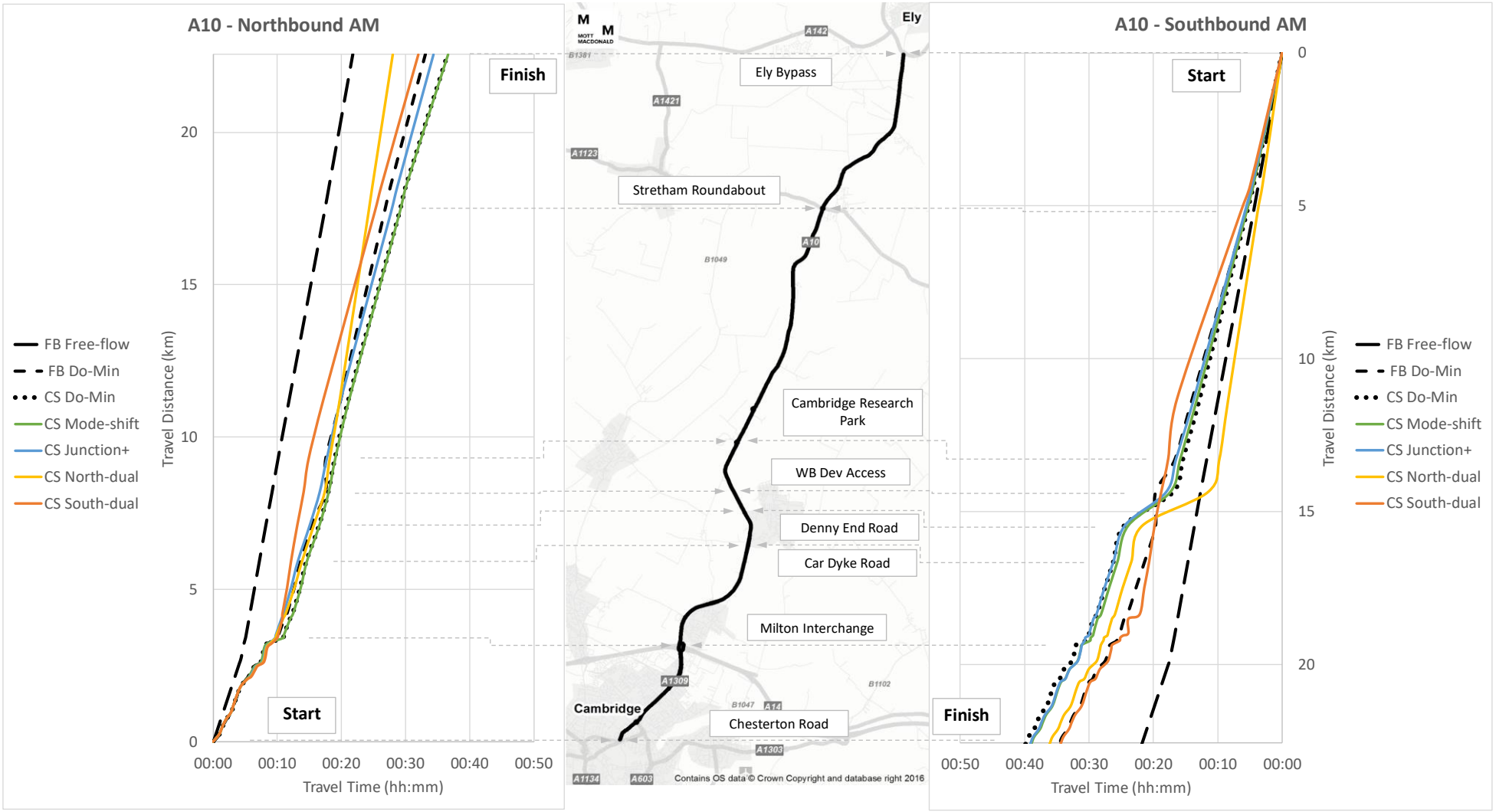
The following two figures show, for the AM and PM peak, modelled journey times along the A10 highway corridor between Chesterton Road and Ely bypass for the following scenarios:

- Future-Base Scenario Do-Minimum
- Combined-Scenario Do-Minimum
- Combined-Scenario Do-Something:
  - Mode-Shift package
  - Junction+ package
  - North-Dual package
  - South-Dual package

These charts show that:

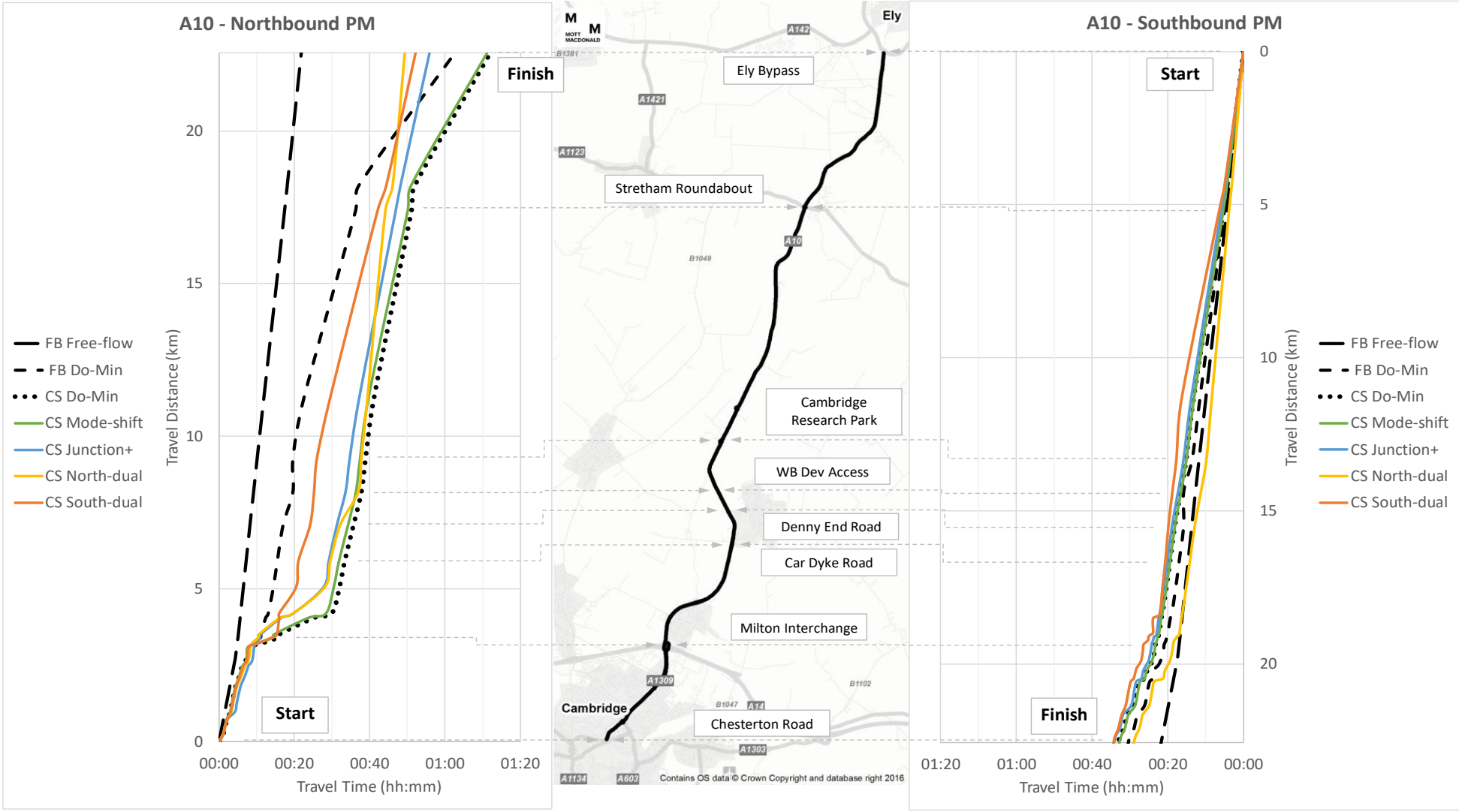
- In the AM peak, the South-Dual package delivers an overall improvement compared to both the Future-Base and Combined-Scenario Do-Minimum situations in both directions. In the southbound direction where demand is highest, this package delivers the poorest performance over the northern section because of the increased demand over this single-lane section, but it then makes up the time on the southern dualled section. Overall it provides a more consistent level of service along the A10 Highway corridor's length, and avoids the delays incurred by the other packages in the vicinity of the new town north of Waterbeach.
- In the PM peak, the South-Dual package improves the journey time over both the Future-Base and Combined Scenario Do-Minimum situations in the busiest northbound direction. The profile shows a similarly consistent level of service along the length of the A10 highway corridor, avoiding the south-section delays of the other packages. In the less busy southbound direction, the journey time is a little greater than the others overall, but still showing only small levels of delay.

Figure 61: A10 corridor modelled journey times – 2031 AM peak



Source: CSRM2

Figure 62: A10 corridor modelled journey times – 2031 PM peak



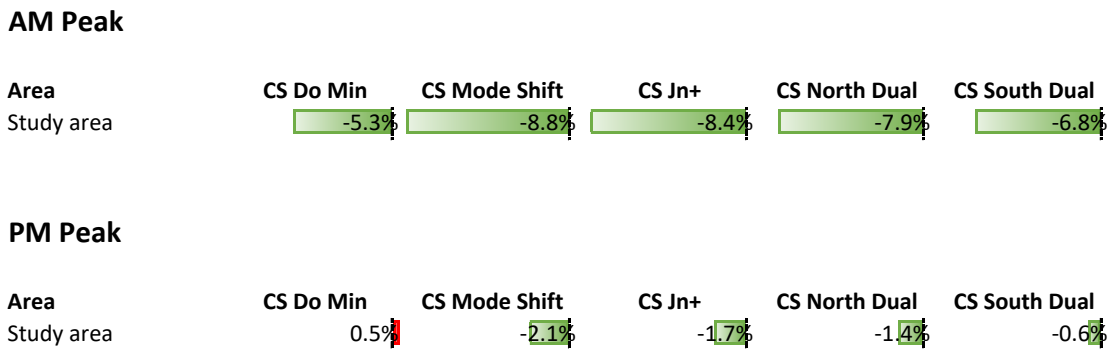
Source: CSRM2

7.4 Performance Indicator Summary

7.4.1 Car Mode Share

The following figure shows the modelled change in car mode share levels for the Combined-Scenario South-Dual package and the Combined-Scenario Do-Minimum situation compared to the Future-Base Do-Minimum situation. The Mode-Shift, Junction+ and North-Dual options are also shown for reference. The results listed are taken from the above analysis and are based on all weekday AM and PM peak hour trips between sectors most likely to use the study area (see Section 4.2.1 above)

Figure 63: Change in car mode share levels compared to Future-Base Do-Minimum



Source: CSRM2

These results show that:

- Compared to both the Future-Base Do-Minimum and the Combined-Scenario Do-Minimum, the South-Dual package delivers a car mode-share improvement in both peak hours, but not to the same extent as the Mode-Shift, Junction+ and North-Dual packages.

7.4.2 Parallel Route Traffic Levels

The following figure shows the change in modelled traffic levels on routes parallel to the A10 for the Combined-Scenario South-Dual package and the Combined-Scenario Do-Minimum situation compared to the Future-Base Do-Minimum situation. The Mode-Shift, Junction+ and North-Dual options are also shown for reference.

The routes listed correspond to the analysis points shown in Figure 3 above as follows:

- B1047 (Horningsea Road) – point 6
- B1049 South (Histon Road) – point 4
- B1049 North (Twenty Pence Road) – point 8
- Landbeach Road – point 3

Figure 64: Change in parallel route traffic levels compared to Future-Base Do-Minimum

AM Peak

Parallel Route	CS Do Min	CS Mode Shift	CS Jn+	CS North Dual	CS South Dual
B1047	52%	49%	40%	43%	-34%
B1049 South	-2%	-3%	-2%	-4%	-11%
B1049 North	14%	12%	14%	-18%	-6%
Landbeach Rd	18%	19%	8%	-10%	10%
All routes	15%	14%	11%	0%	-10%

PM Peak

Parallel Route	CS Do Min	CS Mode Shift	CS Jn+	CS North Dual	CS South Dual
B1047	56%	53%	50%	55%	26%
B1049 South	1%	-1%	1%	-2%	0%
B1049 North	-10%	-10%	-11%	-5%	-13%
Landbeach Rd	-89%	-80%	-30%	-48%	-47%
All routes	-7%	-7%	3%	1%	-6%

Source: CSRM2

These results show that:

- In the AM, traffic flows on parallel routes are generally lower than those in both the Future-Base and Combined-Scenario Do-Minimum situations.
- In the PM, the South-Dual package generates lower flows on the B1047 than in the Combined-Scenario Do-Minimum, but not the Future-Base Do-Minimum. This situation would require further mitigation. For all other routes, however, the predicted flows are lower than in the Future-Base Do-Minimum situation.

Overall, this package has a generally positive impact on parallel route traffic levels, improving on the Combined-Scenario Do-Minimum situation in the AM peak, with similar results in the PM peak, and resulting in an overall improvement in traffic compared to the Future-Base Do-Minimum situation in both peaks.

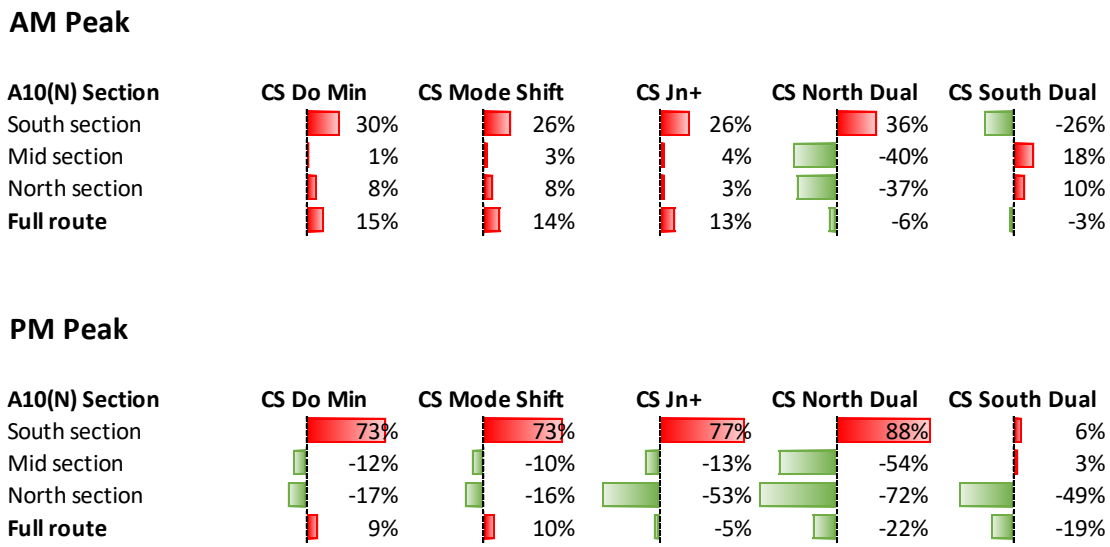
7.4.3 Journey Time

The following figure shows the change in modelled two-way highway journey times on the A10 for the Combined-Scenario South-Dual package and the Combined-Scenario Do-Minimum situation compared to the Future-Base Do-Minimum situation. The Mode-Shift, Junction+ and North-Dual options are also shown for reference.

The journey times are shown by route section and for the full route, where the sections are as follows:

- South section – Milton Interchange to Cambridge Research Park
- Mid section – Cambridge Research Park to Stretham roundabout
- North section - Stretham roundabout to Ely bypass

Figure 65: Change in A10 corridor journey time compared to Future-Base Do-Minimum



Source: CSRM2

These results show that:

- Compared to the Future-Base and the other Combined-Scenario results, the South-Dual package delivers journey time improvements in both peak hours. This is due to better performance on the southern section where the dualling is applied, but it is noted that journey times deteriorate on the mid section in both peaks and the north section in the AM. This is due to there not being enough capacity on these sections to accommodate the additional demand attracted by the south section.

Overall, the South-Dual package results in improved full-corridor journey times compared to both the Future-Base and Combined-Scenario Do-Minimum situations, but not on the mid section.

7.5 Results Summary

Overall, the South-Dual package shows mixed impacts on mode choice. Like the North-Dual package, this package results in increased trip making on the study area and an overall reduction in the car mode share compared to both the Future-Base and the Combined-Scenario Do-Minimum situations, while use of park & ride is higher than with the North-Dual package. However, both car trip and car mode share levels are increased to and from Cambridge, CNFE and CSP because of the increased capacity serving these locations.

In terms of journey time benefits on the A10 highway corridor, like the North-Dual package, this package also delivers improvements over the full route compared to both the Future-Base and Combined-Scenario Do-Minimum situations. This is due to improvements over the dualled section, though the extra traffic this puts onto the single-lane mid and northern section results in some deterioration in performance there.

This Do Something option, however, further underlines the potential benefits to the corridor of dualling in combination with non-highway improvements. The following final option further extends this concept.

8 Full-Dual Package Results

The purpose of this section is to describe and present the CSRM2 model results of the Full-Dual Do-Something package option.

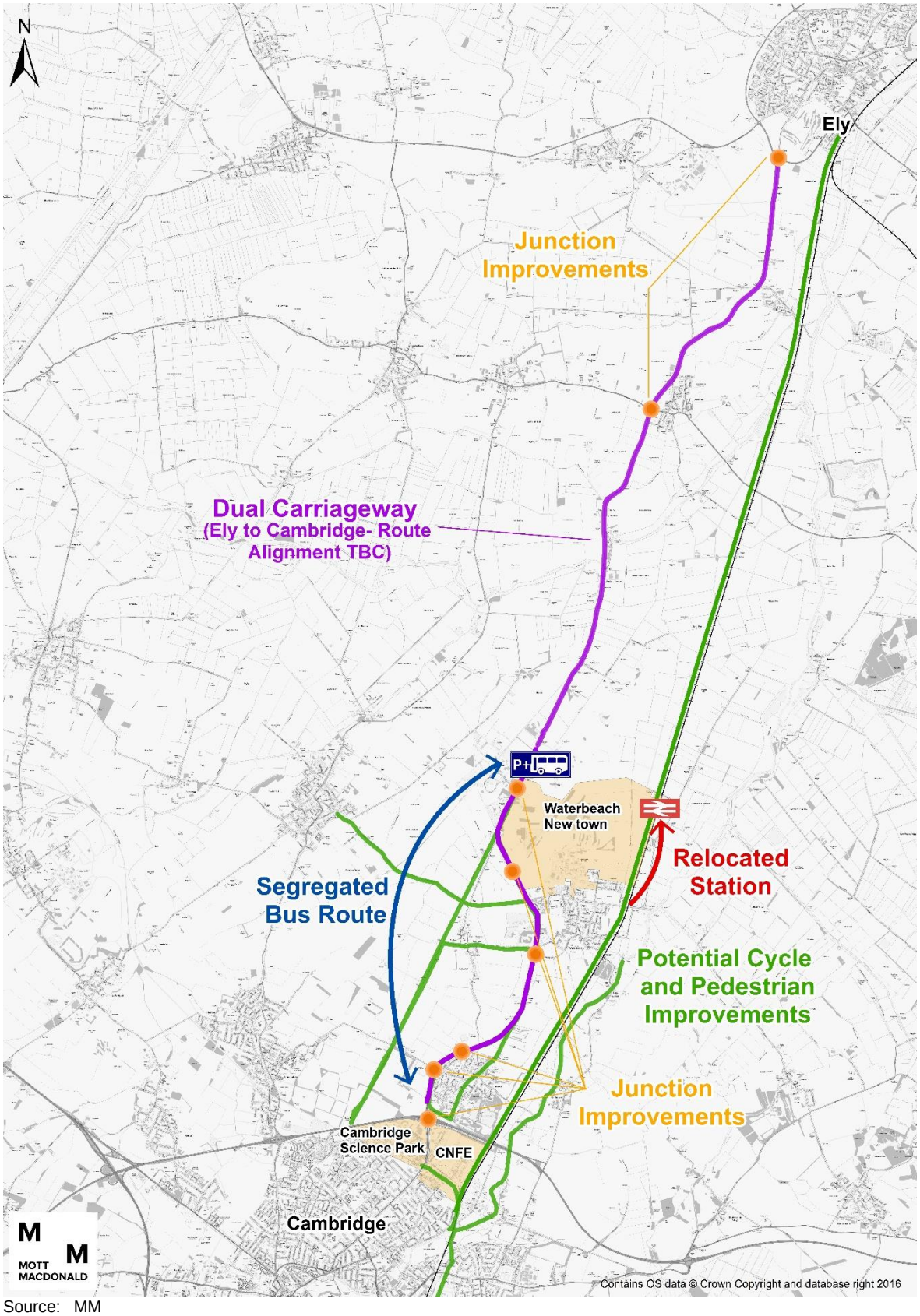
8.1 Package Description

The above results for the South-Dual package show an overall performance improvement for the corridor compared with the Future-Base Scenario, but still with longer journey times on the mid and north sections of route.

The aim of this option is therefore to complement the non-car and junction improvement measures of the Mode-Shift and Junction+ options with the dualling of the full A10between the A14 and Ely bypass.

A summary of the measures included in this option is shown in Figure 66 below.

Figure 66: Full-Dual package measures



Source: MM

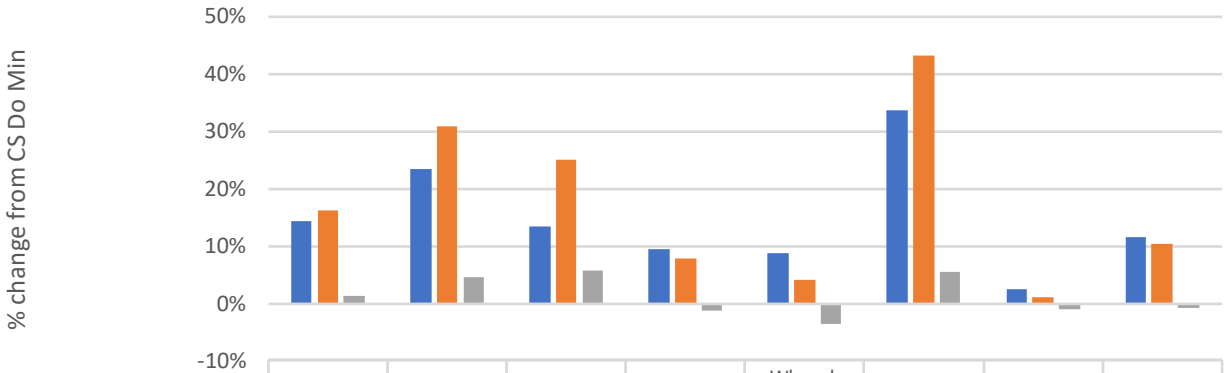
8.2 Trip Levels and Mode Choice

8.2.1 Study Area-Level Analysis

Using the same analysis method described above in Section 4.2.1 for the Mode-Shift package, the following chart shows how the Combined-Scenario Full-Dual package differs from the Combined-Scenario Do-Minimum situation, at both the study area level and A10 highway corridor-using sector level, in terms of:

- Total person trips
- Total car trips
- Car mode share (which is a function of the difference between the above two results)

Figure 67: Change in corridor trips and car mode share by sector, CS Full-Dual package vs CS DM



	Cambridge	CNFE	CSP	Wbeach	Wbeach New Town	Ely	External	A10
Change in person trips	14.2%	23.3%	13.5%	9.5%	8.8%	33.7%	2.4%	11.5%
Change in car trips	16.2%	30.8%	25.0%	7.7%	4.0%	43.3%	1.1%	10.4%
Change in car mode share	1.2%	4.5%	5.6%	-1.3%	-3.7%	5.5%	-1.1%	-0.8%

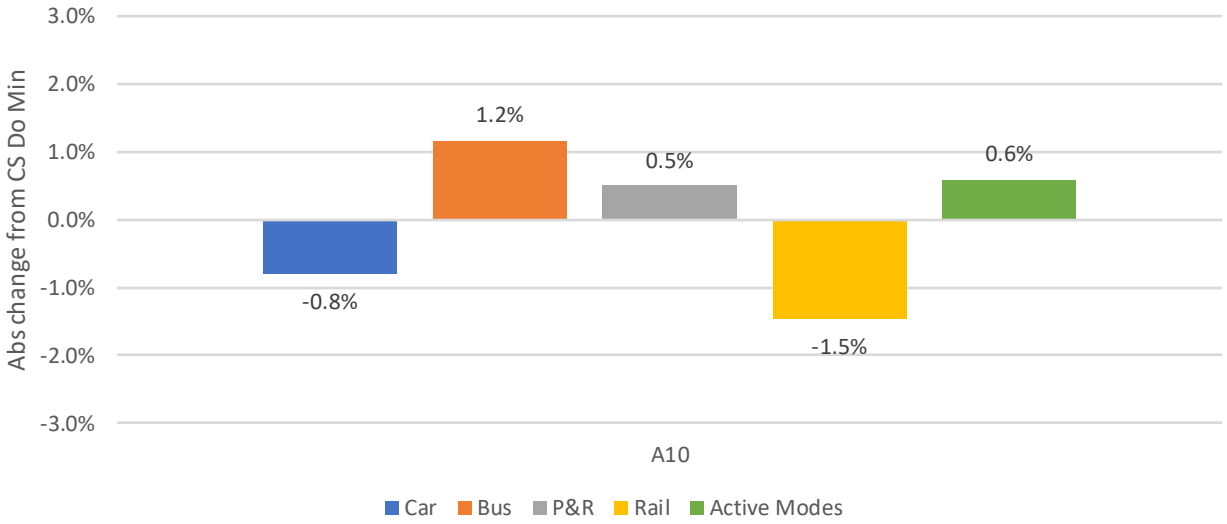
Source: CSRM2

This chart shows that:

- By increasing the overall transport capacity across both non-highway and highway modes, this package increases person trips on the corridor by 11.5%, compared to the 7.2% increase with the South-Dual package. As a result, car trips increase overall, but the car mode share is still 0.8% lower than in the Combined-Scenario Do-Minimum.
- In terms of the distribution of changes, it is a combination of the results from the North-Dual and South-Dual packages, with person-trip, car-trip and car mode share increases at both ends of the corridor. The car mode share to and from Waterbeach and the new town north of Waterbeach, however, remains below Do-Minimum levels, which is what contributes to the above overall car mode share result.

In terms of the modes shifted to from the car, the following chart shows mode shift levels for the Combined-Scenario South-Dual package compared to the Combined-Scenario Do-Minimum situation at the study area level.

Figure 68: Study area mode shift by mode, CS Full-Dual package vs CS Do Min



Source: CSRM2

This chart shows a similar profile to the South-Dual package result, except with less of a shift from car which comes at the expense of less rail and active mode use. Increases in bus and park & ride mode share are still evident, however.

The following chart expands this same result to show how it is distributed across the corridor's component sectors:

Figure 69: Mode shift by mode and sector for study area trips, CS Full-Dual package vs CS Do Min

	Cambridge	CNFE	CSP	Wbeach	Wbeach New Town	Ely	External	A10
Car	1.2%	4.5%	5.6%	-1.3%	-3.7%	5.5%	-1.1%	-0.8%
Bus	2.8%	-1.9%	-9.8%	1.4%	1.2%	-1.1%	1.1%	1.2%
P&R	1.1%	0.0%	0.0%	0.2%	0.5%	0.6%	0.0%	0.5%
Rail	-3.8%	0.5%	5.8%	-3.7%	0.4%	-4.8%	-0.1%	-1.5%
Active Modes	-1.3%	-3.1%	-1.6%	3.4%	1.6%	-0.2%	0.1%	0.6%

Source: CSRM2

This chart shows that:

- The decrease in the rail mode share for corridor trips is due to decreases to and from Cambridge, Waterbeach and Ely. Respectively, these are due mainly to shifts towards bus, active modes and car in these locations.
- The increase in active mode use on the corridor is due to increased activity to and from Waterbeach and new town north of Waterbeach. For all other sectors, use of this mode drops or stays the same.

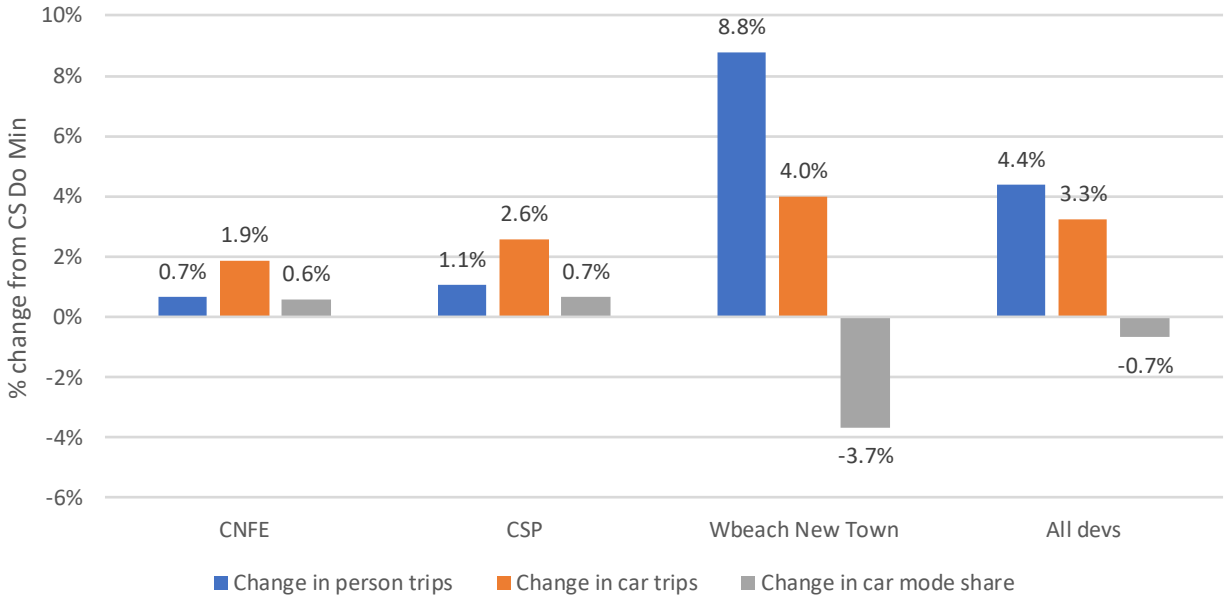
8.2.2 Development-Level Analysis

The following charts present demand model output results for the new developments proposed for the A10 corridor in terms of all external trips which serve them, and not just those which interact with the A10. These results allow the full impact of the Do Something package on each development to be understood.

For each development, the following chart (scaled to be consistent for all Do Something package results) shows how the Combined-Scenario Full-Dual package differs from the Combined-Scenario Do-Minimum situation in terms of:

- Total person trips
- Total car trips
- Car mode share (which is related to the difference between the above two results)

Figure 70: Change in all external trips and car mode share by dev, CS Full-Dual package vs CS DM



Source: CSRM2

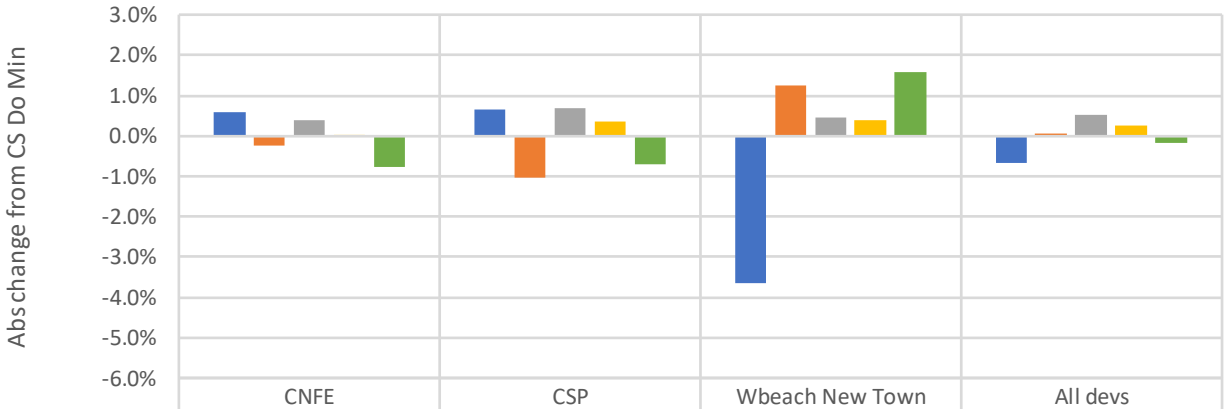
This chart shows that:

- The same results for the new town north of Waterbeach as shown above in the study area-level results. This is because all external trips to and from this development must use the A10 highway corridor. These results show an even greater increase in person trips than for the South-Dual option as highway capacity improvements to the full corridor permit more trips to be released from the site. The corresponding increase in car trips is less than half the person-trip increase due to the reduction in car mode share, though this increase is greater than for the other packages and the car mode share reduction the least.

- Small increases in trips and mode share to and from the CNFE and CSP developments, and smaller than in the study area-level results. This reflects that the greatest increases in car trips for these developments correspond with the measures proposed for the A10 corridor, as capacity is increased along this route.
- Overall, across all three new developments, the results show a net reduction in car mode share, though car trips are 3.3% higher than in the Combined-Scenario Do-Minimum case.

In terms of the modes shifted to for each development, the following chart shows mode shift levels for the Combined-Scenario Full-Dual package compared to the Combined-Scenario Do-Minimum situation.

Figure 71: Development-level external-trip mode shift by mode, CS Full-Dual package vs CS Do Min



	CNFE	CSP	Wbeach New Town	All devs
Car	0.6%	0.7%	-3.7%	-0.68%
Bus	-0.2%	-1.0%	1.2%	0.06%
P&R	0.4%	0.7%	0.5%	0.52%
Rail	0.0%	0.4%	0.4%	0.27%
Active Modes	-0.8%	-0.7%	1.6%	-0.17%

Source: CSRM2

This chart shows:

- The same results for the new town north of Waterbeach as shown above in the study area-level results. This is because all external trips to and from this development must use the A10 highway corridor. However, these results show that the greatest shift from the car is to active modes, followed by bus, park & ride and rail. The shift to bus is greater than in the Mode-Shift package, which shows that the highway improvements are generating bus performance improvements which helps to increase use of this mode. The shift to park & ride is also greater than for the North-Dual package, though a little less than the South-Dual package.
- A decline in mode share for bus and active modes at both CNFE and CSP, shifting to park & ride, rail and car. Park & ride shows the greatest shift at CSP. However, all changes are relatively minor.
- Across the three developments, there is an overall decrease in car mode share and an increase in bus, park & ride and rail. The largest increases in mode share are for park & ride, though active modes show a net mode-share drop.

8.2.3 Trip Levels and Mode Choice Summary

Overall, the Full-Dual package has a mixed impact on travel behaviour within the study area and its environs, when measured against the equivalent Do Minimum situation, resulting in an overall decrease in car mode

share and more park & ride, bus and active mode use, but also a bit less rail use. Car trips and mode share for journeys to and from locations at both ends of the A10 highway corridor are also increased.

8.3 Highway Network Performance

8.3.1 Flow and Delay

For each peak hour, the following figures show:

- Predicted traffic flows and total junction delays for the Full-Dual option
- The difference in traffic flows and total junction delays between the Full-Dual option and the Combined-Scenario Do-Minimum situation

Traffic flow data is shown as scaled bands, where the width and colour reflect the flow level, while junction delays are shown as scaled circles, where the size and colour reflect delay levels.

The results are compared in this section against the Combined-Scenario Do-Minimum instead of against the Future-Base Do-Minimum in order to isolate the impacts of the mitigation measures.

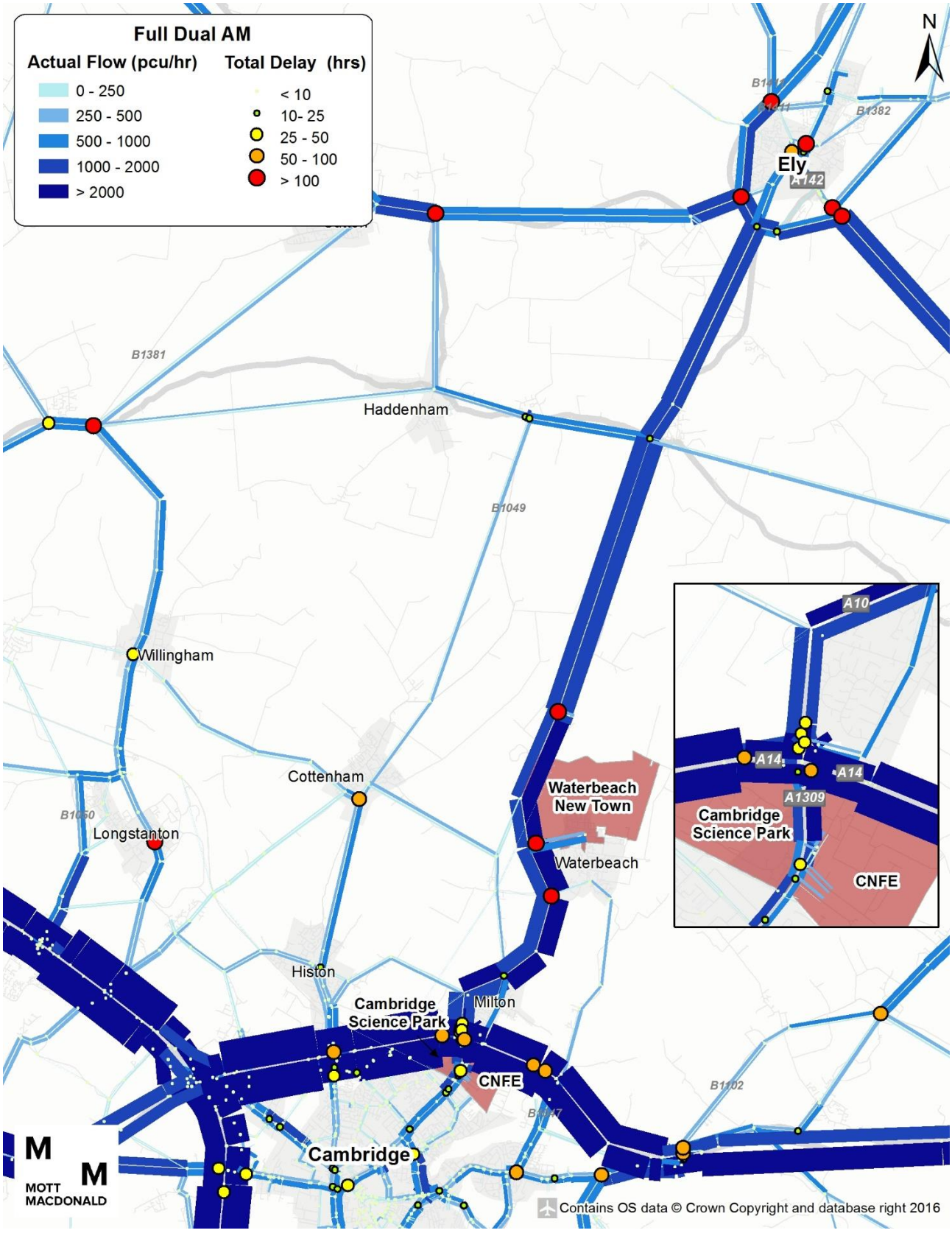
These figures for the AM peak show:

- Compared to the Combined-Scenario Do-Minimum situation, the full corridor shows a high increase in demand. This, in turn, leads to some total delay increases at junctions north and south of the new town north of Waterbeach, which would require mitigation through further detailed design. Delay reductions are also seen on most of the A10 route, however, including Milton Interchange, and on the parallel B1049 route.
- Flows on parallel routes are generally reduced compared to the Combined-Scenario Do-Minimum situation, except for southbound through Milton, which would require mitigation.

These figures for the PM peak show:

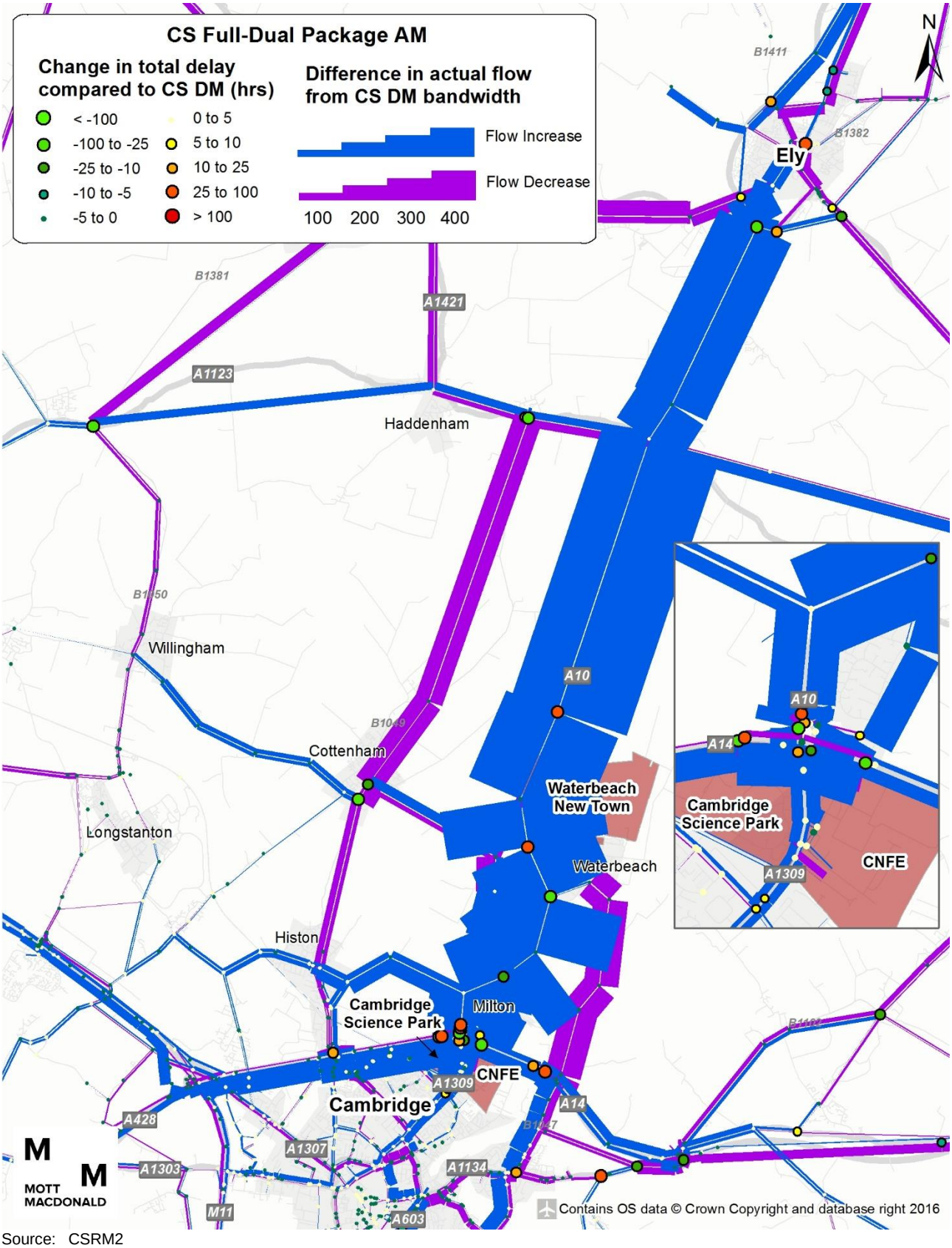
- As with the AM, significant increases in demand on the full corridor which increases delays at some junctions on the A10, including the northern access of the new town north of Waterbeach and Stretham. Delay reductions are seen at other junctions on the corridor, however, including Milton Interchange, and on the parallel B1049.
- Flows on the parallel B1047 and B1049 routes show small changes, with reductions evident on the B1047 and on the northern section of the B1049, but small increases on the southern section. Through Milton, however, larger increases are seen. This impact would require mitigation.

Figure 72: Full-Dual package flow and delay distribution – AM peak



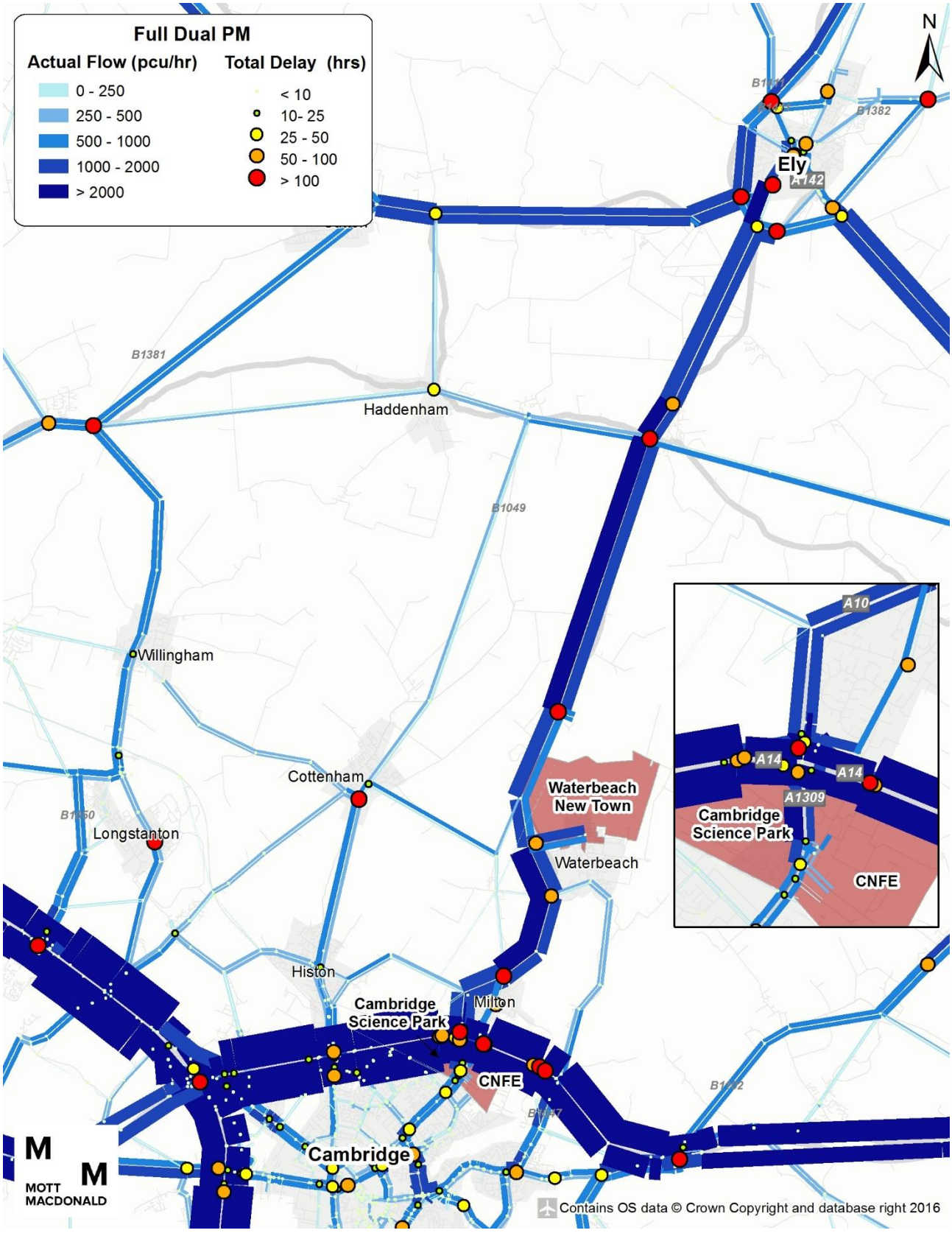
Source: CSRM2

Figure 73: Full-Dual package flow and delay difference vs Combined Scenario Do Min – AM peak



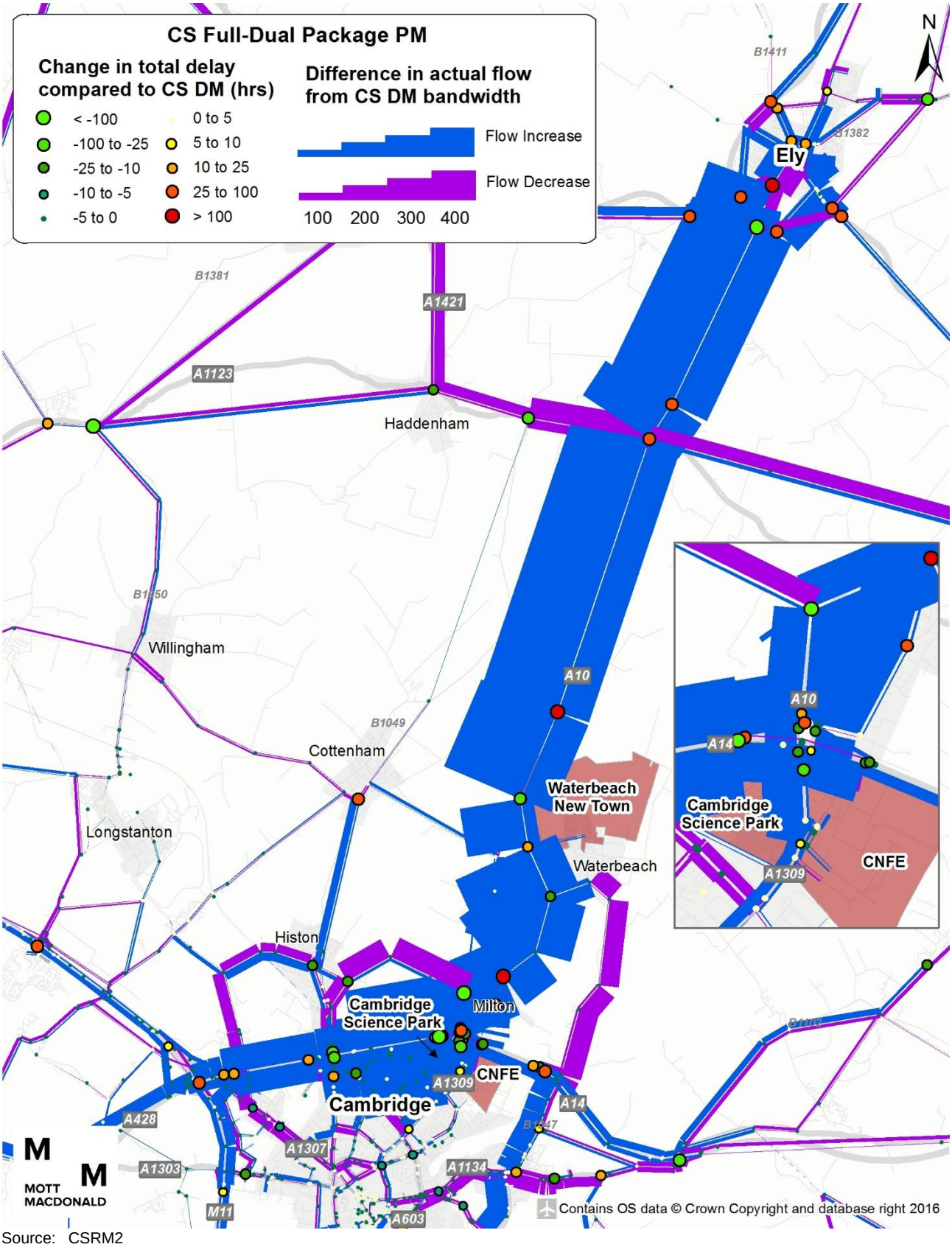
Source: CSRM2

Figure 74: Full-Dual package flow and delay distribution – PM peak



Source: CSRM2

Figure 75: Full-Dual package flow and delay difference vs Combined Scenario Do Min – PM peak



Source: CSRM2

8.3.2 Journey Time

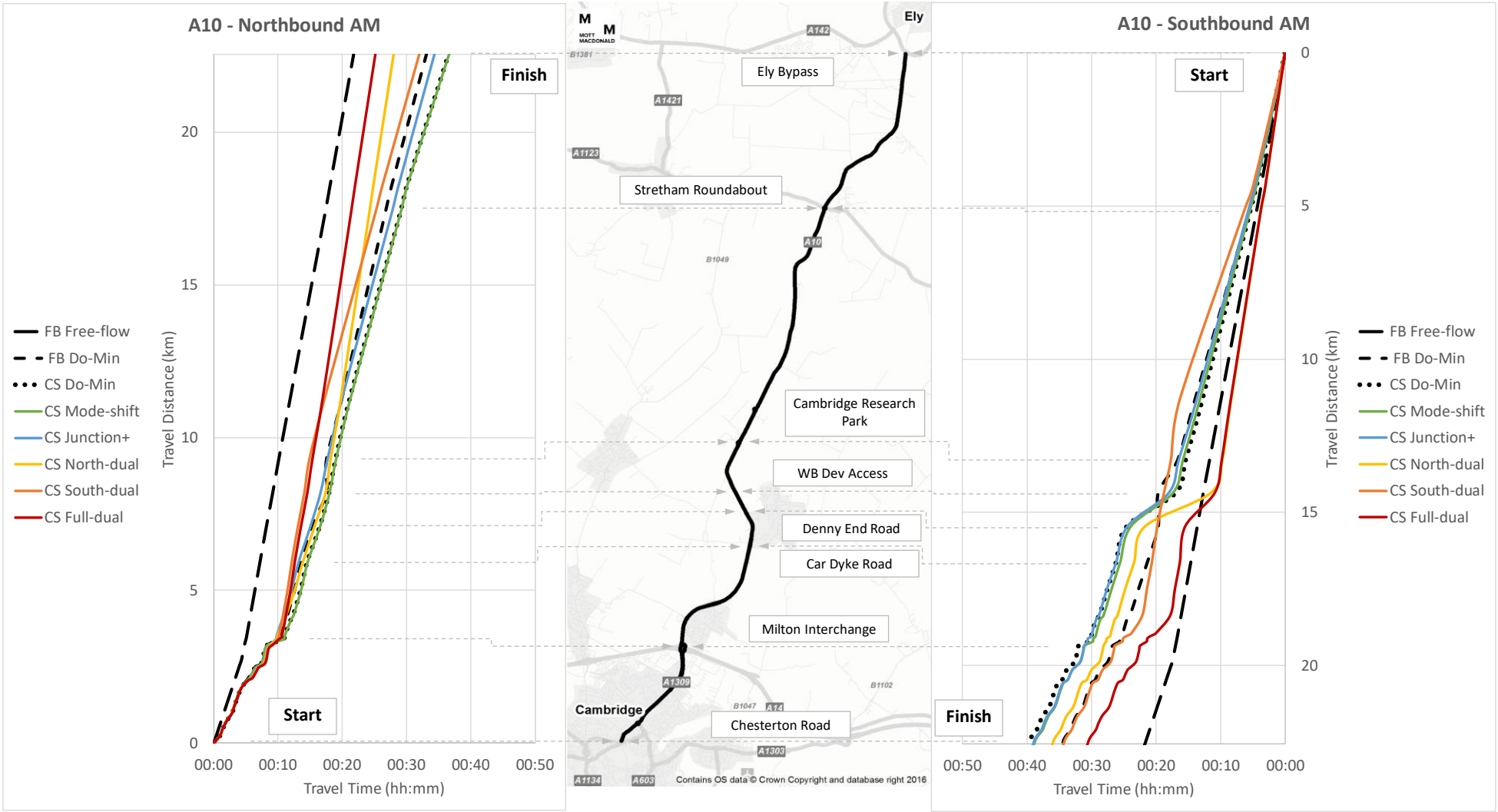
The following two figures show, for the AM and PM peak, modelled journey times along the A10 between Chesterton Road and Ely bypass for the following scenarios:

- Future-Base Scenario Do-Minimum
- Combined-Scenario Do-Minimum
- Combined-Scenario Do-Something:
  - Mode-Shift package
  - Junction+ package
  - North-Dual package
  - South-Dual package
  - Full-Dual package

These charts show that:

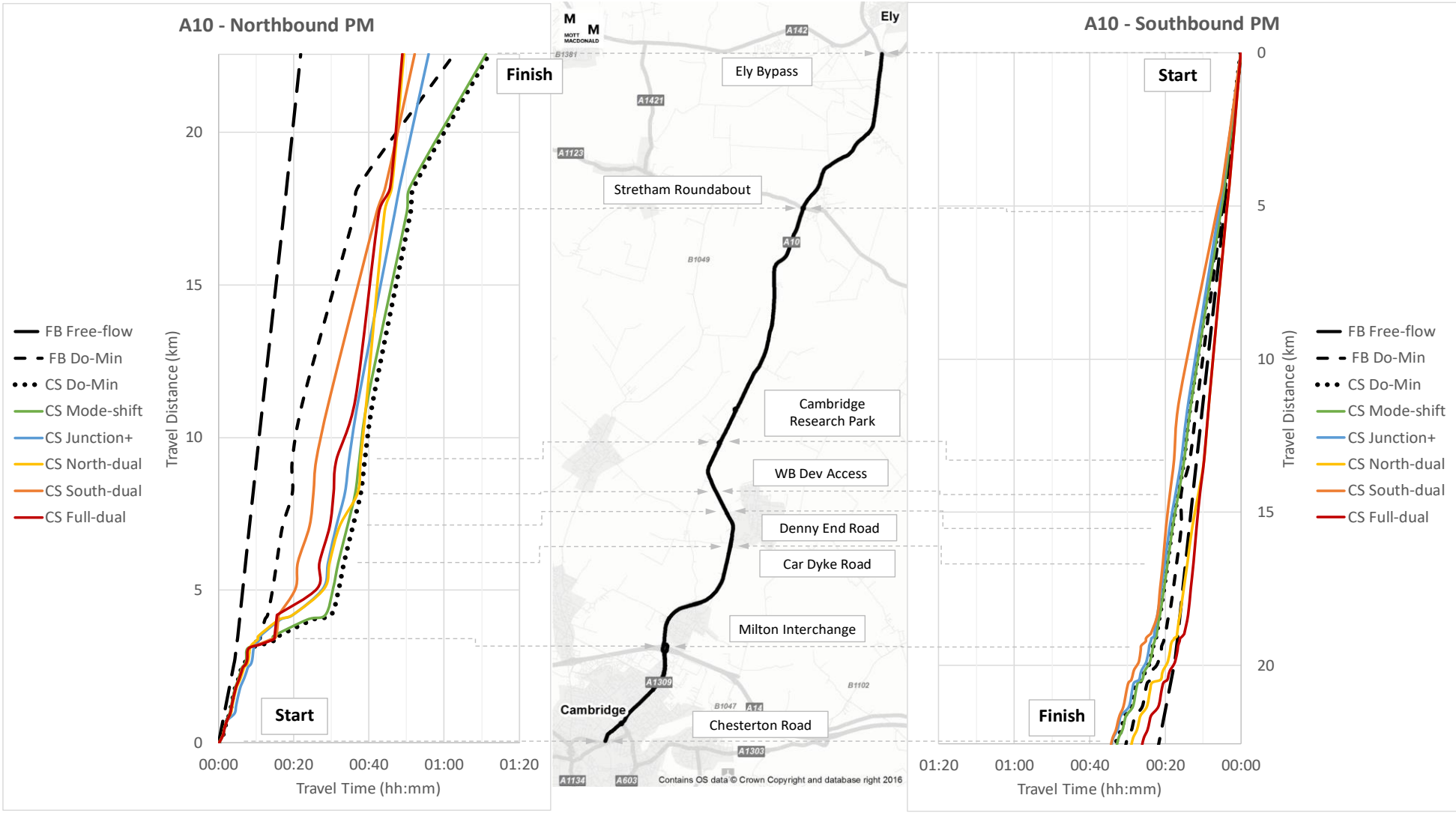
- In both the AM and PM peak, the Full-Dual package delivers an overall improvement compared to both the Future-Base and Combined-Scenario Do-Minimum situations in both directions, and the lowest journey times of all the packages.

Figure 76: A10 corridor modelled journey times – 2031 AM peak



Source: CSRM2

Figure 77: A10 corridor modelled journey times – 2031 PM peak



Source: CSRM2

8.4 Performance Indicator Summary

8.4.1 Car Mode Share

The following figure shows the modelled change in car mode share levels for the Combined-Scenario Full-Dual package and the Combined-Scenario Do-Minimum situation compared to the Future-Base Do-Minimum situation. The other Do-Something options are also shown for reference. The results listed are taken from the above analysis and are based on all weekday AM and PM peak hour trips between sectors most likely to use the study area (see Section 4.2.1 above)

Figure 78: Change in car mode share levels compared to Future-Base Do-Minimum

AM Peak

Area	CS Do Min	CS Mode Shift	CS Jn+	CS North Dual	CS South Dual	CS Full Dual
Study area	-5.3%	-8.8%	-8.4%	-7.9%	-6.8%	-5.9%

PM Peak

Area	CS Do Min	CS Mode Shift	CS Jn+	CS North Dual	CS South Dual	CS Full Dual
Study area	0.5%	-2.1%	-1.7%	-1.4%	-0.6%	-0.001%

Source: CSRM2

These results show that:

- Compared to both the Future-Base Do-Minimum and the Combined-Scenario Do-Minimum, the Full-Dual package delivers a car mode-share improvement in both peak hours, but not to the same extent as the other packages.

8.4.2 Parallel Route Traffic Levels

The following figure shows the change in modelled traffic levels on routes parallel to the A10for the Combined-Scenario Full-Dual package and the Combined-Scenario Do-Minimum situation compared to the Future-Base Do-Minimum situation. The other Do-Something options are also shown for reference.

The routes listed correspond to the analysis points shown in Figure 3 above as follows:

- B1047 (Horningsea Road) – point 6
- B1049 South (Histon Road) – point 4
- B1049 North (Twenty Pence Road) – point 8
- Landbeach Road – point 3

Figure 79: Change in parallel route traffic levels compared to Future-Base Do-Minimum

AM Peak

Parallel Route	CS Do Min	CS Mode Shift	CS Jn+	CS North Dual	CS South Dual	CS Full Dual
B1047	52%	49%	40%	43%	-34%	-36%
B1049 South	-2%	-3%	-2%	-4%	-11%	-13%
B1049 North	14%	12%	14%	-18%	-6%	-37%
Landbeach Rd	18%	19%	8%	-10%	10%	-12%
All routes	15%	14%	11%	0%	-10%	-23%

PM Peak

Parallel Route	CS Do Min	CS Mode Shift	CS Jn+	CS North Dual	CS South Dual	CS Full Dual
B1047	56%	53%	50%	55%	26%	21%
B1049 South	1%	-1%	1%	-2%	0%	2%
B1049 North	-10%	-10%	-11%	-5%	-13%	5%
Landbeach Rd	-89%	-80%	-30%	-48%	-47%	-41%
All routes	-7%	-7%	3%	1%	-6%	-2%

Source: CSRM2

These results show that:

- In the AM, traffic flows on parallel routes are lower than those in both the Future-Base and Combined-Scenario Do-Minimum situations.
- In the PM, the Full-Dual package generates lower flows on the B1047 than in the Combined-Scenario Do-Minimum, but not the Future-Base Do-Minimum. On the B1049, there is also a slight increase compared to both Do-Minimum situations. However, these increases are manageable and would respond to appropriate mitigation.

Overall, this package has a generally positive impact on parallel route traffic levels, improving on the Combined-Scenario Do-Minimum situation in the AM peak, and resulting in an overall improvement in traffic compared to the Future-Base Do-Minimum situation in both peaks.

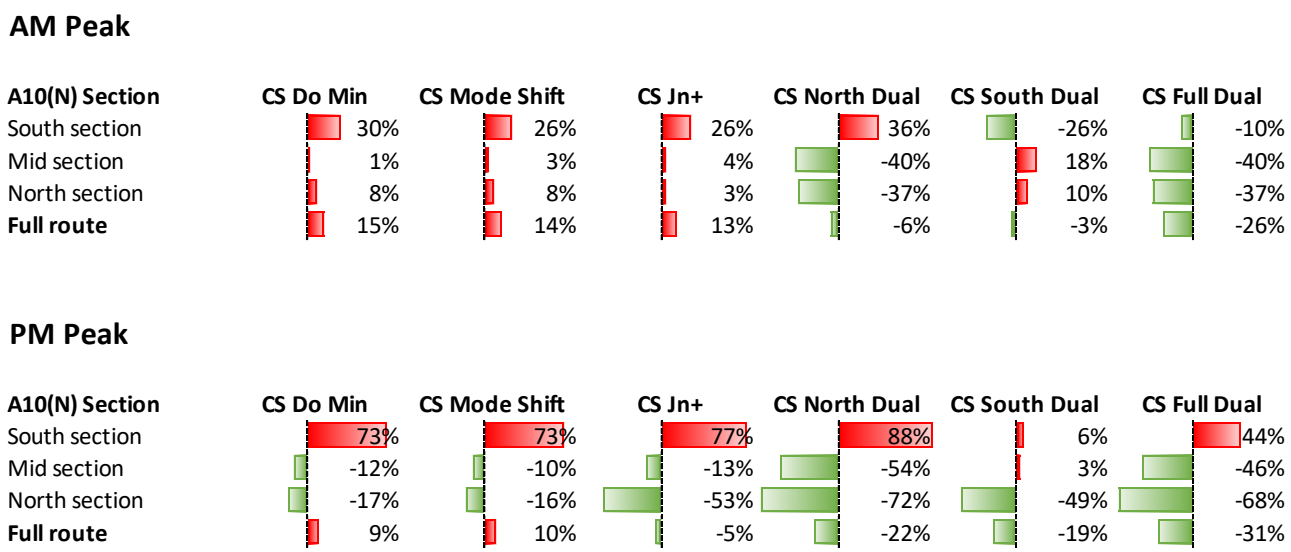
8.4.3 Journey Time

The following figure shows the change in modelled two-way highway journey times on the A10for the Combined-Scenario Full-Dual package and the Combined-Scenario Do-Minimum situation compared to the Future-Base Do-Minimum situation. The other Do-Something options are also shown for reference.

The journey times are shown by route section and for the full route, where the sections are as follows:

- South section – Milton Interchange to Cambridge Research Park
- Mid section – Cambridge Research Park to Stretham roundabout
- North section - Stretham roundabout to Ely bypass

Figure 80: Change in A10 corridor journey time compared to Future-Base Do-Minimum



Source: CSRM2

These results show that:

- Compared to the Future-Base and the other Combined-Scenario results, the Full-Dual package delivers significant journey time improvements in both peak hours, and more than the other packages deliver. The only underperforming section is the southern section in the PM peak, which would require extra consideration at the next level of design development.

Overall, the Full-Dual package results in significantly improved full-corridor journey times compared to both the Future-Base and Combined-Scenario Do-Minimum situations.

8.5 Results Summary

Overall, the Full-Dual package shows mixed impacts on mode choice. Like the other dualling packages, in the study area this package results in increased trip making and an overall reduction in the car mode share compared to both the Future-Base and the Combined-Scenario Do-Minimum situations. However, both car trip and car mode share levels are increased to and from most sectors because of the increased capacity serving these locations.

In terms of journey time benefits on the A10 highway corridor, this package delivers improvements over the full route compared to both the Future-Base and Combined-Scenario Do-Minimum situations, and the greatest improvements of all the package options.

This Do Something option therefore demonstrates the full potential benefits to the study area of dualling in combination with non-highway improvements, but also the risks of unwanted traffic generation and mode-shift which must be effectively managed with major new highway scheme proposals.

9 Sensitivity Test Results

The purpose of this section is to describe and present the CSRM2 highway assignment model results of the M11-Link and the A142-Link sensitivity tests.

9.1 Sensitivity Test Scope and Method

As described in Section 3.5.3 above, sensitivity tests have been undertaken to explore how two potential future highway schemes which could indirectly affect the study area. These schemes are:

- a potential A142-link – this would be a new highway link between the A10 and the A142 (west), in order to relieve pressure from the southern section of the Ely bypass
- a potential M11-link – this would be a new highway link between the A47 and the A14/M11, in order to relieve pressure on the A10 and A141 routes. The CSRM2 model does not cover the northern section of such a link in any detail and so for the purpose of this test it has been assumed the route would run from the Bar Hill area in the south and connect into the A142 somewhere between Chatteris and Ely

These schemes are currently of a hypothetical status only and are being considered by separate studies to establish points of feasibility and detail. However, the degree to which they could potentially impact upon the performance of the A10 corridor is considered here so that any benefits or conflicts with the above Do Something packages can be understood.

The tests have been undertaken using the highway assignment component of the CSRM2 model only. Of the four potential user responses listed in Section 3.6 above which are available when the full demand model component is also used, the highway assignment model only allows for highway users to change their choice of route. However, since both the schemes being tested only involve the addition of new highway capacity, this will be the main user response observed, and so the use of this modelling component allows the primary impact of these schemes on the A10 highway corridor to be assessed.

The highway assignment modelling results are presented for each scheme separately in the following sections.

9.2 Sensitivity Test 1: A142-Link Scheme Impacts

9.2.1 Scheme Concept

The concept of this scheme would be to relieve pressure on the southern section of the Ely bypass by providing a new highway link between the A10, somewhere north or south of Stretham, to the A142 (west), somewhere east or west of Witcham Toll. By diverting flows between these two links away from the bypass, congestion on the bypass would theoretically be reduced.

For the purposes of modelling, the scheme is based on the above Full-Dual Do Something package. The scheme therefore includes the following components:

- Mode-Shift package of non-car mode measures
- Junction+ package junction improvements, where relevant
- Dualling of A10 between Milton Interchange and new A142 link
- Retention of single carriageway configuration for A10 between new A142 link and Ely bypass
- New A142 link in single carriageway configuration

It should be noted that this scheme has been tested at an outline conceptual level only in the CSRM2 model, and that no particular route is inferred by the new model links shown in the results below.

9.2.2 Traffic Flow and Delay Results

For each peak hour, the following figures show:

- Predicted traffic flows and total junction delays for the A142-Link option
- The difference in traffic flows and total junction delays between the A142-Link option and the Combined-Scenario Do-Minimum situation

Traffic flow data is shown as scaled bands, where the width and colour reflect the flow level, while junction delays are shown as scaled circles, where the size and colour reflect delay levels.

As this option is a variant of the Full-Dual package option, these results should be compared with the equivalent results for that package, which are shown in Figure 72 to Figure 75 above.

These figures for the AM peak show:

- Compared to the Combined-Scenario Do-Minimum situation, the new A142-Link shows a strong traffic increase in both directions, as the change is being measured from a zero base. In absolute terms, however, the relative flow level on this link is quite minor and considerably less than on the parallel A10 or A142 routes. A delay benefit is seen on the affected section of the Ely bypass, though.
- Comparing these results with the equivalent Full-Dual results above shows that the reduction in A10 capacity on the northern section results in less demand on the dualled sections of A10. This, in turn, provides a relative performance benefit along those sections, though in reality means that this northern throttle is constraining growth on the dualled sections. This could be alleviated by dualling the north section. It is noted that the Full-Dual package also delivers delay benefits on the Ely bypass.

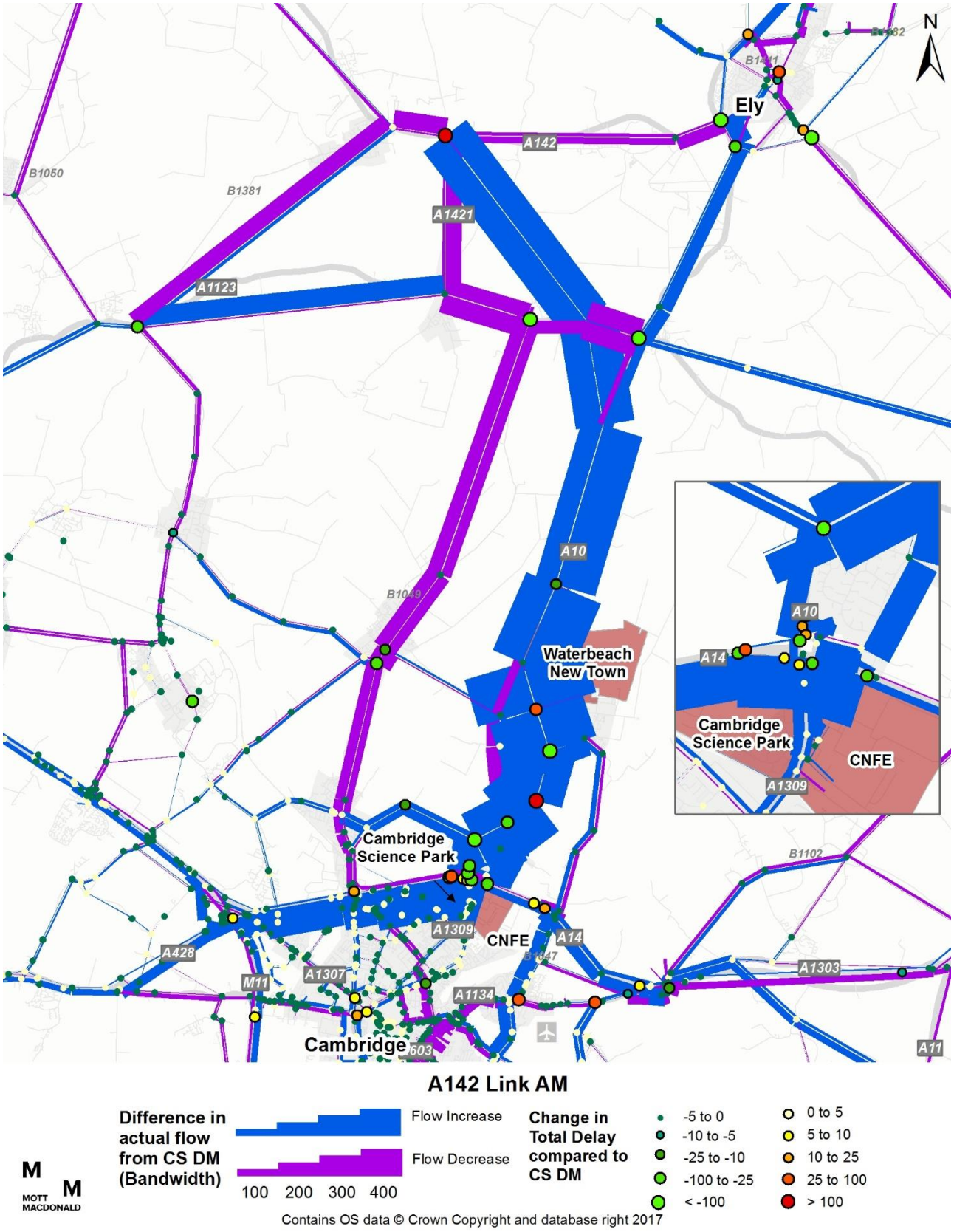
These figures for the PM peak show:

- As with the AM, the new A142-Link shows a strong traffic increase in both directions, but low total flows in absolute terms. Some delay benefit also seen on the affected section of Ely bypass, but some disbenefit also.
- Comparing these results with the equivalent Full-Dual results above shows a similar pattern to the AM, with reduced flows on the dualled sections of A10 generating some performance benefits, but also with little difference in benefit to the Ely bypass.

Figure 81: A142-Link package flow and delay distribution – AM peak

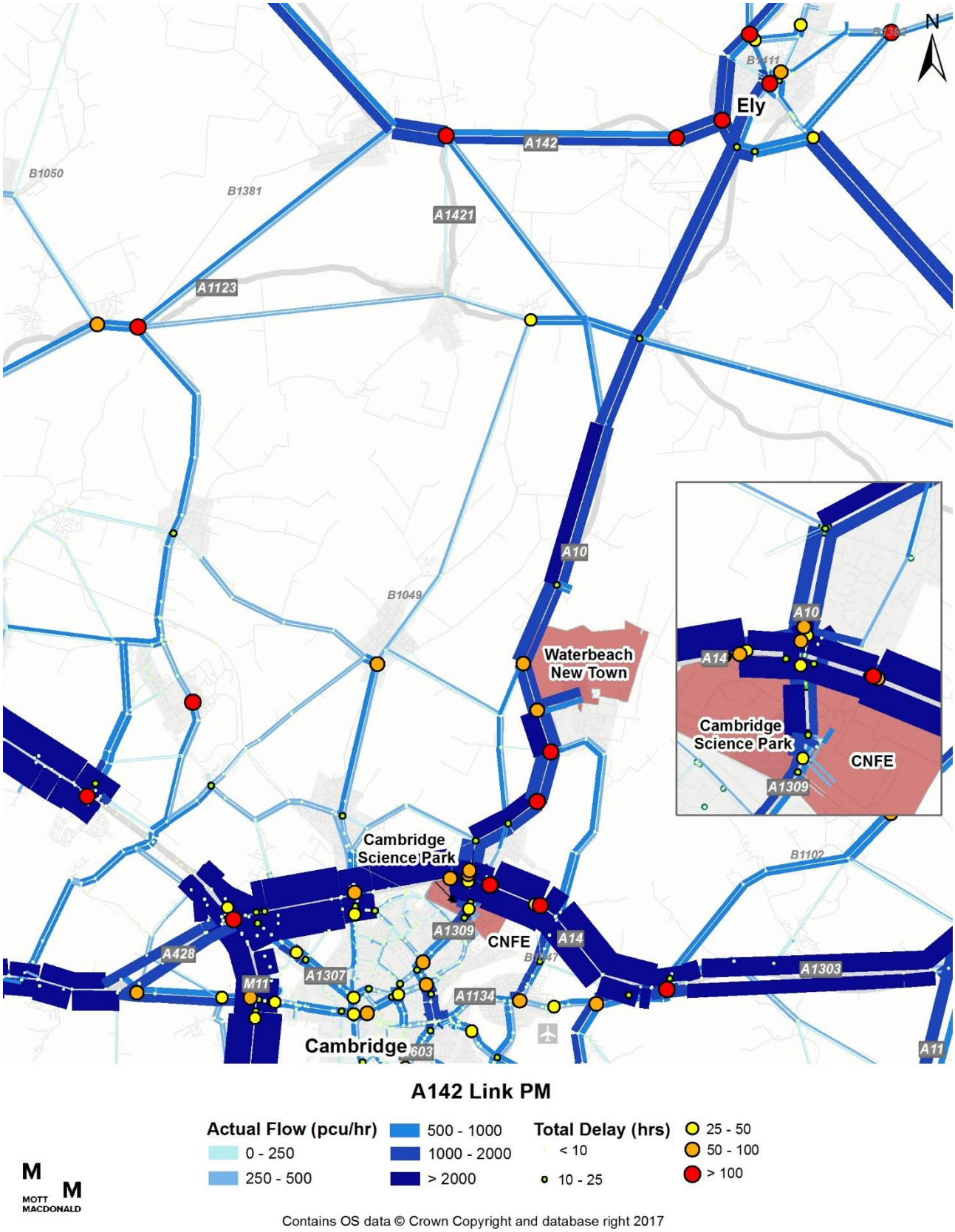
Source: CSRM2

Figure 82: A142-Link package flow and delay difference vs Combined Scenario Do Min – AM peak



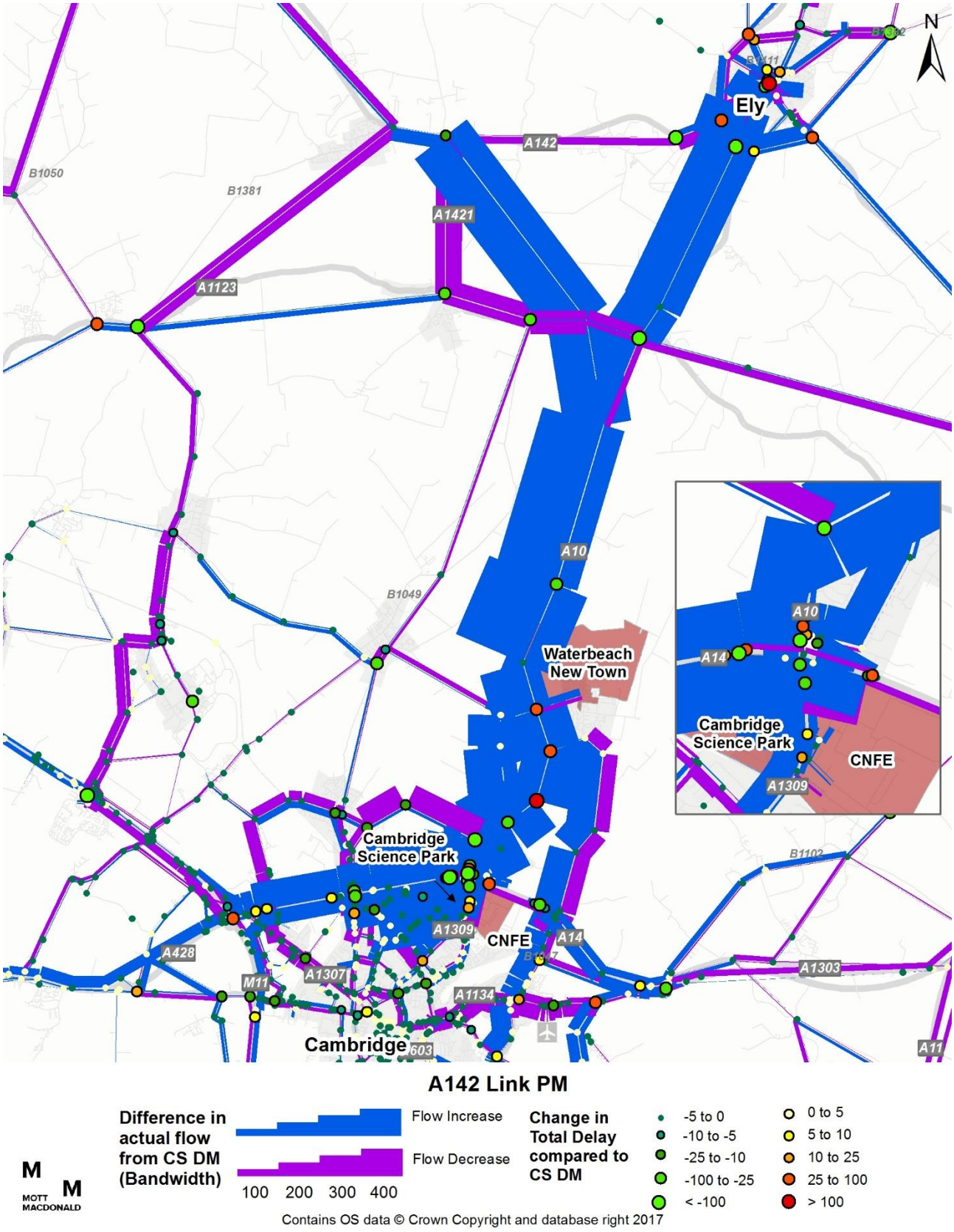
Source: CSRM2

Figure 83: A142-Link package flow and delay distribution – PM peak



Source: CSRM2

Figure 84: A142-Link package flow and delay difference vs Combined Scenario Do Min – PM peak



Source: CSRM2

9.2.3 A10 Journey Time Results

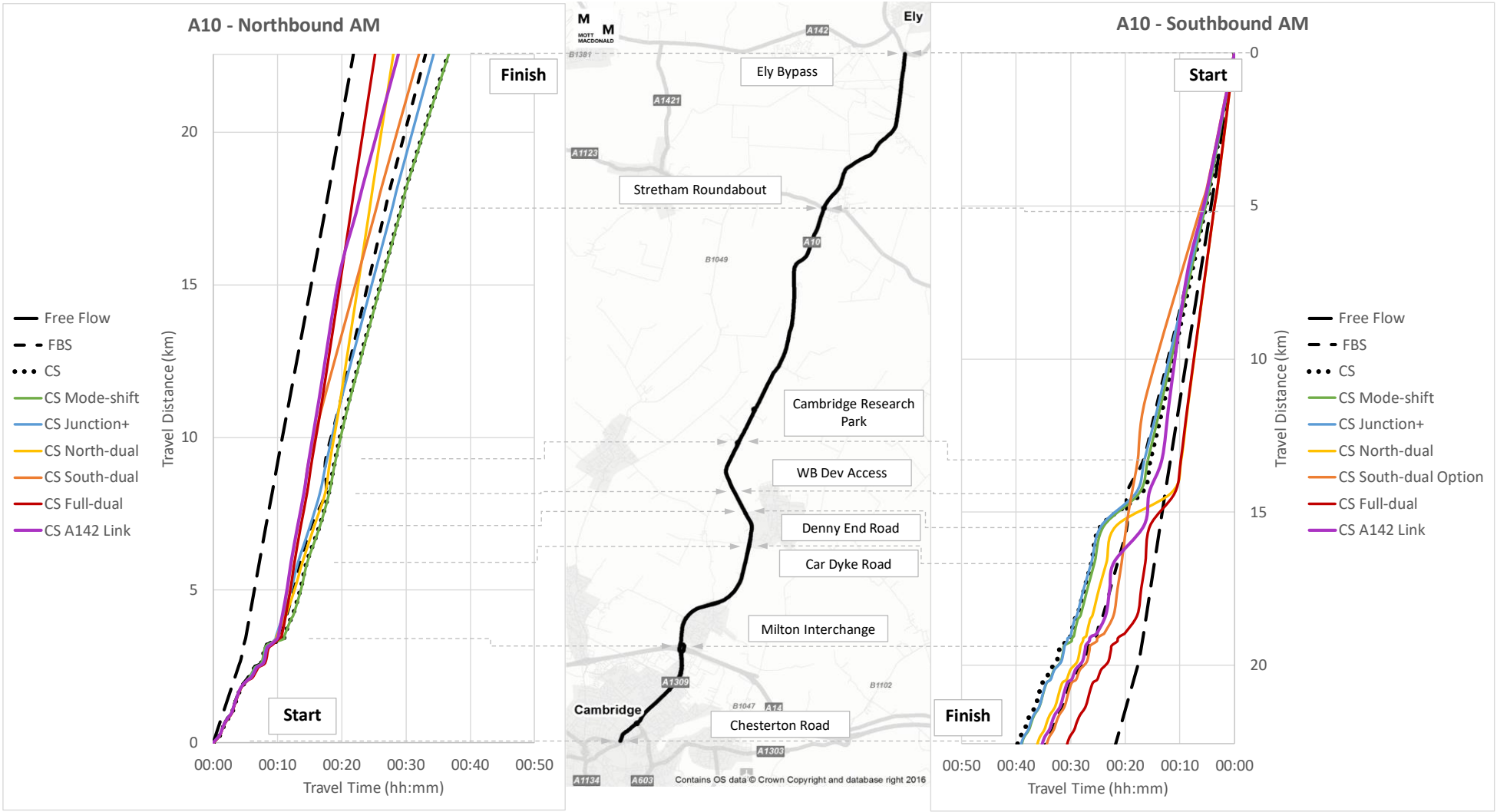
The following two figures show, for the AM and PM peak, modelled journey times along the A10 highway corridor between Chesterton Road and Ely bypass for the following scenarios:

- Future-Base Scenario Do-Minimum
- Combined-Scenario Do-Minimum
- Combined-Scenario Do-Something:
  - Mode-Shift package
  - Junction+ package
  - North-Dual package
  - South-Dual package
  - Full-Dual package
- Combined-Scenario Sensitivity Test:
  - A142-Link option

These charts show that:

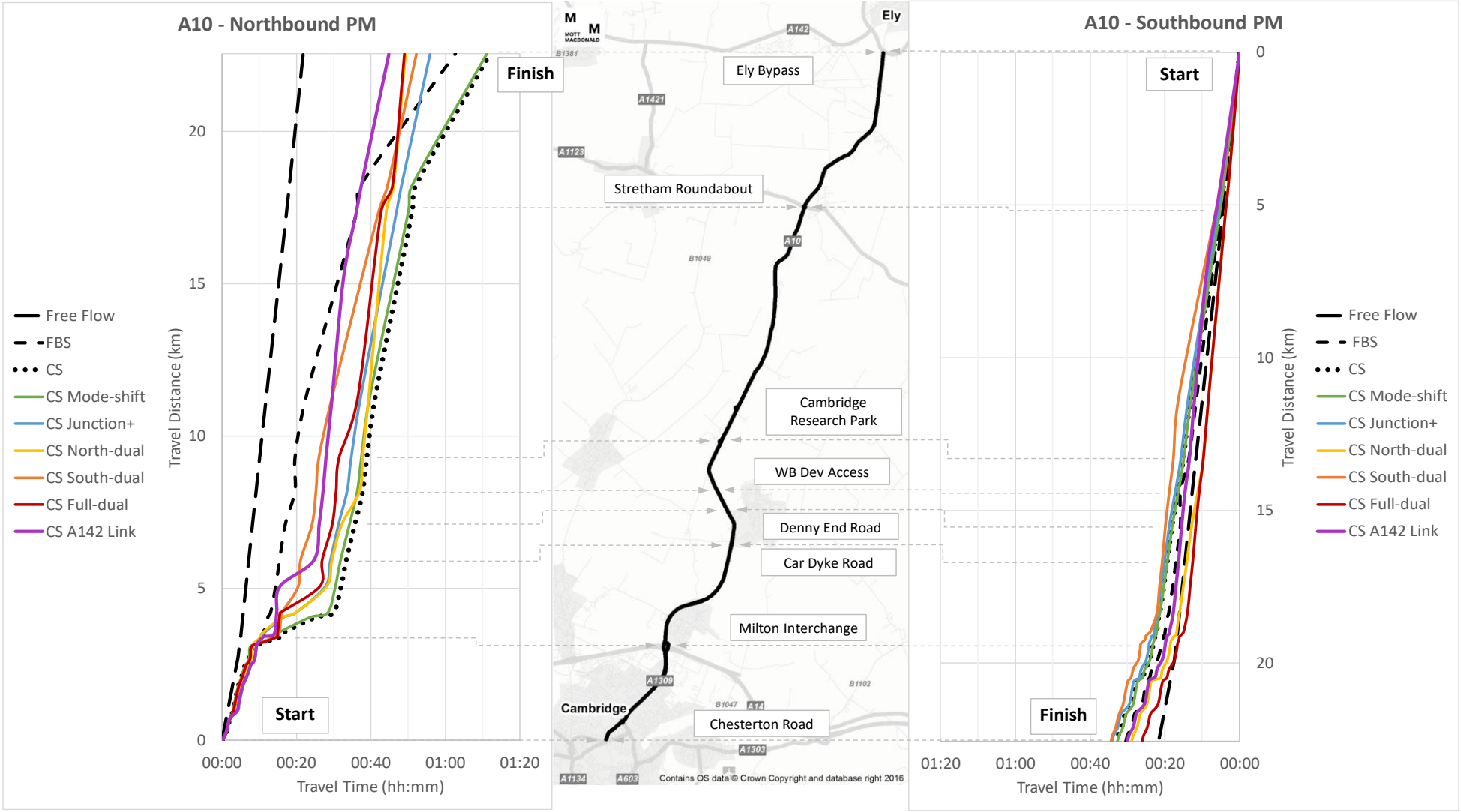
- In the AM, the A142-Link option performs similarly to the Full-Dual package over the dualled sections, but then produces longer journey times on the single-lane northern section.
- In the PM, the reduced flows on the dualled sections of A10 actually result in northbound journey times which are lower than for the Full-Dual package. However, this is more a consequence of the northern single-lane section constraining flow on the dualled sections than it is a result of the new link removing flow from the corridor. In the southbound direction, journey times are longer than for the Full-Dual package.

Figure 85: A10 corridor modelled journey times – 2031 AM peak



Source: CSRM2

Figure 86: A10 corridor modelled journey times – 2031 PM peak



Source: CSRM2

9.2.4 A142-Link Sensitivity Test Results Summary

The A142-Link sensitivity test results show that such a link would only have a limited impact on alleviating congestion on the Ely bypass, as predicted flows on the link are relatively low. This is because modelled demand from the A142 (west) to the A10 is relatively minor.

For the same reason, impacts on the A10 route are also relatively insignificant, with the greater impacts in this test being due to the throttling of capacity on the northern single-lane section, which is not directly related to the introduction of the new link.

In summary, therefore, should this link go ahead in future, it is not considered that it would make a material difference to the type of mitigation treatment applied to the A10 corridor to alleviate the impacts of new development. However, it could potentially generate some congestion benefits on the affected section of Ely bypass.

9.3 Sensitivity Test 2: M11-Link Scheme Impacts

9.3.1 Scheme Concept

The concept of this scheme would be to relieve pressure on the A141 and A10(N) routes by providing a new highway link between the A142, somewhere between Chatteris and Ely, and the A14/M11, somewhere near Bar Hill. By introducing such a link, traffic would be able to reach the A47 and locations to the north directly from the strategic network without having to use less direct and congested A-road routes or inappropriate local road routes.

For the purposes of modelling, the scheme is based on the above Mode-Shift Do Something package. The scheme therefore includes the following components:

- Mode-Shift package of non-car mode measures on A10
- New M11-link in dual-carriageway configuration (though single-carriageway, or a combination of both, would also be an option)

It should be noted that this scheme has been tested at an outline conceptual level only in the CSRM2 model, and that no particular route is inferred by the new model links shown in the results below. The feasibility and detail of this scheme will be developed by separate studies.

9.3.2 Traffic Flow and Delay Results

For each peak hour, the following figures show:

- Predicted traffic flows and total junction delays for the M11-Link option
- The difference in traffic flows and total junction delays between the M11-Link option and the Combined-Scenario Mode-Shift package

Traffic flow data is shown as scaled bands, where the width and colour reflect the flow level, while junction delays are shown as scaled circles, where the size and colour reflect delay levels.

These figures for the AM peak show:

- Comparable flows on the new link to the A10 route; particularly on the mid-section in the southbound direction.
- The flow and delay difference plot show that these flows are providing relief for the parallel routes of the B1048 and the A10, with significant flow reductions on both and in both directions. Delay reductions on both routes are also evident.

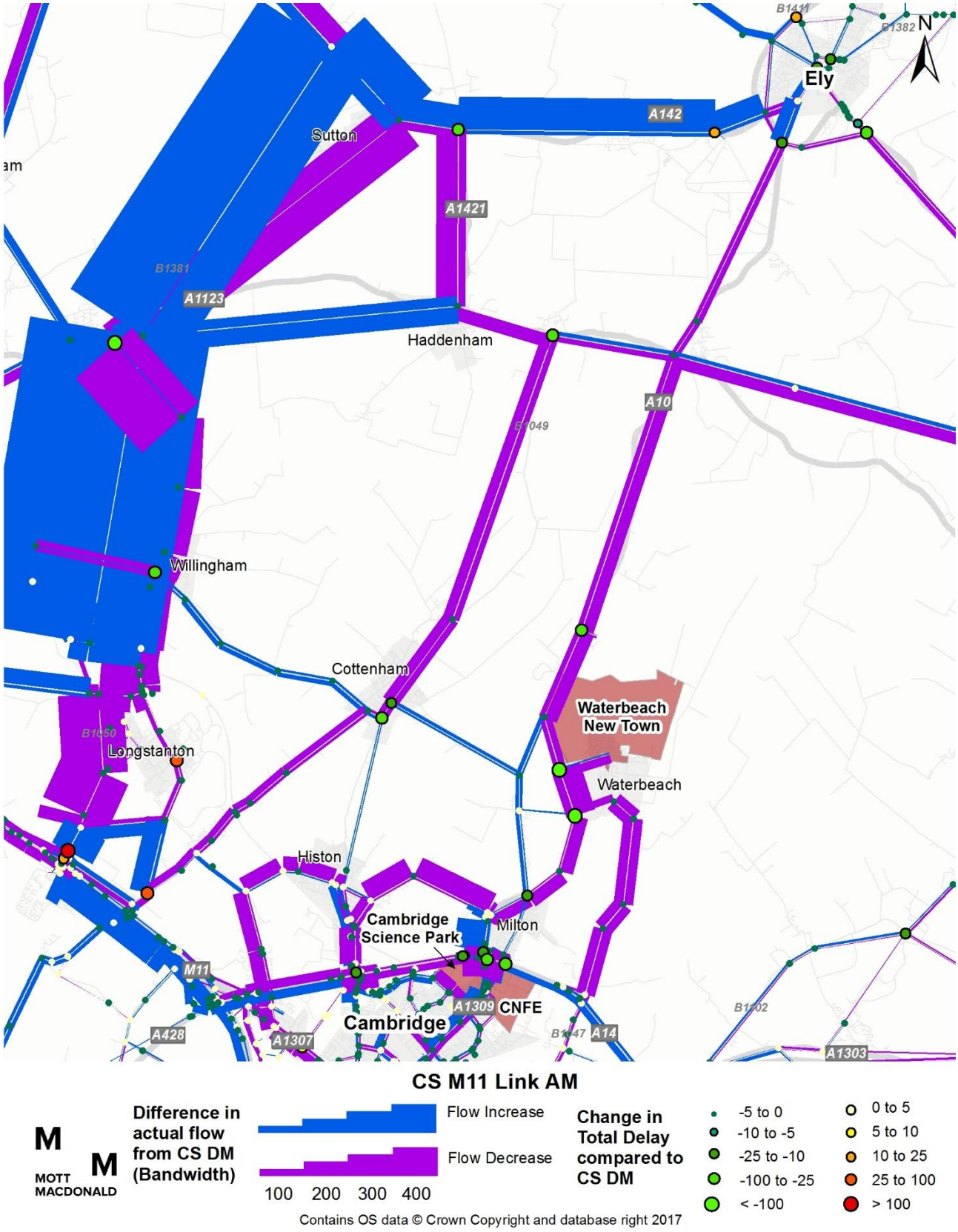
These figures for the PM peak show:

- A similar picture to the AM peak, with comparable flow levels on the new route to the A10, and flow and delay reductions on both the A10 and the parallel B1048.

Figure 87: M11-Link package flow and delay distribution – AM peak

Source: CSRM2

Figure 88: M11-Link package flow and delay difference vs Combined Scenario Do Min – AM peak

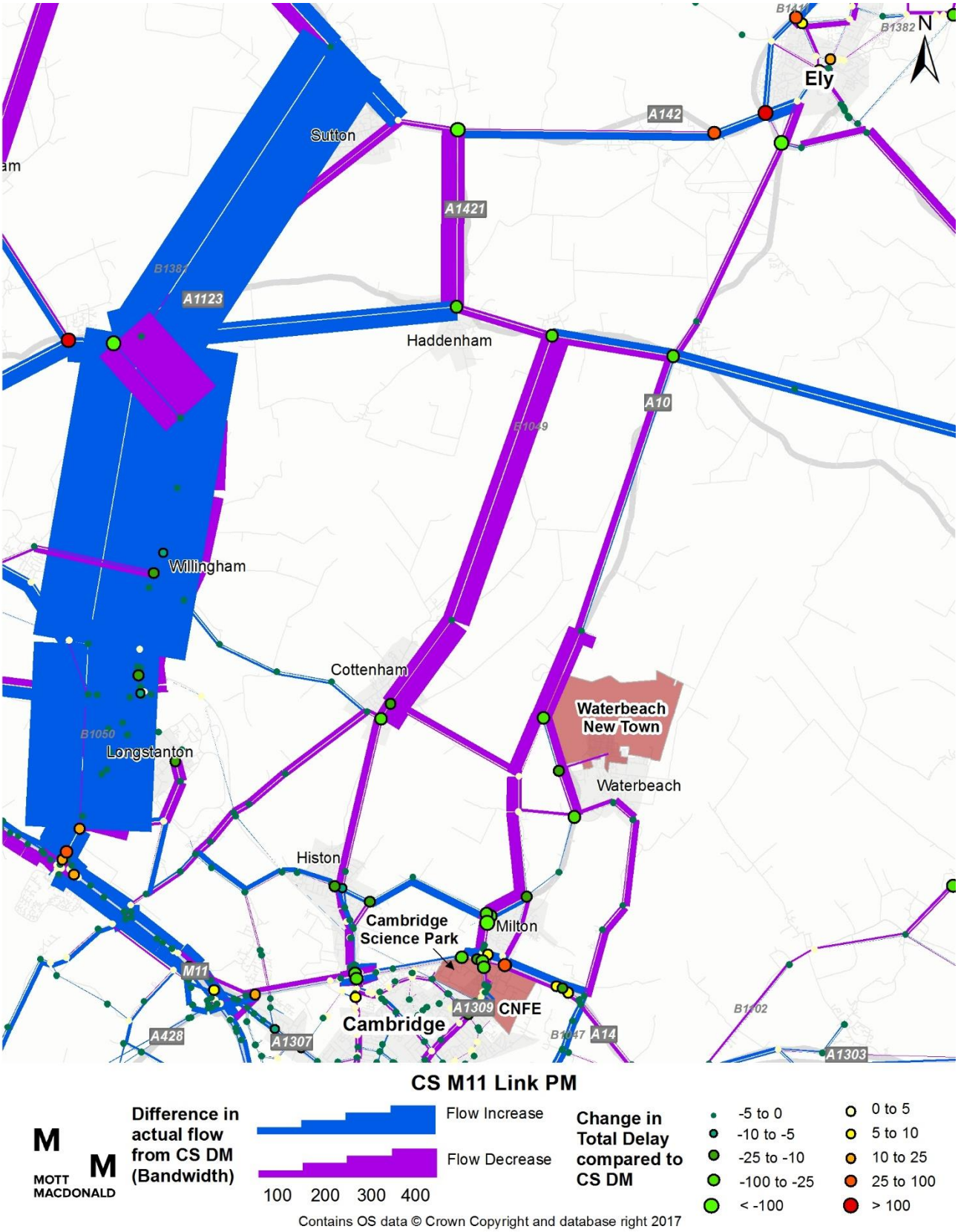


Source: CSRM2

Figure 89: M11-Link package flow and delay distribution – PM peak

Source: CSRM2

Figure 90: M11-Link package flow and delay difference vs Combined Scenario Do Min – PM peak



Source: CSRM2

9.3.3 A10 Journey Time Results

The following two figures show, for the AM and PM peak, modelled journey times along the A10 highway corridor between Chesterton Road and Ely bypass for the following scenarios:

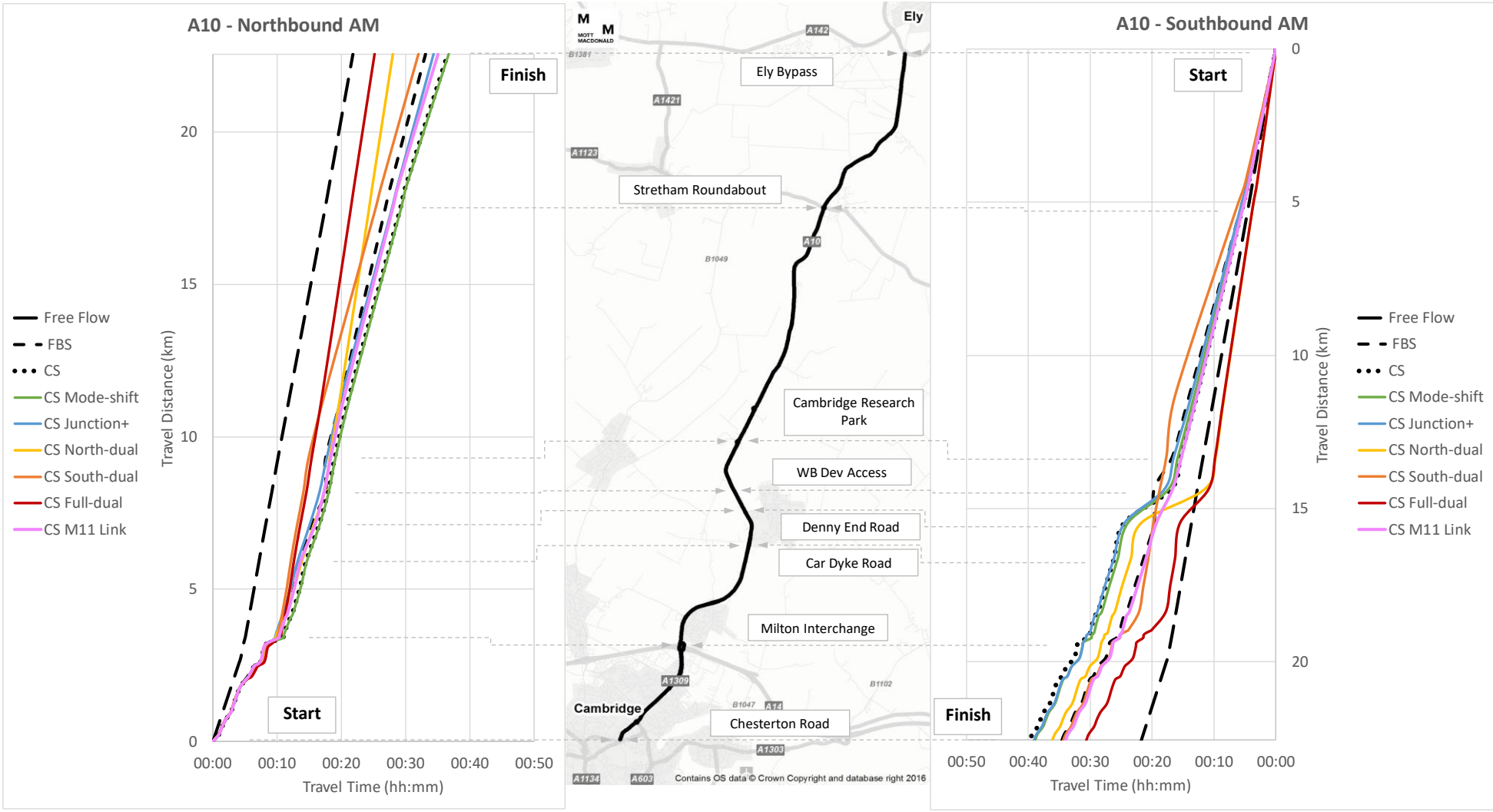
- Future-Base Scenario Do-Minimum
- Combined-Scenario Do-Minimum
- Combined-Scenario Do-Something:
  - Mode-Shift package
  - Junction+ package
  - North-Dual package
  - South-Dual package
  - Full-Dual package
- Combined-Scenario Sensitivity Test:
  - M11-Link option

These charts show that:

- In the AM, M11-Link journey times are similar to those of the Future-Base Do-Minimum in both directions; shorter than the equivalent Mode-Shift package result; and only improved upon by the Full-Dual package in the congested southbound direction.
- In the PM, M11-Link journey times in the congested northbound direction are shorter than those of the Future-Base Do-Minimum and equivalent Mode-Shift package result, and again only improved upon by the Full-Dual package. In the southbound direction, the journey time is shorter than the Mode-Shift option and similar to the Future-Base Do-Minimum scenario.

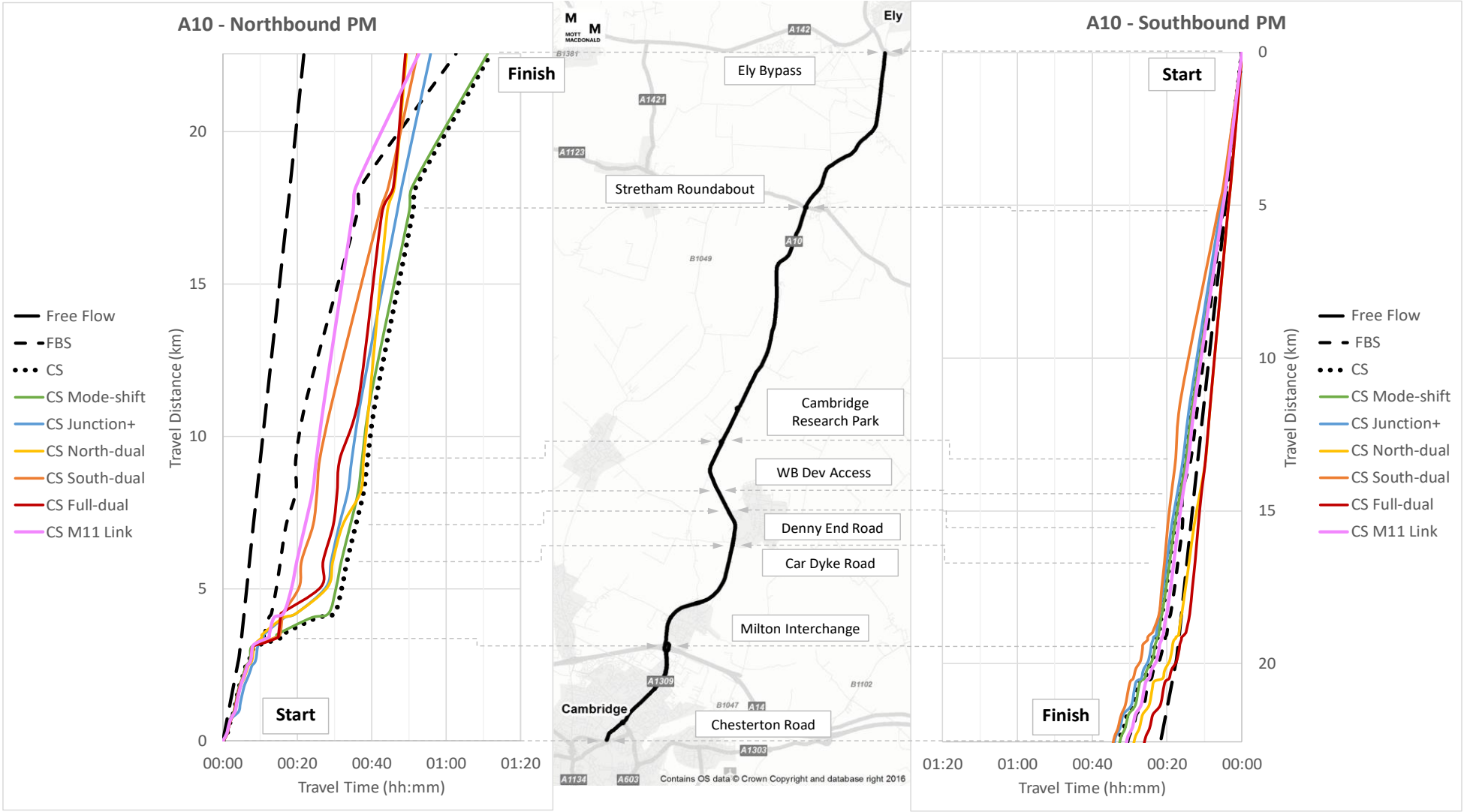
In summary, therefore, the addition of this link improves the Mode-Shift package journey time results to be similar or superior to those of the Future-Base Do-Minimum, and comparable in some cases to the semi-dualled package options. This is as a result of the reduced flows on the A10 route.

Figure 91: A10 corridor modelled journey times – 2031 AM peak



Source: CSRM2

Figure 92: A10 corridor modelled journey times – 2031 PM peak



Source: CSRM2

9.3.4 M11-Link Sensitivity Test Results Summary

The M11-Link sensitivity test results show that such a link would have a potentially positive impact on the A10 corridor, with flows reducing on this and on the parallel B1049 route. As a result, journey time performance on the A10 route is predicted to be superior to the equivalent Mode-Shift package result; similar to the Future-Base Do-Minimum result; and comparable in most cases with the semi-dualled Do-Something scenarios.

In summary, therefore, should such a scheme go ahead in future, the level of highway intervention required on the A10 corridor to accommodate future growth would potentially be less significant in the short term than what would be required without the scheme. As the scheme feasibility, viability and further details are developed as part of a separate study, the impact on the A10 corridor proposals should be considered further.

10 Summary and Conclusions

10.1 Study Background and Report Purpose

Mott MacDonald has been commissioned by Cambridgeshire County Council (CCC) to deliver the Ely to Cambridge Transport Study. The study area includes key rail and highway corridor links (both primary and secondary) between Cambridge, Ely, and beyond. It is also the focus of significant future development, with the new town north of Waterbeach and the Cambridge Northern Fringe East (CNFE) and Cambridge Science Park (CSP) sites being the main future focus for significant residential and employment development in the study area. These key elements are shown in the indicative study area plan above.

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, supported by modelling, that identifies the infrastructure package and phasing of that package to provide for the transport demand of the development of a new town north of Waterbeach.
- Strand 3 – A Transport Study, supported by modelling, which provides evidence for the level of development which could be supported in the CNFE and CSP areas and their phasing, in transport terms.

In order to progress these three strands, 'Do Minimum' modelling has been undertaken using the Cambridgeshire Sub-Region Model (CSRM2) in order to identify transport conditions in 2031 with and without the above proposed developments, but without development-related transport mitigation measures. The results of this process are reported in our Do Minimum Modelling Report.

This report represents the Strand 1 'Options Study', and describes the process by which 'Do Something' packages have been developed for the study area and the transport modelling results for each of them. This report therefore supports and informs the Option Appraisal section of the Strand 1 Strategic Outline Business Case report.

The main steps undertaken to identify potential Do Something packages for the study area and to compare them on transport grounds are as follows:

1. Analysis of Do Minimum modelling results to better understand future demand on the A10 highway corridor with and without development, with a view to identifying the type of transport measures most likely to be required to mitigate development impact on the corridor and facilitate sustainable travel patterns
2. Identification of potential Do Something package options for the study area, based on the Do Minimum corridor analysis
3. Testing of potential Do Something package options in CSRM2 full demand model
4. Comparison of packages based on key model outputs

Assessment of development impacts is achieved by comparing the results of two key future development scenarios, which are as follows:

- The 'Future-Base Scenario', which represents the hypothetical future 'without-development' situation in 2031 where neither the Waterbeach new town, Cambridge Northern Fringe East (CNFE) nor Cambridge Science Park (CSP) intensification developments take place

- The 'Combined Scenario', which represents the future 'with-development' situation in 2031 where both the Waterbeach new town and CNFE/CSP developments take place

A summary of the outcomes of the above main steps is provided in the following sections.

10.2 Do Minimum Corridor Demand Analysis Results

Analysis of the Combined-Scenario Do-Minimum modelling results compared to the Future-Base Do-Minimum modelling results reveals the following:

- The proposed new developments – and especially the new town north of Waterbeach – will have a significant impact on the study area which will require mitigation.
- This impact is most acute on the southern section of the study area where total flows, new development flows and displaced background traffic flows are predicted to be greatest, but significant impacts are also evident on the full route. On average across the study area, the new development flows result in a 39% displacement of background traffic in an average peak-hour.
- Of the background traffic trips, an average of 21% show the greatest potential for mode-shift, with trips between Cambridge and Ely and between Waterbeach and Ely generating the highest proportions in this category.
- Of the new development trips, an average of 45% show the greatest potential for mode-shift, with trips between the new town north of Waterbeach and Ely and between the new town north of Waterbeach and Cambridge generating the highest proportions in this category.

Overall, therefore, the measures considered by the proposed mitigation packages must:

1. Deliver mode shift for A10 existing traffic, and particularly for trips between Cambridge and Ely and between Waterbeach and Ely.
2. Deliver mode shift for A10 new development trips, and particularly for trips between the new town north of Waterbeach and Ely and between the new town north of Waterbeach and Cambridge.
3. Deliver supply-side measures to improve performance of the A10 highway corridor, and particularly for the mid and southern sections of corridor between the new town north of Waterbeach and Cambridge.
4. Deliver parallel route measures to deter any residual traffic flow increases as a result of new development pressures.

10.3 Do Something Package Development

The scope of Strand 1 of this study is described in the study brief as being *"to consider in detail the overall transport capacity requirements of the Ely to Cambridge corridor in the context of growth".*

The priority of this strand of the study is therefore to consider how to manage the performance of the Ely to Cambridge study area in the face of significant future development pressures. In accordance with prevailing transport policy, the need for mitigation has been approached as follows:

1. Consider demand-side mitigation first, to minimise need to travel and to maximise trips by non-car modes
2. Consider supply-side mitigation second, to alleviate residual highway impacts of car demand

All Do Something packages developed by this study therefore include the same level of demand-side mitigation measures, and so differ only in the level and type of supply-side measures considered in addition.

Based on the Do Minimum demand analysis, consultation with the client team, and taking into account measures which already have some basis in either policy and/or developer aspirations, the following Do Something package short-list was taken forward for modelling:

Table 19: Do Something packages short-list

Package Name	Description	Rationale
Mode-shift	Do Minimum highway network plus the above non-highway measures to encourage mode shift	To test the impact of non-highway interventions only
Junction+	Mode-shift option measures, but with above 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 (alignment TBC) from the northern access of the new town north of Waterbeach to Ely	To test the impact of a further highway upgrade, which encourages use of P&R from the new town north of Waterbeach to Cambridge
South-dual	Junction+ option, but with the A10 dualled (alignment TBC) from the southern access of the new town north of 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 (alignment TBC) from the A14 to Ely	To test the impact of a full corridor upgrade

In addition, sensitivity tests were undertaken to consider two potential future highway schemes which could indirectly affect the study area. These schemes are:

- A potential A142-link – this would be a new highway link between the A10 and the A142 (west), in order to relieve pressure from the southern section of the Ely bypass
- A potential M11-link – this would be a new highway link between the A47 and the A14/M11, in order to relieve pressure on the A10 and A141 routes

The Do Something modelling has been carried out using Cambridgeshire County Council's updated CSRM2 transport model.

10.4 Do Something Package Modelling Results Summary

10.4.1 Mode-Shift Package

Overall, the Mode-Shift package shows positive impacts on mode choice for trips using the study area. This results in increased trip making in the study area, a reduction in the car mode share and an increase in the use of all non-car modes. However, despite these benefits, the improvement in highway performance is limited. This outcome therefore confirms the above Do-Minimum demand analysis conclusion that the Do Something packages will need to incorporate highway supply-side as well as demand-side measures. Different approaches to this are considered in the following sections.

10.4.2 Junction+ Package

Overall, the Junction+ package shows positive impacts on mode choice for trips using the study area. This results in increased trip making on the corridor and an overall reduction in the car mode share. In addition, and unlike the Mode-Shift option, this package also generates tangible journey time benefits on the A10 highway corridor. These results therefore further confirm the above Do-Minimum demand analysis conclusion that the Do Something packages will need to incorporate highway supply-side as well as demand-side measures, though it is noted that this package does not restore corridor journey times to Future-Base levels. Further approaches to improving network performance are therefore considered in the following sections.

10.4.3 North-Dual Package

Overall, the North-Dual package shows mixed impacts on mode choice. On the study area, this package results in increased trip making and an overall reduction in the car mode share compared to both the Future-Base and the Combined-Scenario Do-Minimum situations. However, both car trip and car mode share levels

are significantly increased on the corridor to and from Ely because of the increased capacity serving this location. Use of park & ride is also not as increased as would be expected from the concept of this option.

In terms of journey time benefits on the A10 highway corridor, this package delivers improvements over the full route compared to both the Future-Base and Combined-Scenario Do-Minimum situations. This is due to improvements over the dualled section, but the extra traffic this puts onto the single-lane southern section results in a deterioration in performance there.

This Do Something option therefore establishes the potential benefits to the corridor of dualling in combination with non-highway improvements. The following two options consider variants on this theme.

10.4.4 South-Dual Package

Overall, the South-Dual package shows mixed impacts on mode choice. Like the North-Dual package, this package results in increased trip making on the study area and an overall reduction in the car mode share compared to both the Future-Base and the Combined-Scenario Do-Minimum situations, while use of park & ride is higher than with the North-Dual package. However, both car trip and car mode share levels are increased on the corridor to and from Cambridge, CNFE and CSP because of the increased capacity serving these locations.

In terms of journey time benefits on the A10 highway corridor, like the North-Dual package, this package also delivers improvements over the full route compared to both the Future-Base and Combined-Scenario Do-Minimum situations. This is due to improvements over the dualled section, though the extra traffic this puts onto the single-lane mid and northern section results in some deterioration in performance there.

This Do Something option, however, further underlines the potential benefits to the corridor of dualling in combination with non-highway improvements. The following final option further extends this concept.

10.4.5 Full-Dual Package

Overall, the Full-Dual package shows mixed impacts on mode choice. Like the other dualling packages, on the study area this package results in increased trip making and an overall reduction in the car mode share compared to both the Future-Base and the Combined-Scenario Do-Minimum situations. However, both car trip and car mode share levels are increased on the corridor to and from most sectors directly served by the corridor because of the increased capacity serving these locations.

In terms of journey time benefits on the A10 highway corridor, this package delivers improvements over the full route compared to both the Future-Base and Combined-Scenario Do-Minimum situations, and the greatest improvements of all the package options.

This Do Something option therefore demonstrates the full potential benefits to the corridor of dualling in combination with non-highway improvements, but also the risks of unwanted traffic generation and mode-shift which must be effectively managed with major new highway scheme proposals.

10.5 Sensitivity Test Results Summary

10.5.1 A142-Link Test

The A142-Link sensitivity test results show that such a link would only have a limited impact on alleviating congestion on the Ely bypass, as predicted flows on the link are relatively low. This is because modelled demand from the A142 (west) to the A10 is relatively minor.

For the same reason, impacts on the A10 route are also relatively insignificant, with the greater impacts in this test being due to the throttling of capacity on the northern single-lane section, which is not directly related to the introduction of the new link.

In summary, therefore, should this link go ahead in future, it is not considered that it would make a material difference to the type of mitigation treatment applied to the A10 corridor to alleviate the impacts of new development. However, it could potentially generate some congestion benefits on the affected section of Ely bypass.

10.5.2 M11-Link Test

The M11-Link sensitivity test results show that such a link would have a potentially positive impact on the A10 corridor, with flows reducing on this and on the parallel B1049 route. As a result, journey time performance on the A10 route is predicted to be superior to the equivalent Mode-Shift package result; similar to the Future-Base Do-Minimum result; and comparable in most cases with the semi-dualled Do-Something scenarios.

In summary, therefore, should such a scheme go ahead in future, the level of highway intervention required on the A10 corridor to accommodate future growth would potentially be less significant in the short term than what would be required without the scheme. As the scheme feasibility, viability and further details are developed as part of a separate study, the impact on the A10 corridor proposals should be considered further.

10.6 Report Conclusions

The analysis of Do Minimum modelling results shows that the proposed new town north of Waterbeach will have a significant impact on the A10 highway corridor, and substantially more impact than the development proposals for the CNFE and CSP sites. This is because the latter sites can be accessed via a number of different highway routes, whereas the new town north of Waterbeach is fully dependent on the A10 for highway access. As a result, the only way that this already congested route can accommodate significant new development is by displacing an average of 39% of background traffic off the corridor onto other parts of the network, including onto less appropriate parallel routes.

This analysis shows that measures which maximise opportunities for both background traffic and new development traffic to use alternative non-car modes are therefore essential for the study area to function effectively in the face of predicted growth. However, it also suggests that the scale of mode-shift required to deliver this outcome is unlikely to be achievable and that a degree of highway capacity measures will also be required.

The Do Something modelling tests confirm this conclusion, showing that mode-shift measures alone do not restore corridor performance to ‘without-development’ scenario levels. The tests show gradual performance improvements with increasing levels of corridor highway intervention, but with only the dualling options delivering performance levels which reach ‘without-development’ scenario levels. On the other hand, these options also generate the most car trips on the corridor, are more expensive to implement and, because of their complexity and scale, have potentially greater wider impacts that would need more detailed assessment. These potentially conflicting benefits and costs are assessed in the Options Appraisal section of the Strand 1 Strategic Outline Business Case report where a preferred mitigation strategy is identified as an outcome of the appraisal.

The sensitivity test of the M11-Link option, however, shows that the level of highway intervention required for the A10 corridor is potentially related to whether new highway capacity is provided elsewhere. The test for this link shows that providing such a parallel route could potentially reduce the short-term need for some of the proposed A10 corridor highway improvements.

However, it is noted that such a scheme proposal is at a very preliminary level and the subject of separate studies to take it forward. Until its feasibility, viability and impact on the A10 highway corridor are better established, therefore, it can be concluded that the study area will require a combination of mode-shift measures and significant highway interventions in order to be able to function effectively in the face of

predicted growth levels. The recommended combination is outlined in the Strand 1 Strategic Outline Business Case report.