



Countywide Local Plan Modelling

Buckinghamshire County Council

Phase 3 Technical Note

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1. Introduction

1.1 Background

Jacobs is framework consultant to the Transport for Buckinghamshire Alliance (TfB) between Ringway Jacobs and Buckinghamshire County Council (BCC). Under the terms of this contract, Jacobs is commissioned to undertake transport planning, modelling and appraisal projects on behalf of BCC.

Jacobs has been commissioned to assess the transport impact of the revised phase 3 local plan proposals for the districts within Buckinghamshire, comprising the District Councils of Aylesbury Vale (AVDC), Chiltern (CDC), South Bucks (SBDC) and Wycombe (WDC). For the purpose of this note the aforementioned districts will hereafter be referred to as the “districts”.

Jacobs has already completed work on the first and second phases of the Countywide Local Plan Modelling; further details of these phases of work can be found in the Phase One Forecast Modelling Report¹ and the Phase Two Forecast Modelling Report². This note documents the results of the third phase of modelling work, and outlines the development of the revised phase three local plan development scenario. It should be considered as an addendum to the phase two modelling report, providing supplementary information in regards to the revised local plan development scenario.

The previous two phases of modelling support work set out the impacts of the originally proposed local plan developments on the highway network in Buckinghamshire and identified a number of areas in which the model impacts were considered to be significant, in terms of increased travel time and congestion as a result of the previous local plan development proposals. As part of that work, a ‘do minimum’ (DM) scenario, with only committed development (some of which may form part of the local plan), and two ‘do something’ (DS) scenarios, with additional non-committed local plan development, were assessed with a forecast year of 2033.

As part of the second phase of work, a number of mitigation options were also sifted through consultation with the districts and BCC, and a shortlist of potential highway and public transport schemes were identified. These mitigation schemes were then modelled in the DS scenarios, and assessed in terms of their potential to mitigate the impacts arising from the proposed local plan development.

Further details of the forecast scenarios developed and mitigations tested for the previous phase(s) of work can be found in the aforementioned modelling reports. For future reference in this note, “local plan development” refers only to the phase three local plan development which is not yet considered to be committed.

Concurrently there are a number of other studies taking place/completed which either overlap with or use similar inputs to the work which is the subject of this technical note. These include:

- Aylesbury Vale New Settlement Study
- Princes Risborough Expansion Modelling
- High Wycombe Local Plan Sites Modelling
- Chiltern and South Bucks Local Plan Modelling (assessing strategic road network impacts and separately local road impacts)

It should be noted that Chiltern and South Bucks are currently in the process of producing a joint local plan, and the scale of local plan growth is likely to change for the next phase of work.

¹ Jacobs. 2016. Countywide Local Plan Modelling: Forecast Modelling Report Phase 1.

² Jacobs. 2017. Countywide Local Plan Modelling: Forecast Modelling Report Phase 2.

1.2 Scope of study

Phase three of the modelling support work will focus on producing the revised local plan development scenario to replace DS scenarios from phase two. In addition a set of mitigation schemes will also be tested in order to try and mitigate any impacts arising from the local plan development in terms of increased congestion and travel time.

Whilst the main objective of this work will be on mitigating highway impacts arising from the local plan developments within Buckinghamshire, impacts outside of the county, where deemed significant, will also be noted. However, these impacts will only be identified in terms of changes in traffic flow on strategic routes.

This study does not supersede or replace any detailed modelling work that has been done or will be required in future in assessment of the impacts of individual developments. The purpose of this note is only to assess cumulative impacts of development and identify areas where these could be considered significant in terms of travel time changes.

1.3 Development scenarios

Three forecast scenarios were developed during the first and second phases of work, in cooperation with BCC and the districts. These comprised of a 2033 DM scenario which included the projected planning completions to 2033 across Buckinghamshire, as well as committed development (some of which may form part of the local plan proposals), and two DS scenarios which included DM development plus additional non-committed local plan developments across the county.

For phase three, the DM development scenario remained unchanged, but the DS scenario will be updated to reflect the revised local plan development scenario, comprising of the revised local plan growth for the four districts. Further details of the forecast scenarios are provided in Table 3-A of this technical note. The revised DS scenario will then be used to develop the DS with mitigation scenarios.

1.4 Mitigation options

For phase three, BCC has requested two separate mitigation scenarios to be developed, hereafter referred to as run 1 and run 2. The mitigation measures will vary between each of the runs in Aylesbury Vale and Chiltern and South Bucks districts to enable a comparison between the different effects of combinations of mitigation measures.

The list of mitigation options previously shortlisted for the Countywide Local Plan forecasting phase two work will be carried over for this phase of the work. However, in some cases mitigation measures will not be included due to changes in the development scenario for phase three (e.g. mitigation measures linked to the new settlements at Haddenham or Winslow are to be excluded as these proposals are no longer part of the development scenario for phase three). In addition, new mitigation measures are to be added to reflect the results of more detailed Local Plan modelling undertaken in the districts³, following the second phase of work.

Table 4-A sets out the mitigation measures included in each scenario.

1.5 Structure of technical note

The structure of the technical note is as follows:

- Introduction – Outlines the background and scope of the technical note.
- Modelling methodology – Describes the development of the forecast scenarios.
- Development scenarios – Summarises the land use changes between phase two and three.

³ Wycombe Local Plan Sites Traffic Modelling Jacobs U.K. Ltd 2017; Chiltern and South Bucks Local Plan Modelling Report, Jacobs U.K. Ltd 2016

- Mitigation options – Summarises the option sifting process and mitigation options taken forward for testing and appraisal.
- Results – Presents the results of modelling work for each model area and scenario assessed.
- Summary and conclusion – Summarises the results of the phase three modelling work.

2. Modelling methodology

2.1 Overview

This section sets out the modelling methodology adopted to develop the phase three forecast scenarios. Three forecast scenarios were originally developed during the first and second phases of the work. For phase three this has been reduced to a DM (carried over from phase two) and a DS scenario, which reflects the revised local plan development scenario and omits the new settlement at both Haddenham and Winslow.

2.2 Forecast model updates

2.2.1 Revised forecast scenarios

The land use assumptions for the DM scenario remain unchanged from the previous phases of work, however a number of revisions have been made to the development growth assumptions in the DS forecast scenarios. Further details of these changes are provided in section 3 of this technical note.

The methodology for producing the revised forecast matrices is for the most part consistent with phase one and two, as outlined in their respective modelling reports¹². However, the DS scenario will now be comprised of the revised phase three local plan development quantum provided by the four districts. In addition, the phase 2 trip distributions used for the DS local plan development sites have been reviewed, and in some cases revised, where a more suitable donor zone is available.

For the previous phases of work two separate DS scenarios were developed. These scenarios included the same mix of local plan development but the location of a new settlement near Haddenham, included in the DS1 scenario, was instead moved to Winslow in the DS2 scenario. For phase three both these sites have been removed, and therefore only a single DS land use scenario is required to be developed.

2.2.2 Crossrail and East West Rail (EWR)

As with phase two, the impacts of Crossrail and East West Rail (EWR) have been modelled in the phase three DS forecast scenario in the form of a reduction in car journeys (to represent a mode shift from car to rail) in impacted areas. The extent of the reduction in car journeys has been derived using the following assumptions:

- Only car journeys which start or end within 1,500m of a Crossrail or EWR station are considered (for stations that fall within the London zones, all car journeys have been considered).
- 10% of these journeys will switch from car to rail in relation to EWR.
- 35% of these journeys will switch from car to rail in relation to Crossrail.

The assumed percentage reductions and radii were calibrated such that the outturn reduction in car trips approximated the reductions calculated by separate third party modelling of those schemes. This was to ensure that the modelling assumptions/trip impacts were consistent across the different modelling exercises for business case development for these national strategic infrastructure schemes. This modelling data was provided by Transport for London in regards to Crossrail and Atkins in relation to EWR.

2.3 Modelling the mitigation options

For phase three two separate mitigation scenarios have been developed known as run 1 and run 2, which include a different combination of mitigation options, but the same land use assumptions as with the DS scenario. Section 4 of this note provides further detail of the sifting process and options identified for each run. The following subsections summarise the methodology adopted to model the mitigation options in the DS forecast network.

2.3.1 Highway schemes

A number of highway schemes have been added to the DS scenario in consultation with BCC and the districts. The majority of these schemes were already modelled for phase two, and as a result the network coding has been carried over for this phase of work. However, several of the schemes included were not previously modelled, and in these cases detailed descriptions or concept designs have been used instead.

Where information has been unavailable for a specific scheme or if a scheme is in the early stages of conception, sensible assumptions have been made, in consultation with BCC, to ensure each mitigation scheme is represented as accurately as possible within the model.

2.3.2 Public/ sustainable transport schemes

To account for the public transport and sustainable transport schemes in the model, a similar methodology has been adopted as with phase two, where a reduction in car journeys has been calculated for impacted areas. Several such schemes have been considered as part of the mitigation options. These include a number of bus corridor schemes, Wycombe Bus Station Upgrade, improvements to Aylesbury Town Centre, and Grand Union Triangle improvements (further detail of all these schemes is provided in Table 4-A).

The extent of the reduction in car journeys has been based on evidence from the sustainable travel towns' evidence base⁴, as agreed with BCC. The schemes in that evidence base are of a similar nature to the proposed mitigation measures. To calculate the reduction in car journeys the following assumptions have been used:

- *The location and extent of the schemes has been defined using the provided concept drawings.*
- *Only car journeys which start and end within 1,000m of a public transport scheme are considered (for the Aylesbury Town Centre improvements car journeys which start or end within 1,000m of the scheme have been considered, to account for the likely wider impact that may be experienced).*
- *A total of 3% of all car journeys in the 2033 forecast which met the above criteria were assumed to switch from car to sustainable transport. This is in-line with the percentage reduction observed in the sustainable travel town's evidence base.*

⁴ Department for Transport. 2010. The effects of Smarter Choice Programmes in the Sustainable Travel Towns: full report.
<https://www.gov.uk/government/publications/the-effects-of-smarter-choice-programmes-in-the-sustainable-travel-towns-full-report>.

3. Development scenarios

3.1 Overview

This section sets out the revisions made to the DS forecast scenario, in line with the updated land use information provided by BCC. For each development scenario, forecast housing and employment growth has been added to the existing 2013 base land use information to generate a new development quantum.

3.2 Development summary

The DM scenario remains unchanged from the previous phase of work; however, at the request of BCC and the districts the following amendments have been made to the DS forecast scenario for the four districts of Buckinghamshire.

- Aylesbury Vale – A reduction in overall HELAA housing growth but the same level of job growth across the district.
- Chiltern and South Bucks – An increase in overall job growth to reflect the preferred greenbelt option, but the same level of housing growth across the two districts.
- Wycombe – An increase in both Local Plan housing and job growth across the district.

Table 3-A provides a summary of the DM land use assumptions and the absolute differences between the phase two and phase three employment and housing figures for the DS scenario. Further details of the total housing and employment figures can be found in sections 3.2.1 and 3.2.

Future scenario (2033)	Summary details
Do Minimum (DM) 'No development'	<ul style="list-style-type: none"> • Unchanged from phase two and comprised of: • 9,416 houses and 24,265 jobs in Aylesbury Vale; • 1,278 houses and 0 jobs in Chiltern; • 1,297 houses and 1,619 jobs in South Bucks; and • 2,180 houses and 6,011 jobs in Wycombe. • Total: 14,171 houses and 31,895 jobs.
Do Something (DS)	<ul style="list-style-type: none"> • As phase two but; • A reduction of 2,143 houses in Aylesbury Vale; • An additional 522 jobs in Chiltern; • An additional 2199 jobs in South Bucks; and • An additional 1,360 houses and 1,070 jobs in Wycombe district. • Total: 52, 373 houses and 48,624 jobs.

Table 3-A Revised forecast scenarios

Compared with phase two, there is a reduction of 783 houses and an increase of 3,791 jobs in the DS forecast scenarios, across the county. The reductions in housing in Aylesbury Vale (compared with the phase two work) offsets the increase observed in Wycombe. This leads to an overall housing reduction from the phase two figures, when compared across the county as a whole. Chiltern, South Bucks and Wycombe all experience an overall increase in jobs, leading to a net gain at the county level compared with phase two.

Figure 3-A and Figure 3-B illustrates the phase three DS housing and job growth by model zone, respectively.

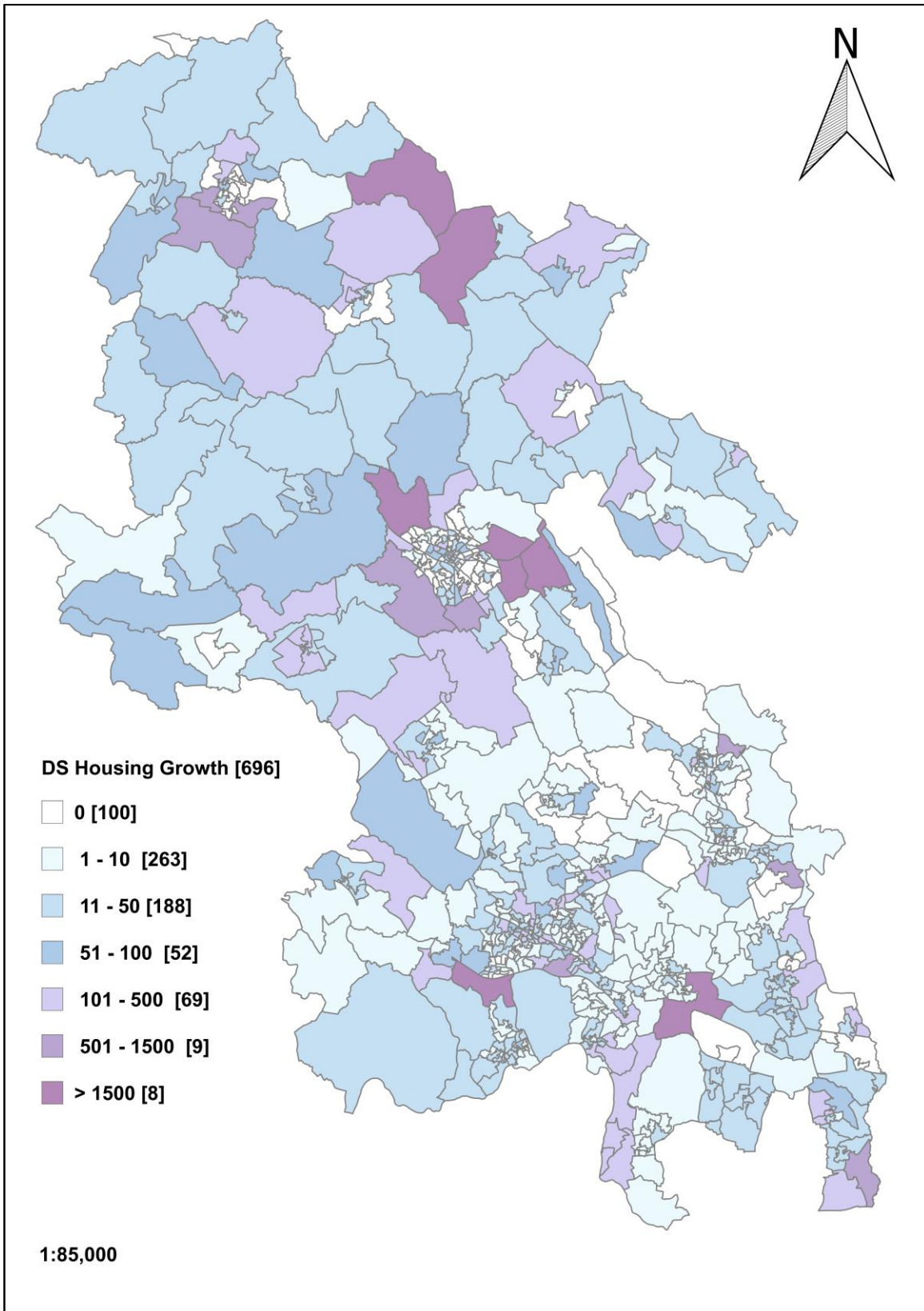


Figure 3-A DS housing growth (including DM) by model zone

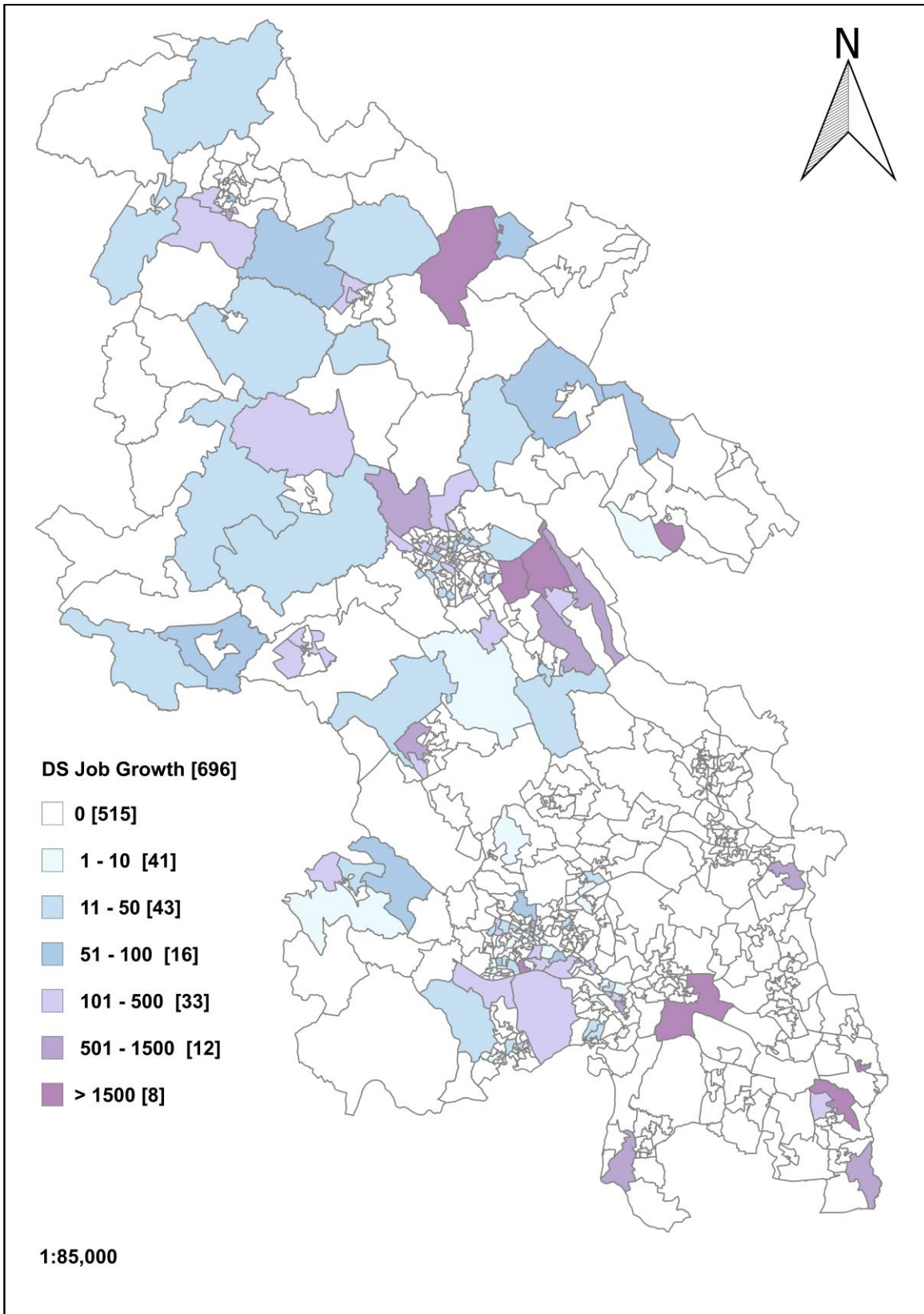


Figure 3-B DS jobs growth (including DM) by model zone

3.2.1 Do Something

Within the county the DS scenario contains the DM land use quantum plus the revised local plan development scenario for phase three. For all areas outside of Buckinghamshire, growth in employment and housing is consistent with NTEM levels of growth. Table 3-B provides a summary of the DS scenario.

Location	Totals
Aylesbury Vale District	• DM commitment plus 20,207 houses and 6,069 jobs
Chiltern District	• DM commitment plus 3,847 houses and 522 jobs
South Bucks District	• DM commitment plus 4,324 houses and 6,578 jobs
Wycombe District	• DM commitment plus 9,824 houses and 3,560 jobs
Outside of Buckinghamshire	• Capped to NTEM growth levels
Total within Buckinghamshire	• DM commitment plus 38,202 houses and 16,728 jobs

Table 3-B Do Something 3 growth

3.2.2 Revised forecast traffic growth

Table 3-C provides a summary of the changes in total trips for cars for each district in DS scenario between phase two and phase three as a percentage.

District	AM peak trip change		IP trip change		PM peak trip change	
	Origin	Destination	Origin	Destination	Origin	Destination
Aylesbury Vale	-3%	-2%	-4%	-5%	-2%	-3%
Chiltern	0%	1%	0%	0%	1%	0%
South Bucks	2%	5%	4%	4%	5%	3%
Wycombe	1%	1%	1%	1%	2%	1%

Table 3-C Change in Car total trip ends from phase two DS scenario to the phase 3 DS scenario

As a result of the revised land use information and changes to trip generation included in phase two, the total trip generation has fallen in Aylesbury Vale but increased in the other three districts, compared with the previous phase of work. This reflects the land use changes described in Table 3-A.

3.2.3 Comparison with NTEM

Table 3-D provides a summary of the total household and job growth for the 2033 forecast scenario. The table also includes NTEM growth figures for the period 2013 to 2033, from version 6.2 of the dataset, for comparative purposes.

Consistency with NTEM growth figures is a requirement for all WebTAG compliant models to be used for major scheme business cases. However, because the purpose of this modelling is for a local plan assessment rather than a business case, it is not necessary to constrain growth to NTEM. Indeed, because the local plan growth is generally in excess of NTEM levels (particularly in South Bucks), it was decided that capping to NTEM growth would not be appropriate.

Nonetheless, a comparison of the model against NTEM is useful as it helps to identify the scale of difference between NTEM and the local plan assumptions, and thereby understand how the districts' local plan growth differs from the levels of growth mandated by the Department for Transport for use in transport scheme business cases. As can be seen from the below table, the level of growth in houses and jobs in the DS forecast

scenario is higher than NTEM growth levels for the same period overall. However, NTEM provides a higher number of households for Aylesbury Vale, and higher number of jobs for Chiltern and Wycombe than the DS growth figures. The amount of jobs growth assumed as a whole for the DS scenario represents a 'worst case' for traffic impacts in that they represent the maximum possible amount of anticipated employment growth

District	NTEM		DM		DS	
	HH	Jobs	HH	Jobs	HH	Jobs
Aylesbury Vale	32,243	11,172	9,416	24,265	29,623	30,334
Chiltern	4,549	3,297	1,278	0	5,125	522
South Bucks	924	2,497	1,297	1,619	5,621	8,197
Wycombe	7,289	14,683	2,180	6,011	12,004	9,571
Total	45,004	31,649	14,171	31,895	52,373	48,624

Table 3-D 2033 modelled scenario growth and NTEM growth

4. Mitigation options

4.1 Overview

This section describes the development of the mitigation scenarios and the selection of the schemes tested. Table 4-A presents the final mitigation options included in each run of the mitigation model.

4.2 Option generation

As part of the phase two work, a long list of schemes was put together by BCC in collaboration with the districts. This included a variety of highway improvements (upgraded roads, junction improvements, relief roads etc.) and an assortment of public transport schemes with the aim of encouraging a mode shift from car to sustainable transport (upgraded bus and rail facilities, improvements to the cycling network, public transport initiatives etc.).

The options were designed to address strategic issues identified in the phase two modelling, as well as concerns of a more localised nature, tackling areas and facilities that could be enhanced and developed in order to reduce congestion and delay arising from the additional housing and employment developments across the county.

In addition, several new schemes were also added to the long list for the phase three work which weren't considered for phase two, as at that stage there was not enough information available to model the schemes. These schemes include Iver Relief Road and Queensway Link.

4.3 Option sifting

A workshop was held with BCC and the districts during phase two to sift schemes from the long list. A number of these schemes were aspirational in nature with minimal scheme development or design, and as a result were excluded from the final short list of mitigations. The schemes that were shortlisted were then assessed as part of the phase two work to understand the effect that they may have in regards to alleviating the impacts of the proposed housing and employment sites. It should be noted that a number of these schemes are still at the concept stage and would require significant additional work to develop into deliverable schemes.

The list of mitigation options previously shortlisted for the Countywide Local Plan forecasting Phase 2 work was carried over for this phase of the work. However, in some cases mitigation measures were not included due to changes in the development scenario e.g. mitigation measures linked to the new settlements at Haddenham or Winslow were excluded as these proposals were no longer part of the development scenario for Phase 3. In a few cases new mitigation measures were added, although these, on the whole, reflected the results of more detailed Local Plan modelling undertaken for Chiltern and South Bucks and for Wycombe District Councils.

For phase three, BCC requested that two separate mitigation scenarios be developed, referred to as run 1 and run 2. The mitigation measures vary between each of the runs in Aylesbury Vale and Chiltern and South Bucks districts to enable a comparison between the different effects of combinations of mitigation measures.

The mitigation schemes included for phase two (and generated for phase three) have been reviewed in collaboration with BCC and the districts, and a number of the schemes have been selected to be tested in run 1 and run 2 of the mitigation scenarios.

4.4 Options for appraisal

Table 4-A outlines each mitigation option taken forward for appraisal in each mitigation scenario after the sifting process was completed. Table 4-B summarises the main differences between the two mitigation scenarios by district.

District	Scheme name	Scheme description	Run 1	Run 2
Aylesbury Vale	North-East Link Road (NELR)	This scheme consists of a new east-west single carriageway link road to the north-east of Aylesbury, between the A413 and A418.	No	Yes
	Eastern Link Road (South)	The southern section of the Eastern Link Road will complete a new north-south, single carriageway road between the A418 Aylesbury Road and A41 Aston Clinton Road, to the east of Aylesbury. The scheme will provide access to the Woodlands Development, and will include an upgraded A41 Roundabout.	Yes	Yes
	Southern Link Road (upgrade)	The Southern Link Road between the A41 Aston Clinton Road and A413 Wendover Road is already included in the without mitigation scenarios. However as a mitigation option, this scheme was upgraded to dual carriageway standard, and includes a new roundabout and left-in left-out access junction.	Yes	Yes
	Stoke Mandeville Bypass Extension	This scheme seeks to extend the planned Stoke Mandeville bypass (A4010 realignment) with a new single carriageway road to meet the Southern Link Road at the A413 Wendover Road.	Yes	Yes
	South Western Link Road	The South Western Link Road scheme will connect the A418 Oxford Road to the planned realigned A4010 (Stoke Mandeville bypass) with a new single carriageway road. It will include a new roundabout on the new Stoke Mandeville bypass and a new entry to the A418 roundabout.	No	Yes
	Western Link Road	This scheme consists of a new NW-SE single carriageway link road to the west of Aylesbury linking the A418 and A41 at Fleet Marston, west of the A41 Berryfields junction. This scheme will finish a complete orbital of Aylesbury.	No	Yes
	A41 Berryfields Junction	Signal timing optimisation has been carried out to better accommodate demand at this junction.	No	Yes
	Willows Capacity Reduction	The scheme tests a reduction in capacity on the Willows to encourage traffic to use the A41 at Berryfields.	No	Yes
	A41 Bicester Road PPTC	The scheme includes implementing bus priority measures (e.g. bus lanes and priority at traffic lights). The improvement will aim to significantly improve journey time reliability and increase the public transport mode share.	Yes	Yes
	A41 Tring Road PPTC Improvements	The scheme includes implementing bus priority measures (e.g. bus lanes and priority at traffic lights). The improvement will aim to significantly improve journey time reliability and increase the public transport mode share.	Yes	Yes
	Stoke Road Signalised Junction	Signal timing optimisation has been carried out to better accommodate demand at this junction.	Yes	Yes
	Traffic calming between	Traffic calming on Prebendal Avenue to reduce rat-	Yes	Yes

District	Scheme name	Scheme description	Run 1	Run 2
	A418 and Stoke Mandeville	running between A418 and Stoke Road.		
	A413 Buckingham Road Improvements	This scheme seeks to improve the approach to the Horse and Jockey junction by dualling the route and optimising the signals at the junction to reduce the level of queuing on the A413 Buckingham Road. The junction with Oliffe Way has also been upgraded to a priority junction.	No	Yes
	Aylesbury Town Centre Pedestrian Network Improvements	This improvement aims to increase safety and enhance the public realm in Aylesbury Town Centre.	Yes	Yes
	Grand Union Triangle	This scheme is designed to provide cost-effective off-road walking and cycling routes in an area of major growth. The project includes improving existing towpaths, the upgrade of a public footpath to a bridleway and then implementation of connecting routes and some small scale improvements.	Yes	Yes
	Buckingham Western Link	This scheme includes a new link road between the A421 and A422.	No	Yes
	Buckingham Area Transport Strategy	Three separate mitigations have been included as part of the transport strategy. <ul style="list-style-type: none"> Route downgrade between High St and West St to reduce traffic flows through the town centre Additional left turn slip at the A422 Stratford Rd/ A413 roundabout Route upgrade on the A421 and A413 to dual – 2 lane standard 	No	Yes
	A421 Roundabout Capacity Improvements	Capacity improvements at the London Rd/ A421 Rbt and Gawcott Rd/ A421 Rbt to increase capacity.	Yes	No
	A421 Corridor Capacity Improvements	A421 route upgrade to dual-2 lane standard between Buckingham and Milton Keynes.	No	Yes
	New Grid Road in Milton Keynes	This scheme will implement a new grid road to the A421 adjacent to the V1 to discourage rat running through Whaddon.	Yes	Yes
	Bletchley By-Pass	This scheme consists of a new single-carriageway road joining the A421 and A4146 South West of Bletchley.	Yes	No
Wycombe	Princes Risborough Infrastructure Package	This package includes two separate improvements. The first is a road to the west of the existing A4010. Alignment option 11b has been included in the model in this case. The second includes a number of improvements to the A4010 including traffic calming and the introduction of a number mini-roundabouts.	Yes	Yes
	Daws Hill - Sports Centre Public Transport Bus Link	This scheme involves upgrading the school drop off area and a new public transport route with improved frequencies.	Yes	Yes

District	Scheme name	Scheme description	Run 1	Run 2
	Heath End Road / Abbey Barn Lane Junction Improvements	This scheme includes relocating and replacing the current junction with a roundabout to the west.	Yes	Yes
	A404/A4155 Westthorpe junction Improvements	This project will support the development of an integrated package of measures to improve junction capacity at the Westthorpe junction. In this case it includes measures to improve capacity on the northbound exit slips of the A404 only.	Yes	Yes
	A40 corridor improvement	This includes a number of separate mitigations to improve traffic conditions on the A40 through High Wycombe (excludes Genoa Link).	Yes	Yes
	Gomm Valley Spine Road	This scheme includes a new link road to the east of High Wycombe, associated with the Gomm Valley development.	Yes	Yes
	PPTC: Desborough Avenue / A404 Marlow Hill	The scheme includes implementing bus priority measures (e.g. bus lanes and priority at traffic lights). The improvement will aim to improve journey time reliability and increase the public transport mode share.	Yes	Yes
	Wycombe Bus Station Upgrade	Improvements to Wycombe Bus Station to improve the service provided.	Yes	Yes
	Holland Farm Spine Road	This scheme involves the introduction of a single carriageway spine road through the Holland Farm development from Hedsor Road to Princes Road.	Yes	Yes
	New Link at Queensway	Adds a new link road to the north-east of the Hazelmere Crossroads to alleviate congestion at the junction.	Yes	Yes

District	Scheme name	Scheme description	Run 1	Run 2
Chiltern and South Bucks	Gore Hill Roundabout Improvements	Capacity improvements at the junction to reducing queueing.	No	Yes
	A416 congestion management corridor	A series of new signalised junctions through Chesham to improve signal coordination through the town centre.	No	Yes
	Berry Hill Junction Improvements	This scheme includes signal optimisation, an additional eastbound traffic lane on Bath Road and a right turn ban into Berry Hill.	No	Yes
	A412 Improvement	This scheme aims to improve the geometry and lines of sight at the A412 Five Points roundabout through widening and partly signalising the junction.	Yes	Yes
	Beaconsfield Transport Strategy	This scheme includes traffic calming on several roads in Beaconsfield including Wattleton Road, Burkes Lane, Holtspur Top Lane, Gregories Road and Candlemass Lane. It also includes a ban of right turns at the A40/ Broad Lane junction.	Yes	Yes
	A412/ Bangors Road North Capacity Improvements	Capacity improvements including widening to two lanes to reduce queueing on the northbound approach.	No	Yes
	Land North of Denham Rbt	This scheme moves the site access for the Land North of Denham Roundabout from Priory Close to Denham Court Drive to alleviate congestion at Denham Rbt.	Yes	Yes
	Iver Relief Road	This scheme adds a new relief road between Thorney Lane South to Mansion Lane to provide an alternate route for HGVs currently using Iver High Street.	No	Yes

Table 4-A List of options to include in the DS with mitigation forecast scenarios

District	Run 1	Run 2
Aylesbury Vale	<p><u>Aylesbury</u> Run1 includes the majority of schemes with the exception of the link roads to the north and west, improvements at the A41 Berryfields junction and on the A413.</p> <p><u>Buckingham/ Milton Keynes</u> Run 1 does not include any schemes in Buckingham except the A421 roundabout improvements but includes the Bletchley Bypass.</p>	<p><u>Aylesbury</u> Run 2 includes the complete circle of link roads as well as the improvements at the A41 Berryfields Junction and on the A413.</p> <p><u>Buckingham/ Milton Keynes</u> Run 2 includes the majority of mitigation schemes in Buckingham but excludes the Bletchley Bypass and A421 roundabout improvements and instead includes dualling the A421 between Buckingham and Milton Keynes instead.</p>
Wycombe	All mitigations schemes are included in both runs.	All mitigations schemes are included in both runs.
Chiltern and South Bucks	Run 1 of the mitigation includes the 5 Point Roundabout improvements, Beaconsfield Transport Strategy and the relocation of the site access for the Land North of Denham Roundabout.	Run 2 includes all schemes from run 1 plus the Iver Relief Road, Bangors Road North improvements, Chesham congestion management corridor, Berry Hill junction improvements and the Gore Hill Roundabout improvements.

Table 4-B Summary of mitigation schemes included in each mitigation forecast scenario

5. Results

5.1 Overview

The purpose of this section of the technical note is to present the modelling outputs from the phase three forecast scenarios. As with the previous phases of work, a set of model outputs have been produced to illustrate the impacts of the DS forecast scenario compared with the DM, as well as the DS with mitigation compared against both the DS and DM.

For this phase of work two separate mitigation runs have been developed and are referred to as run 1 and run 2 in the following section. The main differences between the two mitigation runs are set out in Table 4-B. There are no differences in terms of land uses between the DS and DS with mitigation scenarios.

Section 5.2 and the subsequent sub-sections split the county into the geographic areas described in the phase two report. For each area a summary is provided of the key impacts as a result of the DS land uses (in the absence of mitigation measures) and then a comparison is made against each 'with mitigation' scenario (where differences occur), to understand the extent to which the various mitigation schemes have improved the situation in the model.

It is important to note that the DS development scenario (with and without mitigation) models the cumulative impact of the revised local plan development scenario across the model, whilst the mitigated scenario also gives an indication of the overall impact of the included mitigation. As such, the narrative below focuses on areas as a whole in terms of travel time and congestion changes, and does not distinguish between or attribute impacts to individual developments and mitigation schemes.

The majority of the commentary in this section is based on the model output from the phase 3 Countywide Model; however wherever necessary information has been supplemented with evidence from other modelling work and local knowledge. All of the model outputs produced for this phase of work can be found in Appendix A and Appendix B of this note. A detailed description of the different types of output can be found below.

5.1.1 Congestion ratio

The congestion ratio plots show the ratio of the congested travel time to the free flow travel time on each modelled link. An increase in the congested travel time on a link is not only affected by increases in flow, but also by delays at the downstream junction. As a result it is possible, where junctions are constrained, to see congestion on a particular link, without any significant increase in demand flow.

Links are plotted according to the following criteria:

Colour of the band	Congestion ratio	Interpretation
Transparent	1	Link experiences free flow conditions
Green	1-1.5	Travel times are up to 50% greater than in the uncongested situation
Yellow	1.5-2	Travel times are between 50% and 100% (i.e. two times) higher than in the uncongested situation
Orange	2-4	Travel times are between 100% and 400% (i.e. two to four times) higher than in the uncongested situation
Red	>4	Travel times are more than 400% (i.e. more than four times) higher than in the uncongested situation

Table 5-A Congestion ratio criteria

Congestion ratio plots have been produced for the DM, DS, DS with mitigation run 1, DS with mitigation run 2 for all time periods.

5.1.2 Change in travel time

Plots of the change in travel time show the difference in congested link travel times between an altered and comparison scenario (for example DS and DM) as a percentage. The change is only shown for those links on which the congested travel is more than twice the free flow time in either scenario, i.e. for those links for which the congestion ratio is greater than 2 (and thereby marked with an orange or red band as described in 5.1.1). This ensures that only those areas which experience relatively high levels of congestion are shown.

The congested link travel time is the same as that used for the congestion ratio. It is worth noting that where an area is already congested in the comparison model, travel times will be more sensitive to smaller increases in trips.

Plots have been produced for the following five combinations of scenarios for all time periods:

Adjusted Scenario	Comparison Scenario
DS without mitigation	DM
DS with mitigation run 1	DM
DS with mitigation run 2	DM
DS with mitigation run 1	DS (without mitigation)
DS with mitigation run 2	DS (without mitigation)

Table 5-B Adjusted-comparison scenario pairings for which change in travel time plots have been produced

Links have been plotted according to the following criteria:

Colour of the band	Interpretation	Notes
Transparent	Either travel time on the link is the same in both scenarios, or the change in travel time does not lead to congested conditions (in which the congested travel time is at least twice the uncongested time).	n/a
Green	Travel time in the scenario is less than in the comparison scenario (for the scenario without mitigation this is often as a result of reassignment away from congested links. For the scenario with mitigation this is usually as a result of mitigation scheme mitigating the impacts)	The greater the decrease the thicker and darker the band
Red	Travel time in the scenario is greater than in the comparator.	The greater the increase the thicker and darker the band

Table 5-C Change in travel time criteria

In addition, the actual percentage change is plotted adjacent to the link in question in most cases where there is sufficient space available on the plot.

5.2 Summary of Impacts

To aid interpretation of the model outputs, a description of the impacts has been provided below for each built up area within Buckinghamshire which was referenced in the phase two report. In some cases, where

necessary to aid interpretation, demand flows (hourly demand volume in vehicles) have been shown in addition to the plots described previously.

Within the descriptions, the terms 'DM', 'DS', 'run 1' and 'run 2' are used to refer to the do minimum, do something and do something with mitigation run 1 and run 2, respectively. Generally, the impacts described below are consistent across both the AM and PM peak periods. Where there is a difference between the periods, additional detail is provided. Furthermore, where impacts are described as being relatively slight, moderate or significant, this is in relation to the other settlement areas within Buckinghamshire.

5.2.1 Aylesbury Vale District

5.2.1.1 Milton Keynes (adjacent to Aylesbury Vale District)

A comparison of the DS against the DM shows relatively little difference in travel time in Milton Keynes. However, on the western edge of the town, close to the A421, some significant travel time increases are observed both on the A421 and connecting minor roads.

Travel time increases are relatively slight on the A421, within Buckinghamshire, compared to the DM (up to 6%), although the A421 immediately east of the county boundary experiences relatively significant travel time increases in the PM peak (up to 150%) on the approach to the Coddimoor Lane/ Whaddon Road/ A421 roundabout. This occurs because westbound demand flow increases by approximately 250 vehicles in the DS scenario compared with the DM, and the junction is already congested in the DM.

On roads adjoining the A421 there are moderate to significant increases in travel time as a result of increases in demand flow on these links and the A421. These increases arise as a result of the additional development in the DS scenario. The increases in demand lead to additional queuing and congestion on the minor arms of junctions along the A421 as both the capacity for traffic exiting the minor arm is reduced, and the demand flow increases. Notable travel time increases occur on Coddimoor Lane (up to 300%), Shucklow Hill in the AM peak (up to 100%), and Whaddon Road in the PM peak (up to 80%), comparing the DS with the DM.

Figure 5-A shows the travel time changes between the DS and DM in the PM peak.

Run 1 of the mitigated scenario includes the Bletchley Bypass but excludes dualling of the A421. In this scenario there are relatively slight travel time decreases on Stoke Road, between Newton Longville and the A4146 (up to 60%), as two-way demand flows fall by more than 1000 vehicles. However, the inclusion of the alternate route further increases demand flow on the A421, leading to a worsening of congestion than that experienced in the DS scenario.

Run 2 of the mitigated scenario includes dualling the A421 between Buckingham and Milton Keynes, but excludes the Bletchley Bypass. In this scenario, the increase in capacity on the A421 leads to relatively slight improvements in travel time (up to 80%) on the corridor. However, this has the effect of inducing additional demand on the route, which leads to further travel time increases on the adjoining minor roads, compared with the DM.

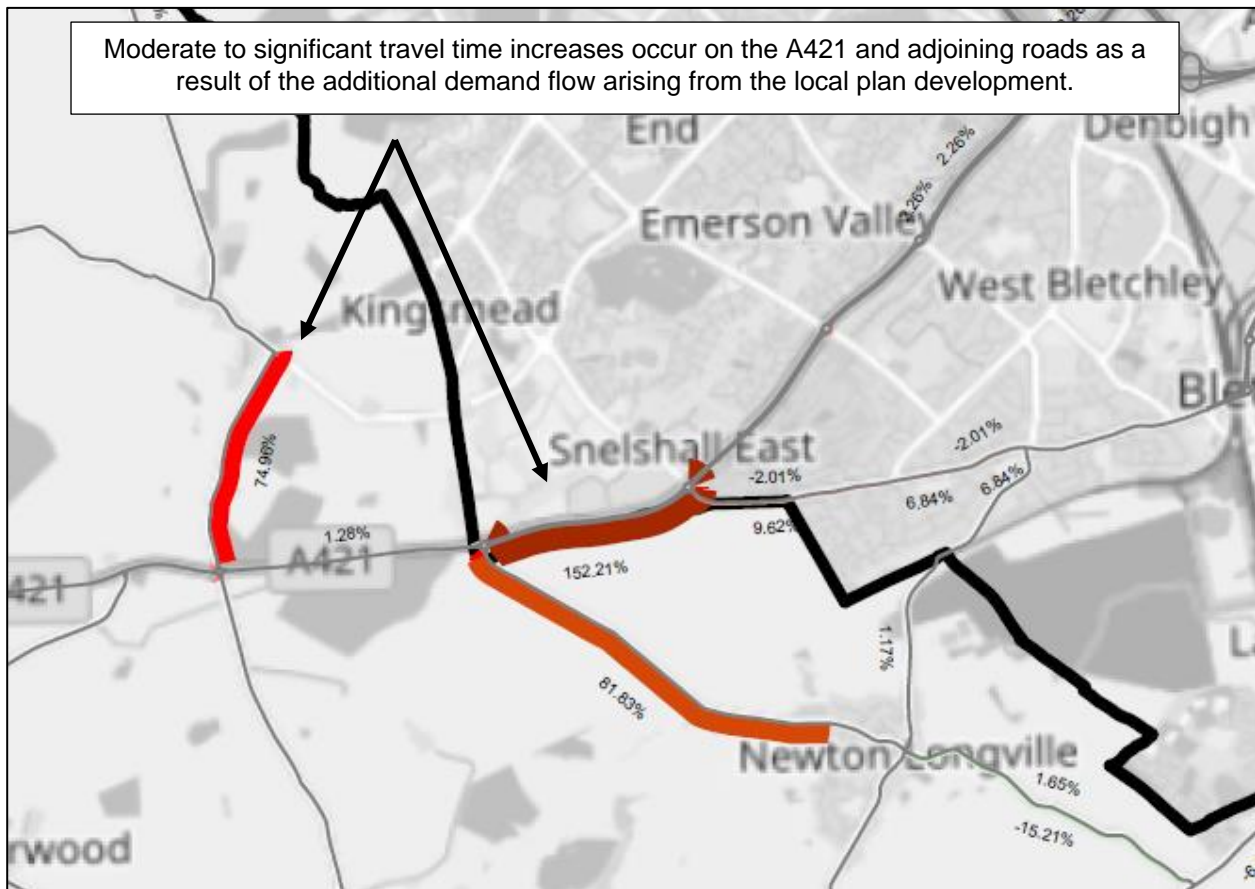


Figure 5-A Travel time changes from the DM to the DS scenario during the PM peak in Milton Keynes

Both run 1 and run 2 include a new grid road in Milton Keynes which connects to the Tattenhoe Roundabout. This is modelled as an additional zone connector which simulates an additional northern arm at the junction. The purpose of this scheme is to remove some of the traffic from the A421 in Milton Keynes, immediately east of the County boundary, which it does. However, counter-intuitively this actually results in significant travel time increases on the A421 east of the junction in both mitigation scenarios.

This impact occurs because the grid road increases the demand flow on the circulatory of the Tattenhoe Roundabout, reducing the capacity for westbound traffic to enter the junction from the eastern arm. This impact is somewhat mitigated in run 1 (particularly in the AM) as the inclusion of the Bletchley Bypass provides an alternative route for traffic heading toward Aylesbury, which otherwise would have used the A421 via the new connection. The impacts identified in the model would suggest that along with the new grid road, improvements to the Tattenhoe Roundabout to better cope with the increased demand approaching it via the grid road, would be appropriate.

Figure 5-B shows the travel time changes in run 2 during the PM peak. Illustrating the issues described above.

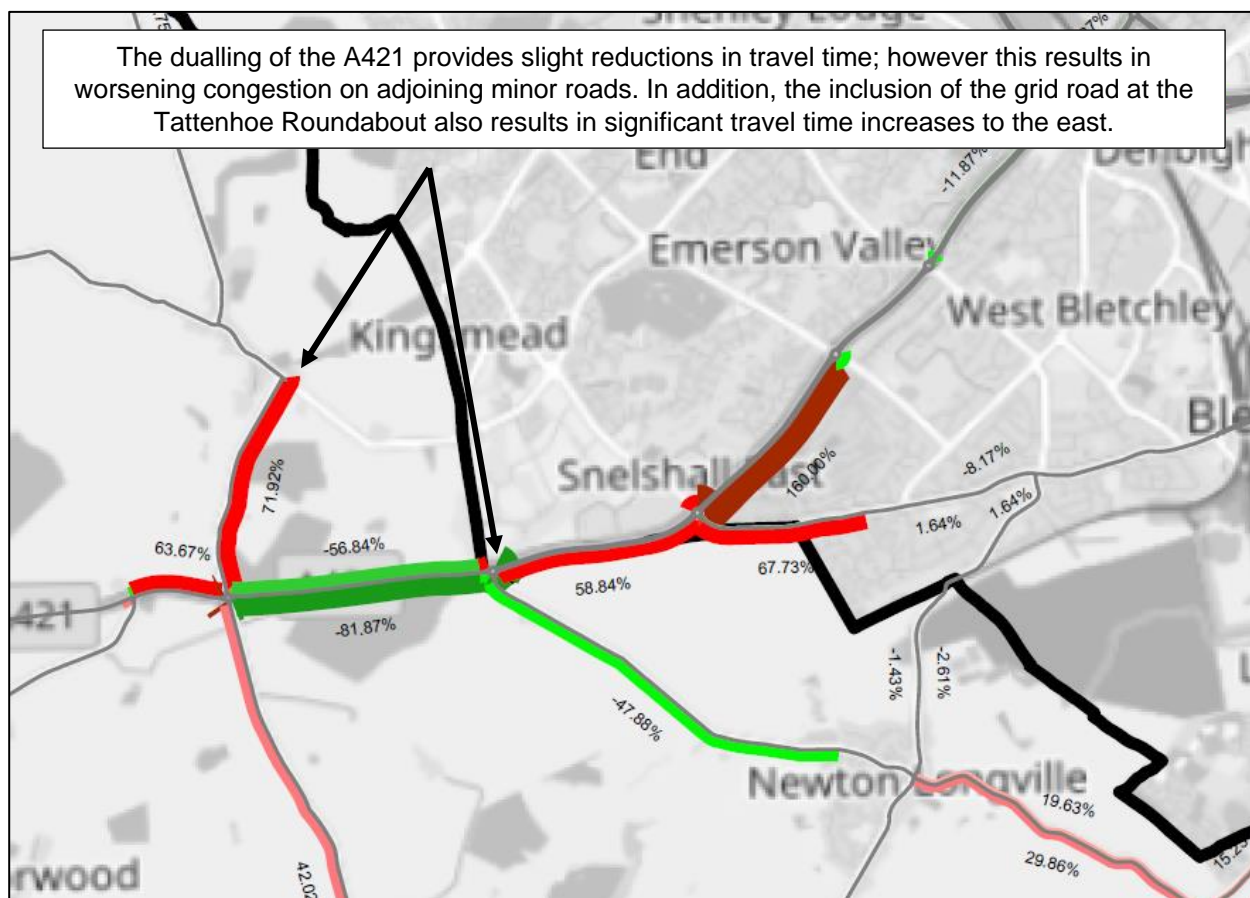


Figure 5-B Travel time changes from the DM to the DS run 2 scenario during the AM peak in Milton Keynes

It should be noted that there is a potential for further mitigation measures, including junction improvements at the Bottledump Roundabout, to reduce congestion on the A421 corridor. The potential for additional mitigation in this area will be reviewed as part of the ongoing work relating to Salden Chase MDA.

5.2.1.2 Buckingham

There are only relatively slight increases in travel time in the Buckingham area in the DS scenario compared with the DM, with the addition of the local plan development.

Run 1 of the mitigated scenario includes the junction capacity improvements at the London Road/ A421 Roundabout and Gawcott Road/ A421 Roundabout. The inclusion of the scheme results in relatively slight to moderate reductions in travel time compared to the DM, in isolated locations on the A421 and A413 to the south and east of the town. Overall this scheme has little impact in terms of the local plan development, as Buckingham is only slightly impacted in the unmitigated scenario.

Run 2 of the mitigated scenario include all mitigation schemes in Buckingham except the above. In general the schemes result in widespread slight to moderate travel time reductions particularly in the immediate vicinity of the schemes. Although there are some moderate travel time increases on West Street as a result of the traffic calming scheme (up to 70%), and on the eastbound approach to the London Road/ A421 Roundabout (up to 110%) in the AM peak due to the increased demand flow on the A421 as a result of the dualling scheme. However, as with run 1 this scheme has little impact in terms of the local plan development, as Buckingham is only slightly impacted in the unmitigated scenario.

Figure 5-C illustrates the travel time changes from the DM to the DS run 2 during the AM peak, highlighting the impacts described in the previous paragraph.

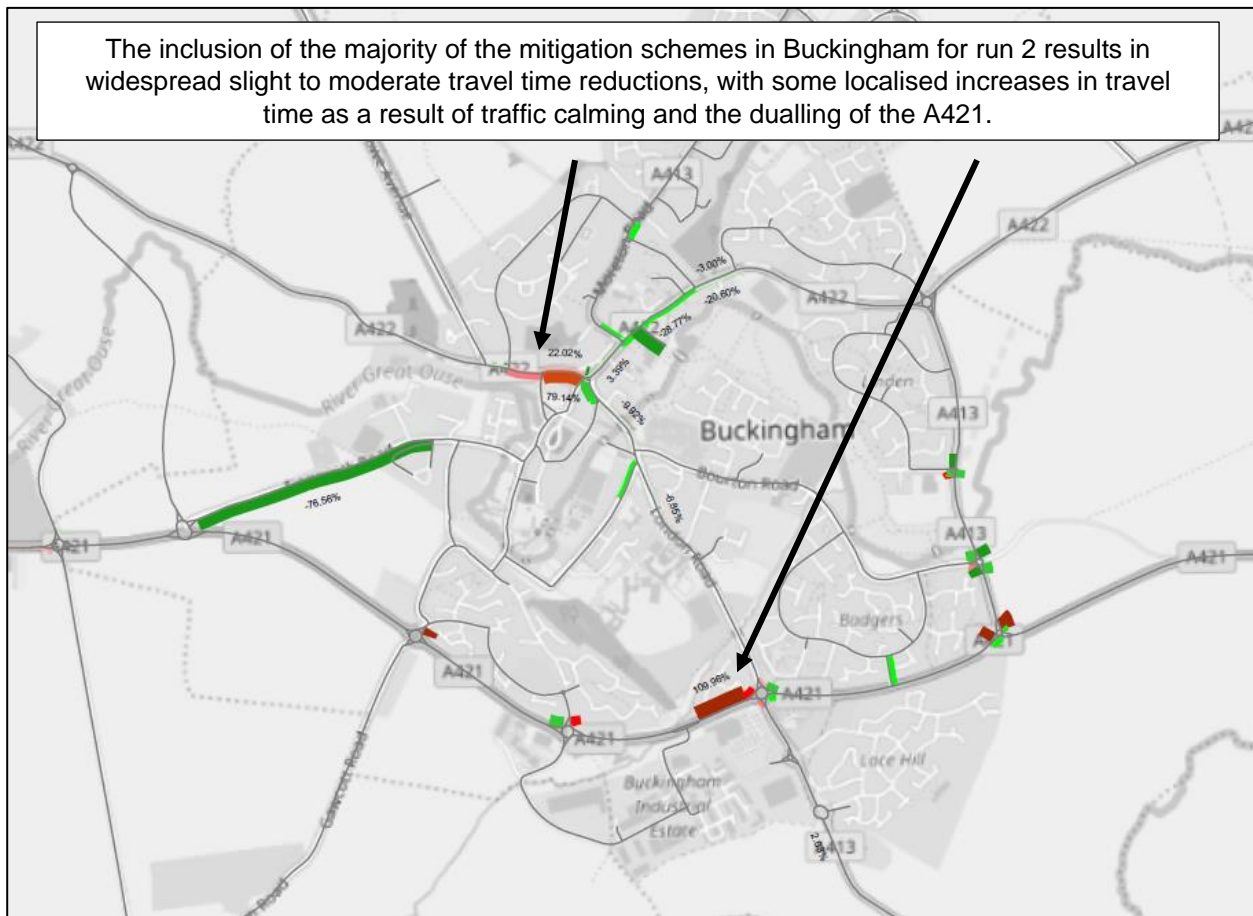


Figure 5-C Travel time changes from the DM to the DS run 2 scenario during the AM peak in Buckingham

5.2.1.3 Winslow

A comparison of the travel time changes between the DS and DM scenario indicate that the town experiences relatively slight increases in travel time across both the AM and PM peak with the local plan development in place. The impacts differ from that observed for phase two as the 4,000 house development site to the north of Winslow has been removed for this phase. As a result it was not necessary to test any mitigation in the local area in either mitigation scenario.

5.2.1.4 Aylesbury

There are relatively significant travel time increases to the south and east of Aylesbury in the DS scenario, compared with the DM, with the local plan development in place. However, travel time changes to the west and north of the town are less noticeable, and these areas of Aylesbury are relatively unaffected by the local plan development compared with other locations.

The most significant travel time increases occur on the A41, between the A41/ Park Street/ Walton Road Roundabout and A41/ College Road North Roundabout (up to 500%), and can be attributed to increases in demand flow on the A41, compared with the DM (around 200 to 400 two-way trips), as well as increases in demand flow on the minor arms of the junctions described below. These increases arise as a result of the local plan development included in the DS scenario.

The additional traffic on the A41 corridor results in congestion on the approaches to the A41/ Bedgrove/ Broughton Lane Roundabouts, A41 Tring Road/ A4157/ King Edward Avenue Roundabouts, and A41/ Aylesbury Road Roundabout. Furthermore, congestion on the approaches to the minor arms of these junctions also increases in the DS compared with the DM. This is because both the capacity for traffic exiting at the minor

arms of these junctions is reduced, and the opposing demand flow on the A41 increases. This effect is most noticeable on the A4157 Oakfield Road where travel time increases of up to 300% are observed southbound in the AM peak, with congestion extending back on to Stocklake.

It is worth noting that travel time increases on the A41 in the phase three DS are more significant than that observed for phase two, despite an overall decrease in the number of houses included in Aylesbury Vale. This occurs because of an increase in vehicle trips on the A41, accessing the Woodlands development site from the west, as oppose to the east, compared with phase two. The most significant impact of this is at the A41/ Aylesbury Road Roundabout, where there is a greater amount of congestion of the approach to the junction from the A41 west, compared with phase two, due to the additional traffic demand.

In addition to the A41, the Stoke Mandeville Bypass and A413 Wendover Road experience significant travel time increases in the DS compared with the DM, which is particularly noticeable in the AM peak.

The travel time increases on the Stoke Mandeville Bypass arise as a result of increased traffic queuing back from the Walton Street Gyratory and Stoke Road/ Mandeville Road signals. This reduces the capacity for traffic turning out onto the B4443 from the Stoke Mandeville Bypass, resulting in travel time increases of up to 250% on the approach. The travel time increases on the A413 Wendover Road (up to 700%), arises as a result of the additional southbound and northbound traffic turning onto the Southern Link Road, at the A413/ Hampden Fields Link Road Roundabout, which is not included in the DM scenario.

Figure 5-D illustrates the travel time changes described in the previous paragraphs to the south and east of Aylesbury during the AM peak.

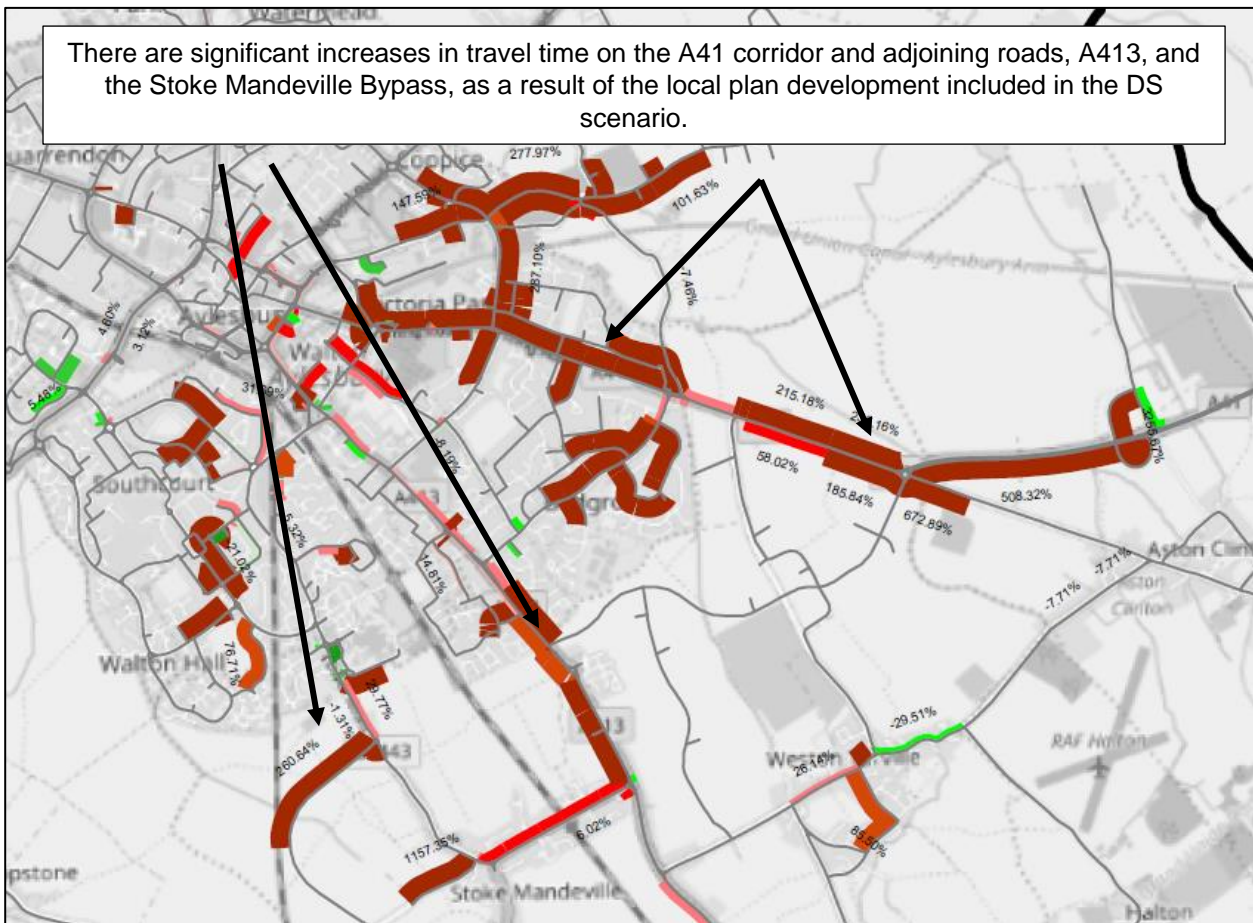


Figure 5-D Travel time changes from the DM to the DS scenario during the AM peak in Aylesbury

Run 1 of the mitigated scenarios includes dualling the Southern Link Road, the southern section of the Eastern Link Road, Stoke Mandeville Bypass Extension, Stoke Road signal optimisation and traffic calming on Prebendal Avenue, as well as an adjustment to the matrices to account for a number of public transport improvements.

The inclusion of the mitigation results in moderate reductions in travel time on the A41 (up to 75%), and on the approach to the A41 from the A4157 (up to 80%), and on Broughton Lane (up to 67%) when comparing run 1 with the DS scenario. This occurs because traffic is now able to assign to the completed Eastern Link Road, and therefore bypass the alternative routes. However, the improvements in travel time do not completely offset the impact of the additional development included in the DS, and when comparing run 1 with the DM, there are still travel time increases on the A41 and Stocklake with the mitigation in place.

The inclusion of the Eastern Link Road also results in an increase in traffic demand on Bedgrove compared with the DS scenario (approximately 350 two-way trips), which causes significant travel time increase on Bedgrove (up to 700%) and back onto the A413 (up to 300%), compared with the DM scenario. In the DS scenario these vehicles assign to the Southern Link Road; however with the A41 Hamburger Roundabout in place there are significant travel time increases on the approach to the junction from the Southern Link Road, which causes the traffic reassignment.

The signal timing improvements on Stoke Road generally have a positive impact, resulting in moderate travel time decreases of approximately 50% to 100% on Stoke Road and adjoining minor roads in both time periods.

Figure 5-E shows the travel time changes arising in the AM peak in run 1 of the mitigated scenarios compared with the DM.

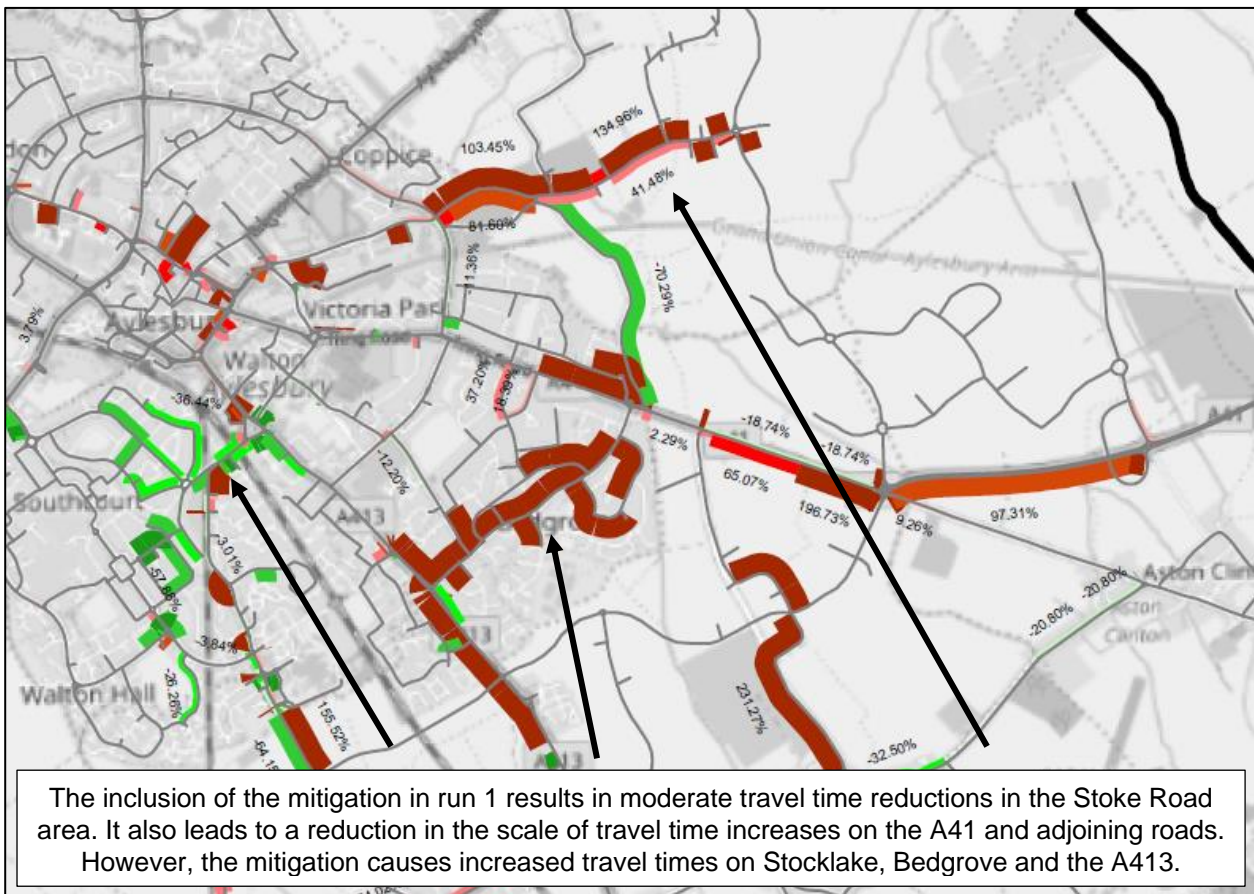


Figure 5-E Travel time changes from the DM to the DS run 1 scenario during the AM peak in Aylesbury

Run 2 of the mitigated scenarios includes all of the options in run 1 plus the complete circle of link roads, as well as dualling of the A413 on the approach to the Horse and Jockey junction, signal timing improvements at the junction itself, and signal timing improvements at the A41 Berryfields junction.

In general, the travel time changes on the A41, Bedgrove, Stoke Road and the Southern Link Road are similar to run 1, although the travel time reductions on the A41 are more widespread compared with the DS, and the increase in travel time on Stocklake is not present when compared with the DM scenario.

The improvements on the approach to the Horse and Jockey junction lead to moderate reductions (up to 80%) in travel time as congestion is reduced with the improved signal timings and greater road capacity. At the A41 Berryfields junction there are moderate travel time reductions (up to 75%) on the approach to the junction from the south, particular in the PM peak, as the improvements to the timings reduce delay for traffic turning onto Paradise Orchard.

The inclusion of the two link roads to the west of Aylesbury results in significant travel time increases on the existing approaches to the A418/ Coldharbour Way Roundabout (up to 200%), compared with the DM scenario. This occurs as the additional traffic demand using the new link roads conflicts with the existing traffic demand on the other arms of the junction, resulting in increased queuing. Therefore, improvements to the Coldharbour Way junction are likely to be required in order to cope with the additional traffic demand through the junction which occurs with the link roads in place.

Figure 5-F shows the travel time changes arising in the AM peak in run 2 of the mitigated scenarios compared with the DM.

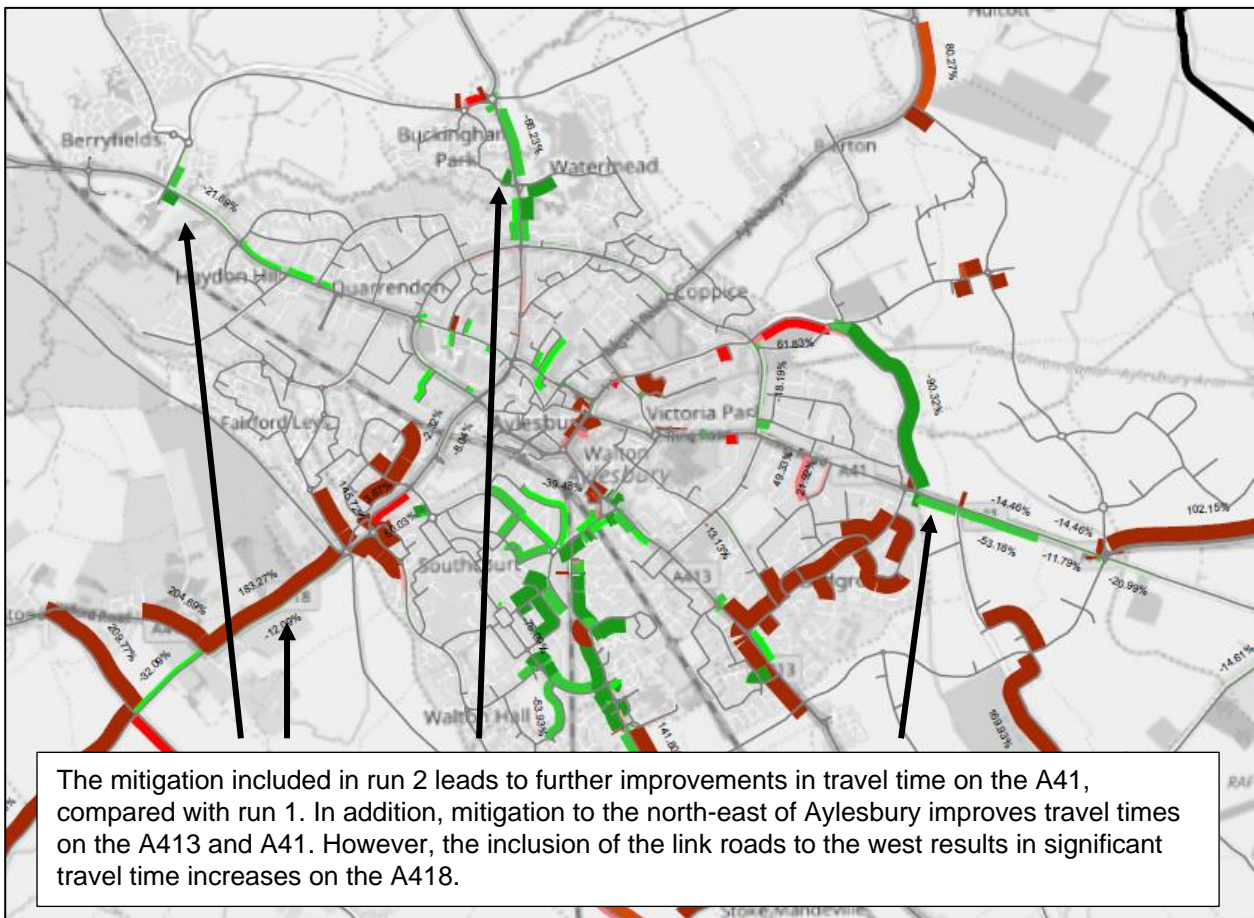


Figure 5-F Travel time changes from the DM to the DS run 2 scenario during the AM peak in Aylesbury

5.2.1.5 Haddenham

There are no notable travel time changes in the Haddenham area in the DS scenario compared with the DM. This result is not unexpected as for phase three there are no significant housing or employment developments located in the near vicinity, and as a result no mitigation has been tested in this area.

5.2.1.6 Wendover (including RAF Halton)

There are relatively significant increases in travel time in the Wendover area in the DS scenario compared with the DM, particularly in the PM peak. However, it should be noted that these impacts occur only as a result of congestion at the High Street/ Aylesbury Road/ Tring Road Roundabout, and that the rest of the Wendover area is only slightly impact in terms of travel time increases.

On the western approach to the High Street/ Aylesbury Road/ Tring Road Roundabout there are significant travel time increases of up to 200% across both time periods. This occurs because traffic flow through Wendover on High Street increases by approximately 100 to 200 two-way trips in the DS scenario compared with the DM. As a result the High Street/ Aylesbury Road/ Tring Road Roundabout is unable to cope with the additional traffic demand leading to queuing and congestion. The congestion at this junction also causes some traffic reassignment to Hale Road, which causes further travel time increases of up to 100% on the adjoining road network.

Figure 5-G illustrates the travel time increases occurring in the DS scenario compared with the DM in the PM peak.

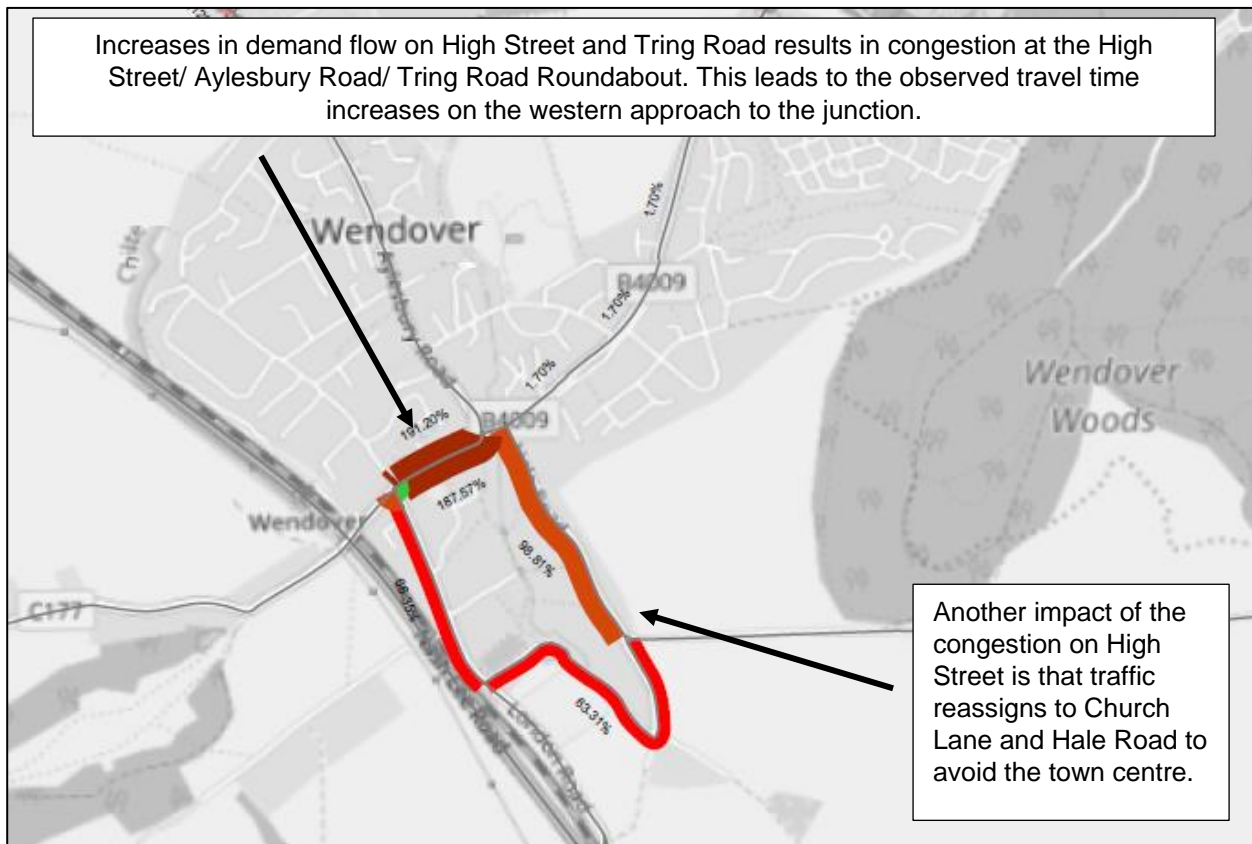


Figure 5-G Travel time changes from the DM to the DS scenario during the PM peak in Wendover

No mitigation options have been tested in the Wendover area for this phase of work. However, the travel time increases at the High Street/ Aylesbury Road/ Tring Road Roundabout and surrounding minor roads are reduced in both mitigation scenarios as a result of a small reduction in demand flow (<100 two-way trips) on the B4009. This has a noticeable impact because the junction is very sensitive to slight changes in traffic flow.

It is worth noting that the phase three DS scenario includes a development of 1,000 houses known as RAF Halton to the north-east of Wendover. The model outputs for the DS scenario in the Halton area do not show any notable travel time increases despite the presence of the development. However, the Countywide Model has limited network coverage in this area, and as a result the traffic to and from the development site loads directly onto the B4009 as opposed to the local road network (which is not included in the modelled network). This methodology ensures that the wider strategic impact of the development site is included in the modelled results, despite the limited network coverage in this area; however the limitation is that any local impacts in Halton will not be captured.

5.2.2 Wycombe District

5.2.2.1 Princes Risborough

A comparison of the travel time changes from the DS to the DM scenario suggests that Princes Risborough in general experiences relatively moderate increases in travel time (up to 80%) as a result of the local plan development scenario. The moderate travel time increases are mostly observed to the south-east of the town, near to Longwick, and at the Picts Lane/ Station Road junction as shown in Figure 5-H.



Figure 5-H Travel time changes from the DM to the DS scenario during the AM peak in Princes Risborough

Both runs of the mitigation include the relief road and A4010 traffic calming schemes, which make up the Princes Risborough Infrastructure Package.

The inclusion of the relief road results in a slight reduction in northbound travel time on Summerleys Road in the PM peak (up to 50%) compared with the DM. In addition the slight travel time increases in the Longwick area compared with the DM are also reduced with the relief road in place as it provides an alternate route for traffic using the B4009. However, the relief road does lead to travel time increases southbound on Summerleys Road, as the new junction is not present in the DM.

The traffic calming scheme on the A4010 has a slight impact in terms of changes in travel time compared with the DM, and leads to a slight reduction in travel time on the A4010 through the town centre. However, this is not unexpected as the reduced capacity on the A4010 is offset by the traffic reassignment to the new relief road.

Figure 5-I illustrates the travel time changes in the DS run 1 scenario compared with the DM in the AM peak.

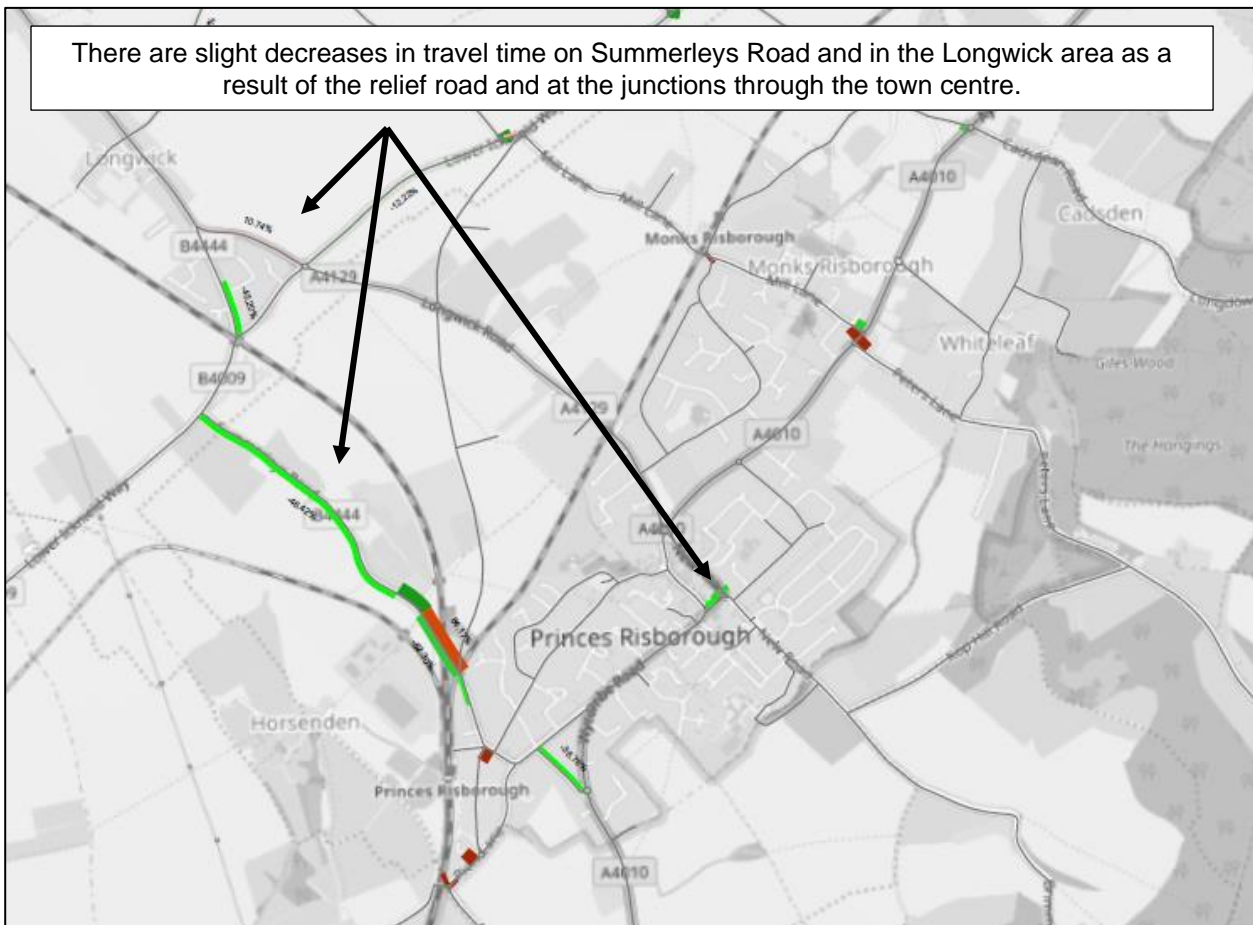


Figure 5-I Travel time changes from the DM to the DS run 1 scenario during the AM peak in Princes Risborough

It should be noted that the infrastructure option considered here differs from a concurrent study in support of the Princes Risborough Expansion⁵, and that Expansion study was undertaken in the context of a greater development of 2,500 new homes and greater employment space, and with higher trip rates associated with these developments, along with greater detail as to the location of access roads to the development.

Differences between the model outputs from the two studies should be considered in the context of these differences. The Expansion Study showed a greater impact on the town centre without the new infrastructure and greater congestion in the mitigated scenario, but the same overall effect of the relief road removing through traffic from the town centre. The Princes Risborough Expansion Modelling study⁵ should be referred to for more detailed analysis of local impacts of the Expansion schemes, as this work seeks only to investigate the suitability in a strategic context.

5.2.2.2 High Wycombe

High Wycombe already experiences significant congestion in the DM scenario (see Figure 5-J), and there are relatively significant increases in travel time in the DS scenario in both peak periods across the area compared with the DM, as illustrated in Figure 5-K. Capacity issues at Handy Cross junction, itself already heavily congested, and on the A404, leads to greater congestion throughout High Wycombe. Other congested areas with significant travel time increases include the Abbey Way Gyratory, Pedestal Roundabout and the A40 corridor.

As was noted in the previous reports, due to the levels of congestion, this area of the model is sensitive to small changes in traffic flows; even very small increases result in significant travel time increases.

⁵ New Local Plan: Princes Risborough Expansion: Princes Risborough Expansion Traffic Modelling

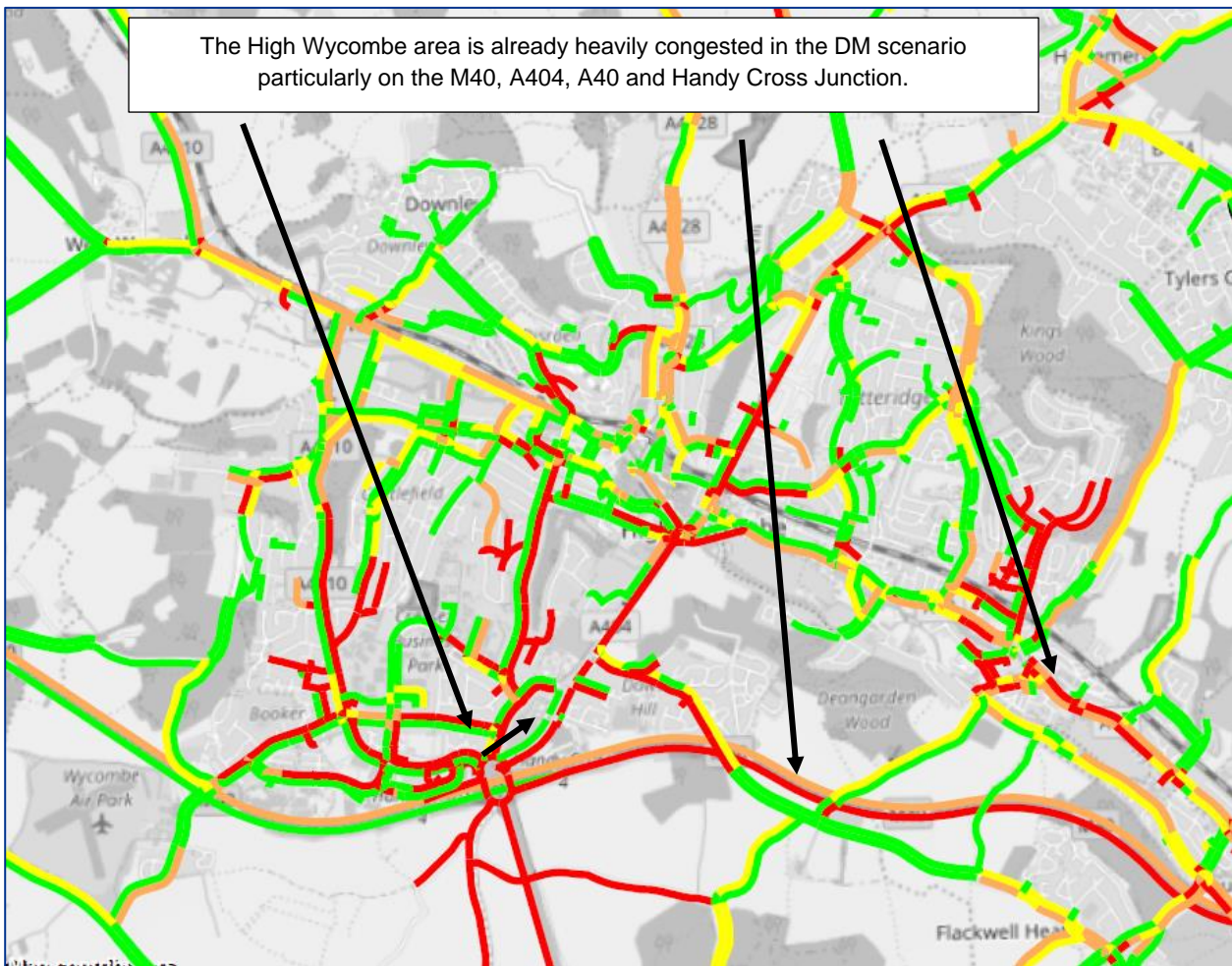


Figure 5-J Congestion in the DM scenario during the AM peak in High Wycombe

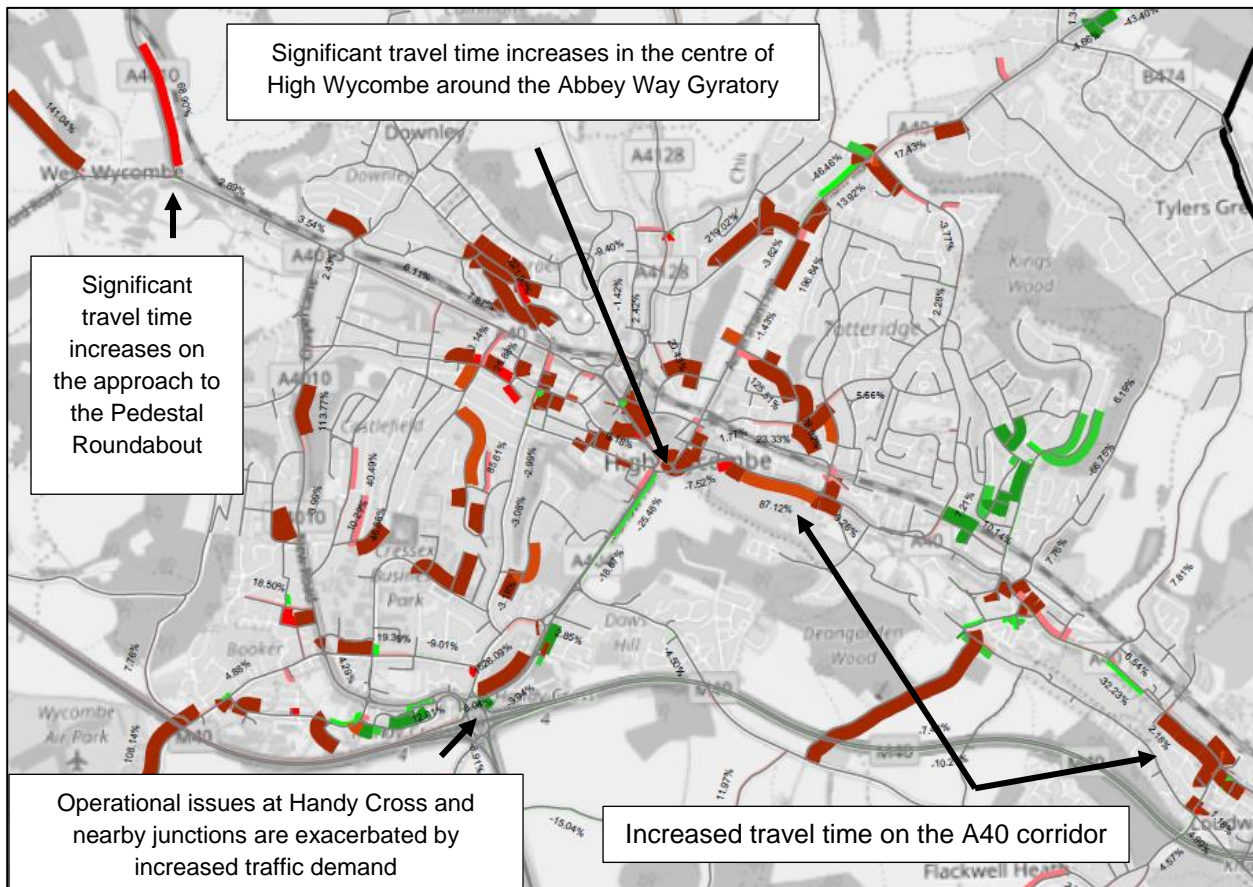


Figure 5-K: Travel time changes from the DM to the DS scenario during the AM peak in High Wycombe

Both mitigation scenarios include the same schemes in the High Wycombe area including the A40 corridor improvements, Gomm Valley Spine Road, Hollands Farm Link Road, Queensway Link Road and the Westhorpe junction improvements. In addition to this a number of public transport schemes have been included through an adjustment to the trip generation of affected model zones.

The potential for mitigation schemes in High Wycombe is limited due to the constrained nature of the urban environment, particularly through the town centre and on the A40 corridor. There is limited space for improvements on the highway network and in some cases the mitigation has the effect of drawing additional traffic onto the main corridors through the town.

It should be noted that the Queensway Link mitigation at the Hazelmere Crossroads is discussed in detail in Section 5.2.3.6.

There are some moderate localised improvements in travel time with the mitigation schemes in place across the High Wycombe area compared with the DM. This includes a reduction in travel time on the northern section of Cock Lane in the AM peak (up to 40%), and a reduction in travel time on the approach to the Hazelmere Crossroads on Penn Road (up to 40%) and Amersham Road N (up to 80%), as a result of reduced demand through the junction with the Queensway link in place.

In the PM peak there are significant travel time reductions at the eastern end of the A40 corridor, particular at the M40 J3 Roundabout. The travel time reductions in this area arise due to the signal timing improvements at the Rayners Avenue Junction as part of the A40 corridor improvements. This leads to a reduction in queuing on the westbound A40, which in the DM is congested back to J3 of the M40.

However, despite these improvements there are still moderate to significant travel time increases in all other areas of High Wycombe, particularly in the centre of Wycombe, on the M40 and on the A40 corridor, which in

general have greater increases in travel time than in the unmitigated scenario. For example there are significant increases in travel time on the A40 between Cock Lane and Gomm Road where the new spine road connects, as this draws additional traffic to the A40 resulting in delays.

Figure 5-L illustrates the travel time changes described in the previous paragraphs in regards to the mitigated scenarios.

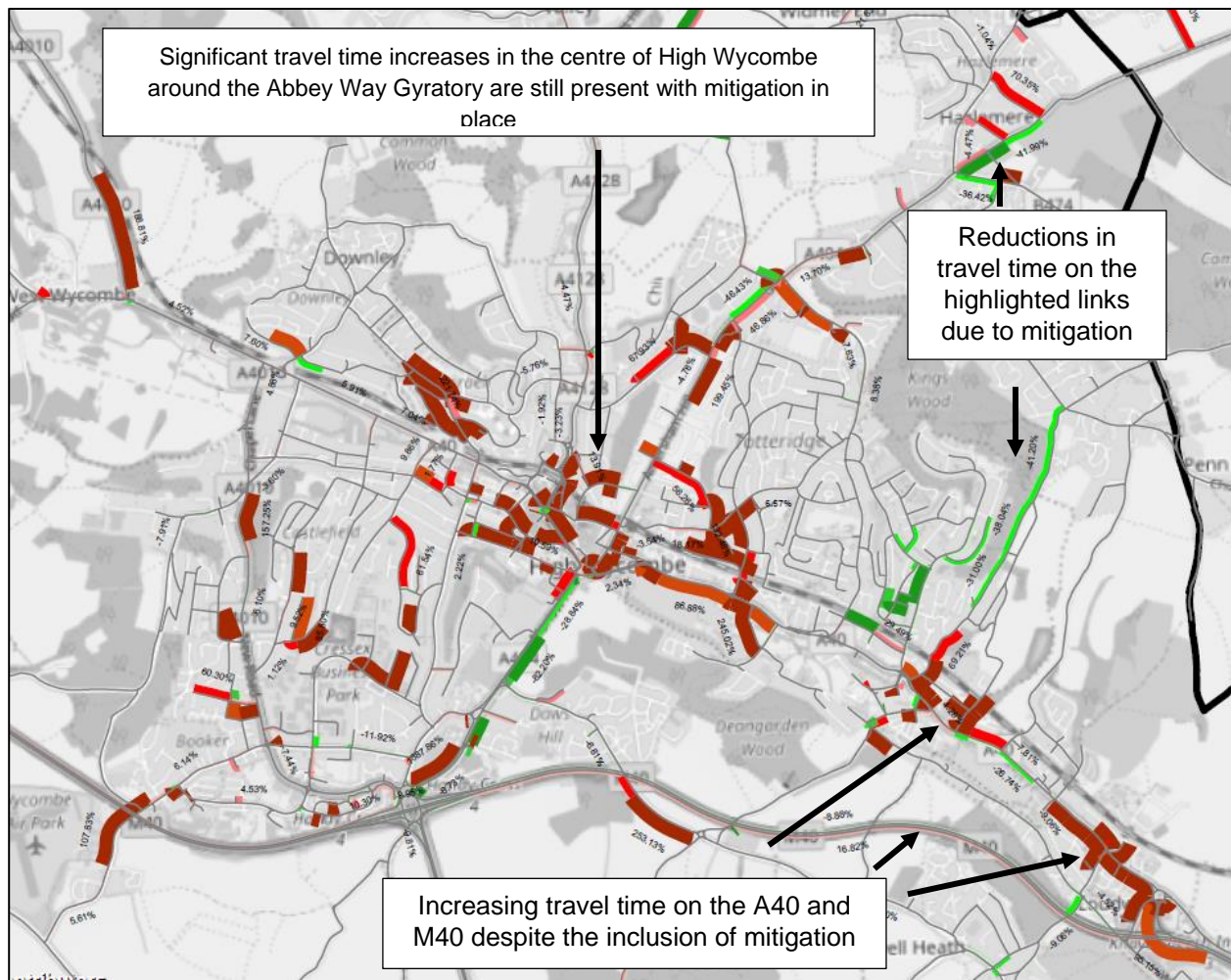


Figure 5-L Travel time changes from the DM to the DS run 1 scenario during the AM peak in High Wycombe

As has been noted in previous work, the Countywide model is known to be sensitive to changes in traffic flow in this area, and tends to show greater overall levels of congestion than observed. The model outputs from this work should therefore be considered in this context; however the general trends, and particular areas identified as being significantly impacted, are clear.

In addition, a separate piece of work is also being undertaken as part of the Wycombe Local Plan⁶ looking specifically at the impacts of Local Plan development sites within and around the High Wycombe area, which shows a similar pattern in traffic flow and congestion. It is also worth noting, that whilst the overall validation of the Countywide Model is considered sufficient for this work, it is known through other studies that the High Wycombe area would likely benefit from further base year calibration and validation to address the sensitivity of this area of the model to small changes in traffic flow.

⁶ Wycombe Local Plan Sites Traffic Modelling Jacobs U.K. Ltd 2017

5.2.2.3 Bourne End

For a number of routes in Bourne End there are relatively moderate to significant increases in travel time in the DS scenario over the DM in the AM peak. This includes Furlong Road (up to 500%), Hedsor Road (up to 90%), Wessex Road (up to 75%) and southbound on A4094 Station Road.

The travel time increases are the result of increased congestion south of Bourne End on the A4094 Ferry Lane, at Cookham Bridge. The signalised junction at this location is already over capacity in the DM, and with the DS development in place there is an increase of approximately 130 southbound trips on the A4094. The extra traffic demand results in greater congestion through Bourne End, with additional vehicles queuing on the approach to the crossing. This impacts other junctions along the A4094, leading to the observed increases in travel time on the minor roads in Bourne End.

The impacts are not seen in the PM peak as the increase in southbound traffic flow on the A4094 Ferry Lane amounts to approximately 20 vehicles in the DS scenario, compared with the DM. As a result the level of congestion between the DS and DM remains similar.

Figure 5-M shows the travel time increases in the DS scenario compared with the DM in the AM peak, as described above. Figure 5-N illustrates the congestion already present in the DM on the approach to Cookham Bridge.

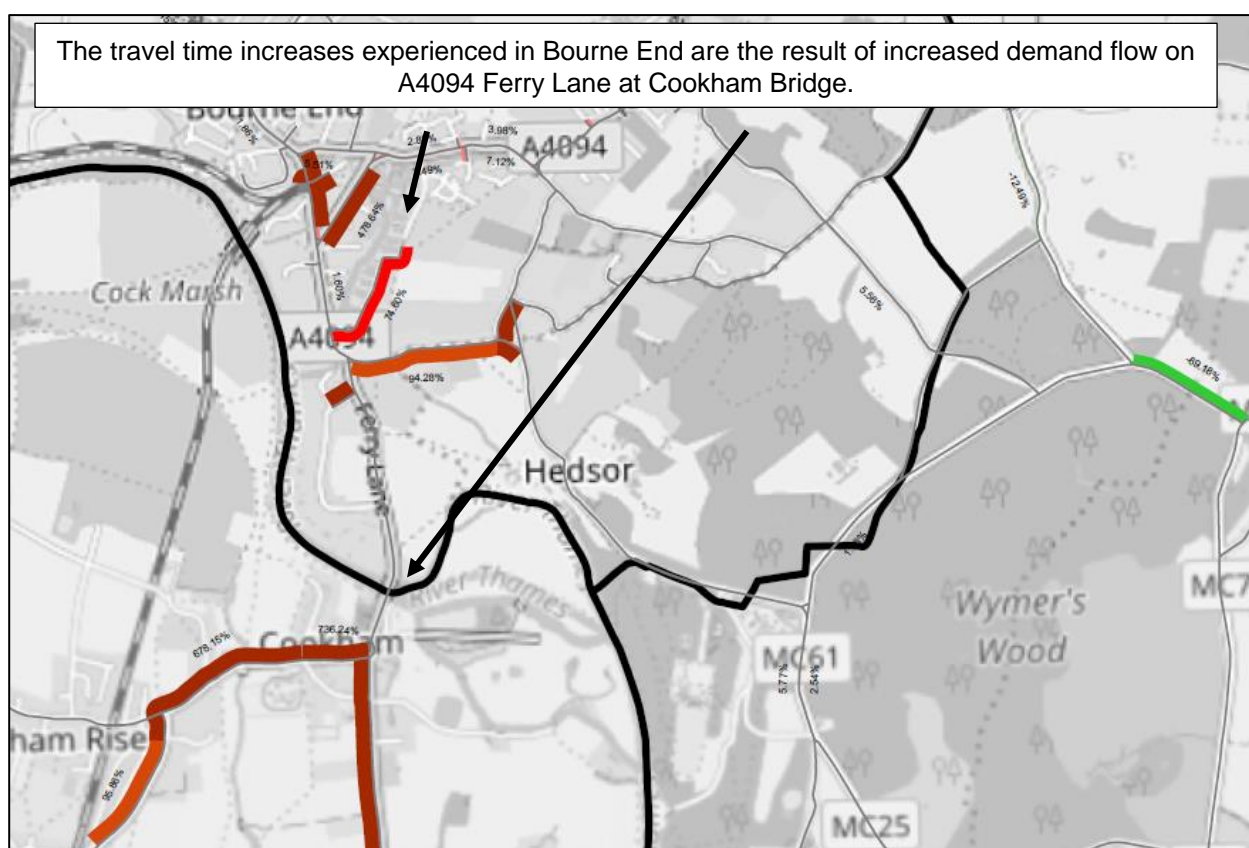


Figure 5-M Travel time changes from the DM to the DS scenario during the AM peak in Bourne End

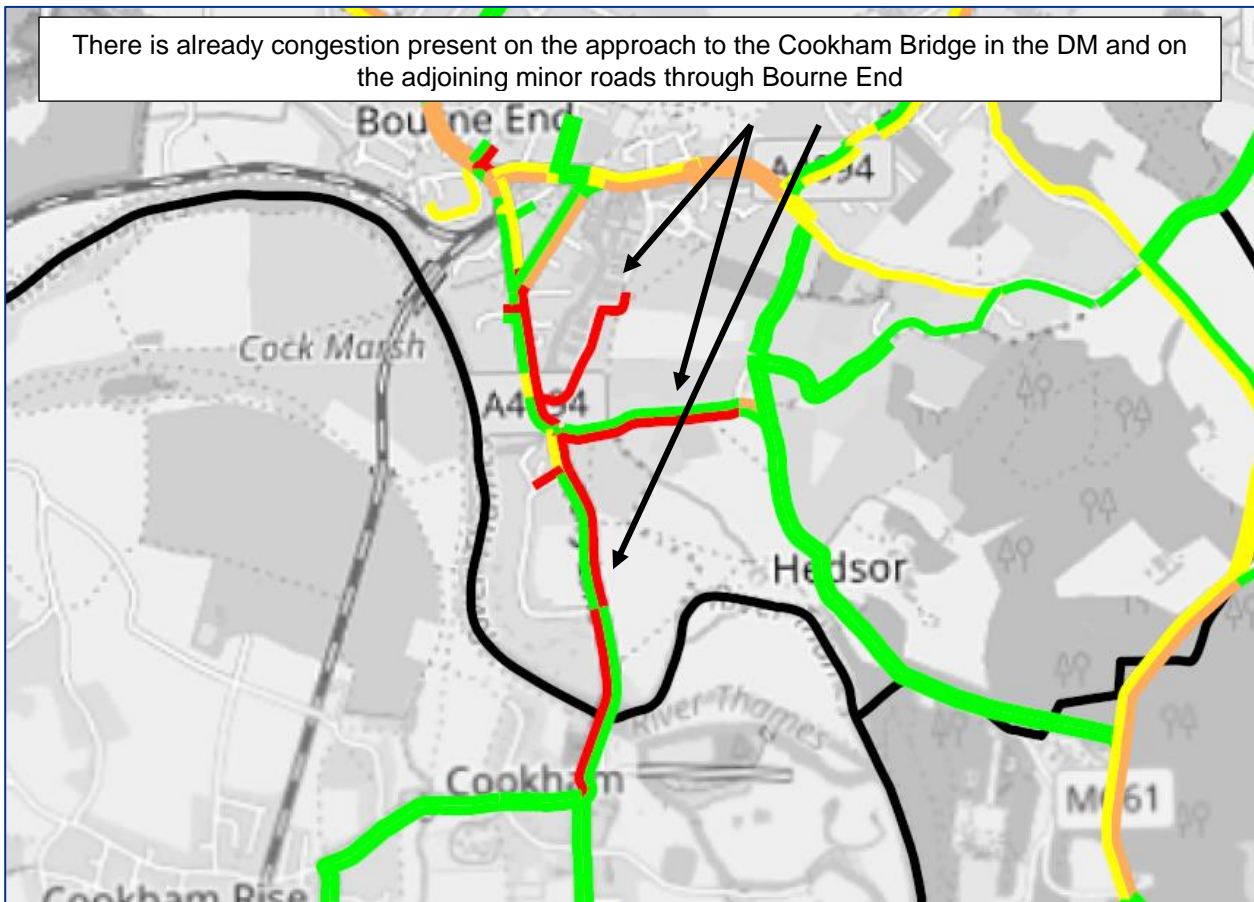


Figure 5-N Congestion ratio in the DM scenario during the AM peak in Bourne End

Both mitigation run 1 and 2 include Hollands Farm Link Road in the Bourne End area. With the mitigation in place the travel time increases on Furlong Road, Hedsor Road and Wessex Road are reduced compared with the DS scenario (up to 400% reduction from the DS), as vehicles using these links in the DS reassign to the new link road, reducing delay at the other junctions. However, the demand flows on the A4094 remain similar between scenarios, and the congestion at the Thames River crossing remains the main constraint in this area.

Figure 5-O illustrates the travel time changes with the mitigation in place in Bourne End during the AM peak.

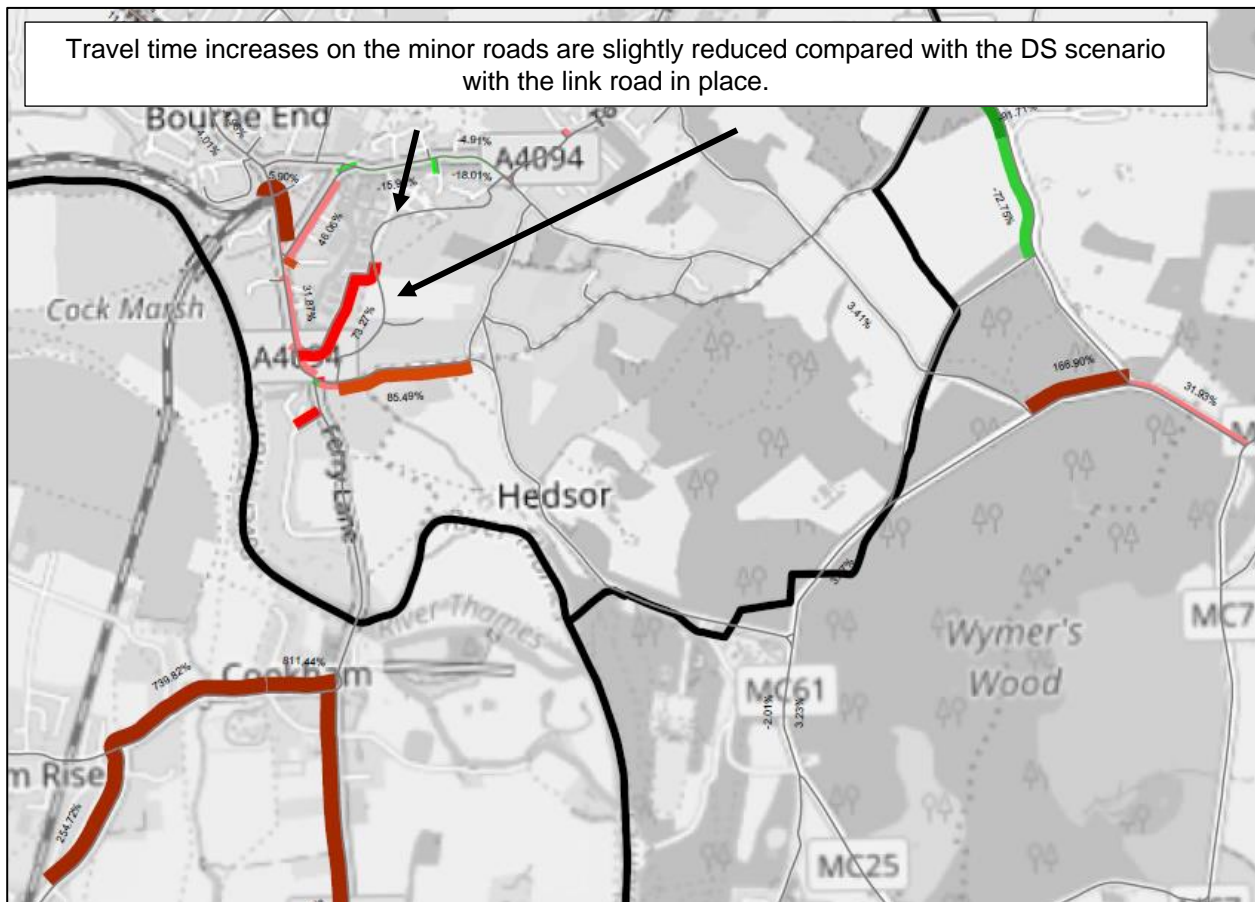


Figure 5-O Travel time changes from the DM to the DS run 1 scenario during the AM peak in Bourne End

It should be noted that the separate Wycombe Local Plan Sites modelling work (referred to at the end of section 5.2.2.2) did not identify a significant congestion issue on the approach to Cookham Bridge on the A4094; however, Cookham/ Bourne End is outside of the study area for that piece of work, and therefore the network and associated junction coding is not as detailed as that which is included for this work. As a result the Wycombe Model does not provide as reliable an indicator of congestion in that area as does the Countywide model.

5.2.2.4 Marlow and A404

In general there are relatively slight increases in travel time in the Marlow and Bisham area when comparing the DS with the DM scenario, with the notable exception of the Marlow Bridge area, which is already heavily congested in the DM scenario. At this location, congestion from the Bisham Roundabout which affects this area is further exacerbated in the DS scenario, due to both increased southbound traffic flows on the road (approximately 50 vehicles), and northbound on the A404 at the junction (approximately 100 vehicles).

There are also significant increases in travel time on the A404 (up to 90%) and Wycombe Road (up to 300%) particularly in the PM peak, which are linked to the increased congestion at Handy Cross in the DS scenario. In addition, congestion already present in the DM scenario at the Westhorpe junction and Bisham Roundabout is present in the DS scenarios, with delays on Little Marlow Rd approaching the Westhorpe junction increasing compared with the DM scenario.

The majority of impacts described above are due to congestion on the A404 corridor, particularly at the Bisham Roundabout and Handy Cross Junction, and are not primarily related to constraints on the local road network in the Marlow area. The Bisham Roundabout was previously reviewed as a Pinch Point Scheme, but was later withdrawn because of wider adverse effects on the A404 corridor.

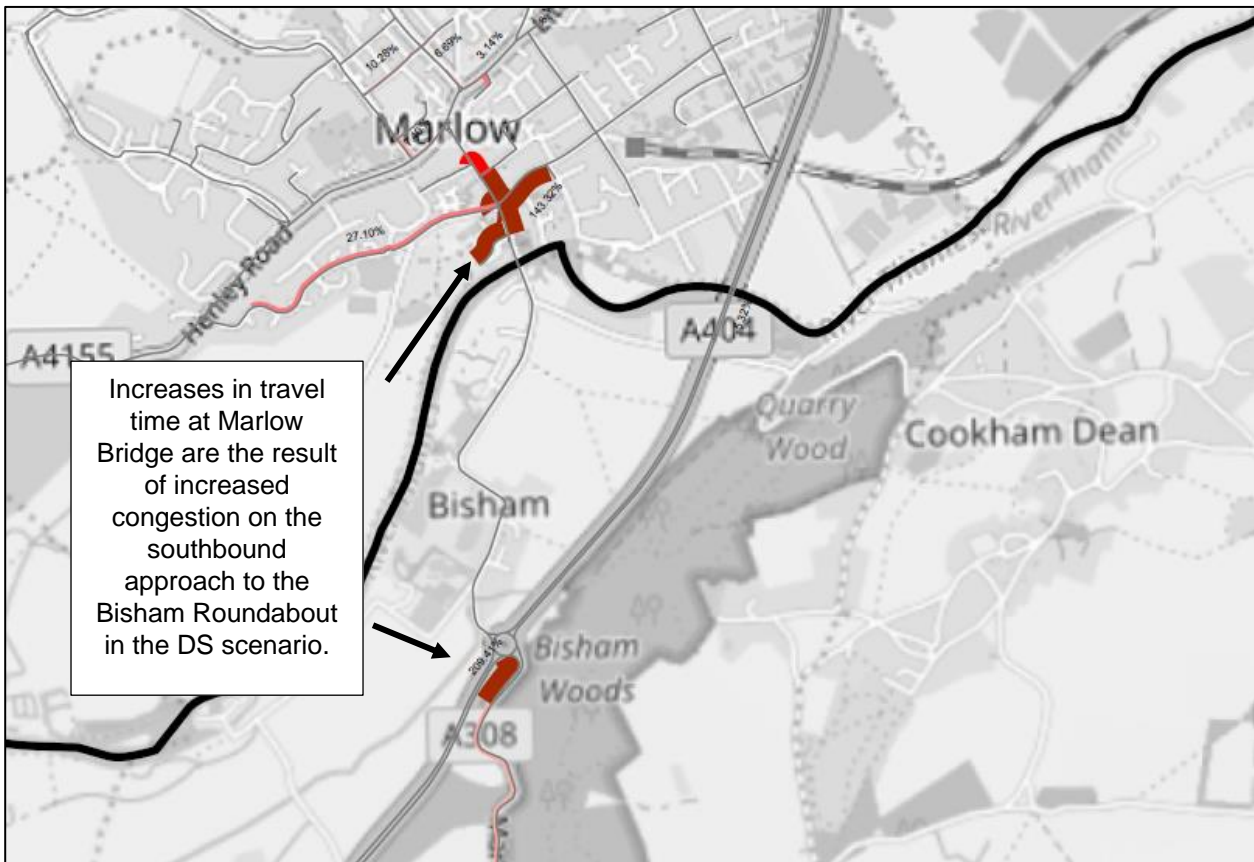


Figure 5-P Travel time changes from the DM to the DS scenario during the AM peak in Marlow

Both runs of the mitigation scenario include capacity enhancements at the Westhorpe junction for northbound vehicles leaving the A404. With the scheme in place the congestion ratio plots show a decrease in congestion at this location comparing the DM and DS scenarios, as shown in Figure 5-Q. However, the mitigation does not address the capacity issues at the Bisham Roundabout, and as a result the travel time increases observed in the DS are also carried over to the mitigation runs.

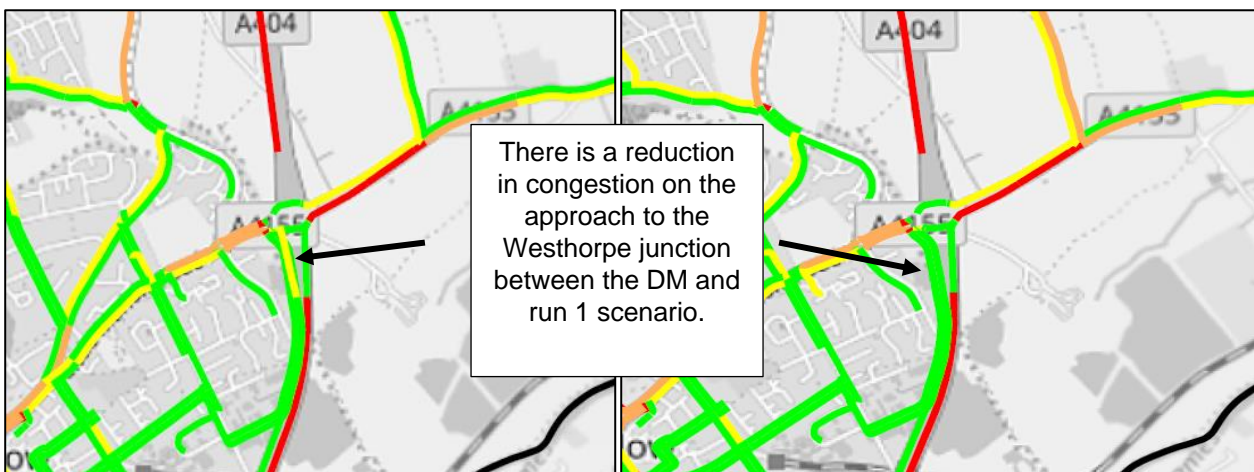


Figure 5-Q: Congestion ratio at the Westhorpe junction in the DM (left) and run 1 (right) scenarios during AM peak

is reduced to 20% compared with the DM, as some of the additional traffic on the circulatory is reassigned to the new left turn slip lane from the A355 northbound.

5.2.3.3 Little Chalfont, Chalfont St Peter and Chalfont St Giles

There are relatively moderate increases in travel time across the Little Chalfont area as a result of the local plan development scenario, particularly in the AM peak. The majority of these impacts are observed on the A404 and adjoining minor roads as a result of increases in traffic demand on the main corridor. Figure 5-S shows the travel time increase experienced in the DS scenario compared with the DM in the AM peak.

There are slight travel time increases on Stony Lane (up to 30%) as a result of an increase in westbound demand flow (approximately 100 vehicles) on the A404, at the Stony Lane/ A404 junction. This reduces the capacity for vehicles exiting Stony Lane onto the A404. There is also a similar increase in travel time on Church Grove (up to 50%) and Burtons Lane (up to 30%) where increases in demand flow both on the A404 and minor road result in a travel time increases on the approach to the junctions.

There are also moderate travel time increases on the approach to the A404 White Lion Road/ B4442 Cokes Lane Roundabout, due to both an increase in demand flow on the circulatory (up to 70 vehicles) and on the approach to the junction from Cokes Lane (approximately 50 vehicles). This results in travel time increases on Cokes Lane (up to 100%) and White Lion Road (up to 90%) as the capacity for traffic entering the junction is reduced.

There are no notable impacts in the Chalfont St Peter or Chalfont St Giles with the local plan development scenario in place in the DS scenario. In addition, no mitigation has been included in either mitigation run in Little Chalfont, Chalfont St Peter or Chalfont St Giles.

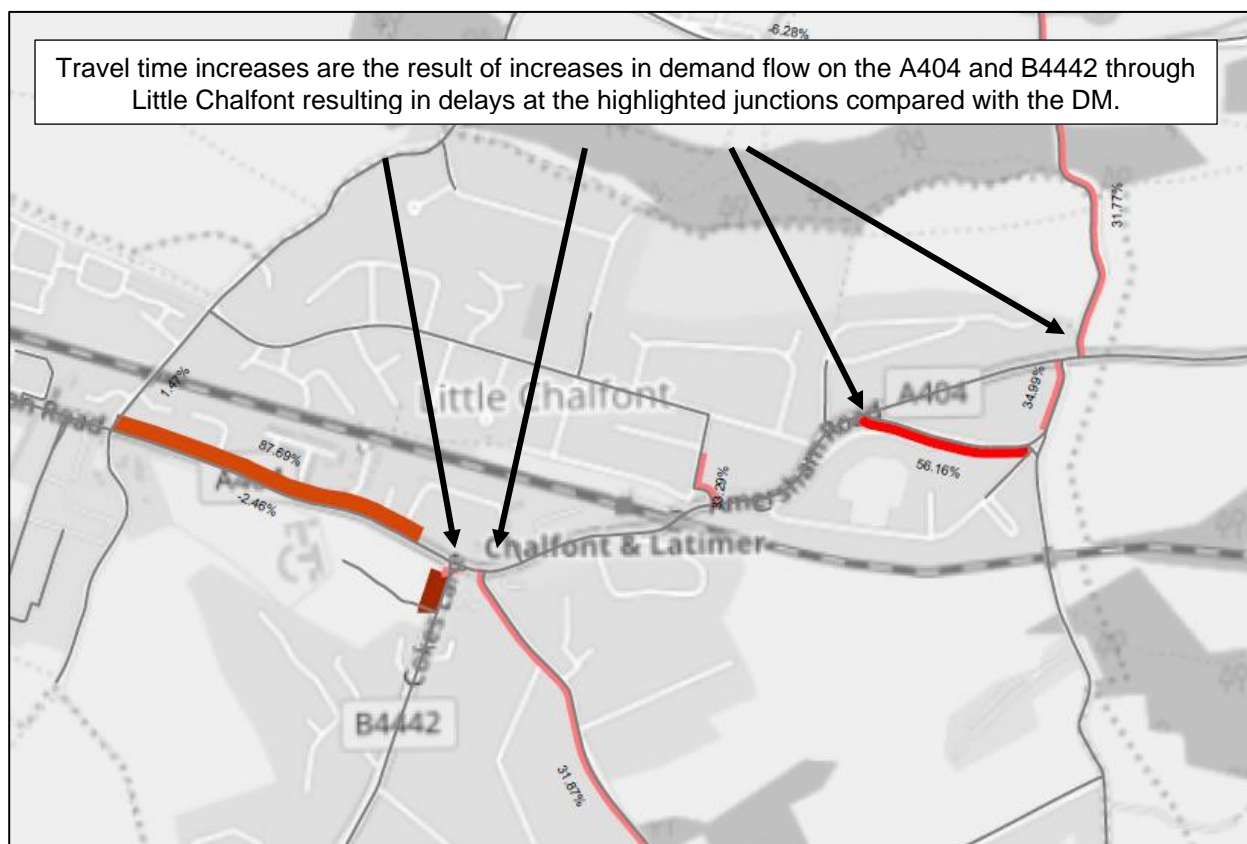


Figure 5-S Travel time changes from the DM to the DS scenario during the AM peak in Little Chalfont

5.2.3.4 Beaconsfield

There are relatively significant increases in congestion in the DS scenario compared with the DM in Beaconsfield. The travel time increases are experienced in a number of areas across the town including the town centre, Longbottom Lane, Potkiln Lane and Junction 2 of the M40.

In the town centre there are increases in travel time on the B474, Gregories Road (up to 250%), Maxwell Road (up to 95%), Baring Road (up to 290%) and Reynolds Road (up to 150%). These roads already experience a high level of delay in the DM scenario, and this is further exacerbated in the DS scenario due to increases in demand flow on the B474 (approximately 100 two-way trips).

The cause of the congestion in this area is attributable to the Baring Road/ Reynolds Road/ B474 Roundabout and the Gregories Road/ Burkes Road/ B474 Roundabout. Neither roundabout has sufficient capacity for southbound traffic on the B474. This leads to significant queuing on the B474 which restricts traffic exiting the adjoining roads.

The observed travel time increase westbound on Longbottom Lane (up to 400%) only occurs during the AM peak, and is the result of an increase of approximately 100 vehicles heading south on the A355 at the A355/ Longbottom Lane junction. This reduces the capacity for vehicles egressing Longbottom Lane creating additional delay.

A similar situation is observed at Potkiln Lane where travel time increases of up to 100% are due to an increase in westbound demand flow on the A40 (approximately 75 vehicles). As with Longbottom Lane, this reduces the capacity for vehicles egressing Potkiln Lane creating delay.

The travel time increases observed at Junction 2 of the M40 are actually due to delays at the Burnham Road/ A355 junction to the south of the motorway. With the local plan development in place there is an increase of approximately 100 additional vehicles heading southbound on the A355. The junction is already over capacity in

the DM and with the addition of the extra demand the delay further increases. This results in queueing traffic that extends back through the motorway junction leading to the observed travel time increases of up to 260%.

Figure 5-T illustrates the impacts in Beaconsfield in terms of travel time increases in the DS scenario compared with the DM, in the AM peak.

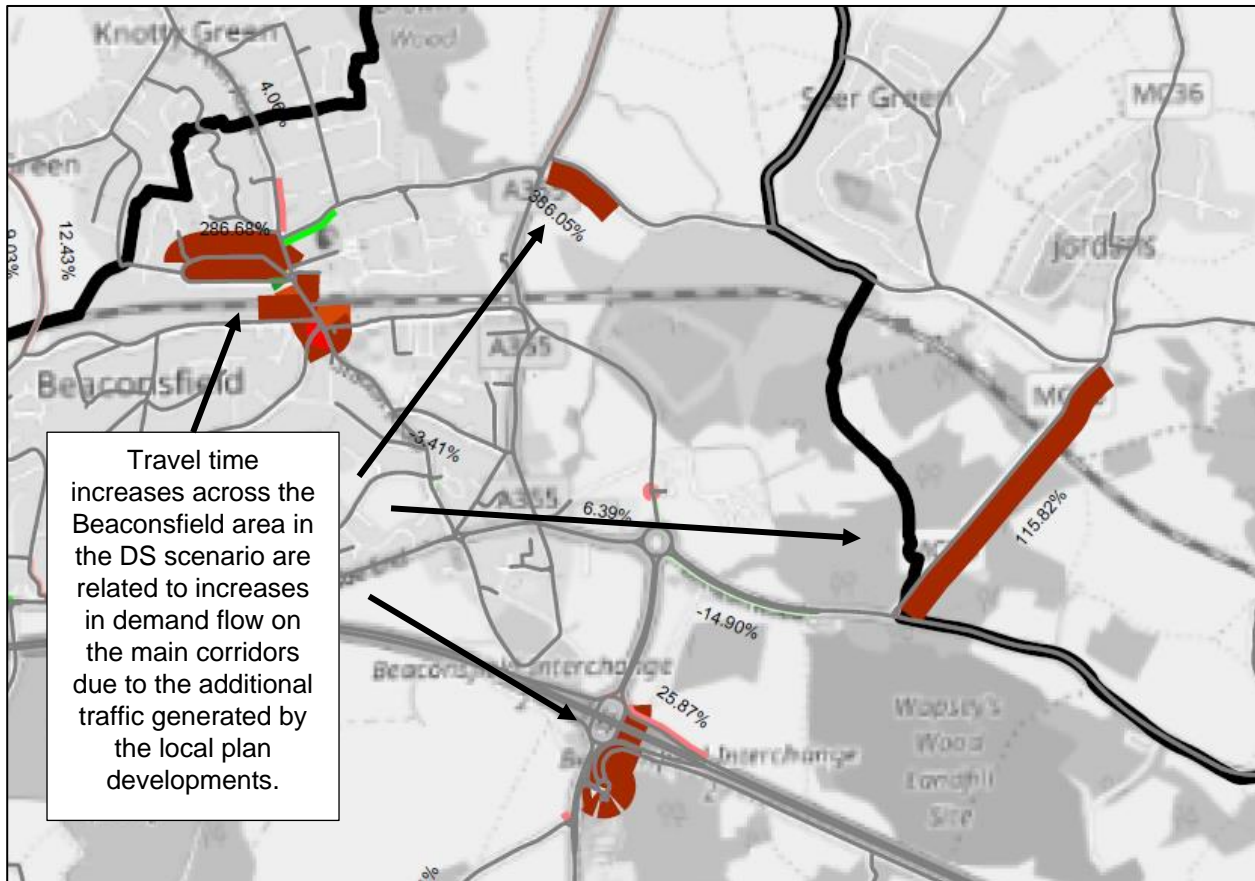


Figure 5-T Travel time changes from the DM to the DS scenario during the AM peak in Beaconsfield

Both run 1 and run 2 of the mitigated scenarios includes the Beaconsfield Transport Strategy. With the mitigation in place the travel time increases present in the DS through the town centre are removed, and in the AM peak, moderately reduced (up to 50%) compared with the DM scenario. This is because in the mitigated scenario demand flows southbound on the B474 through the town centre do not increase compared with the DM, and therefore there is no increase in delay.

The other significant travel time increases in the DS scenario at Longbottom Lane, Potkiln Lane and Junction 2 of the M40, are still present in both run 1 and run 2 of the mitigated scenario.

Figure 5-U illustrates both the travel time reductions and increases present in the DS run 1 scenario compared with the DM, in the AM peak.

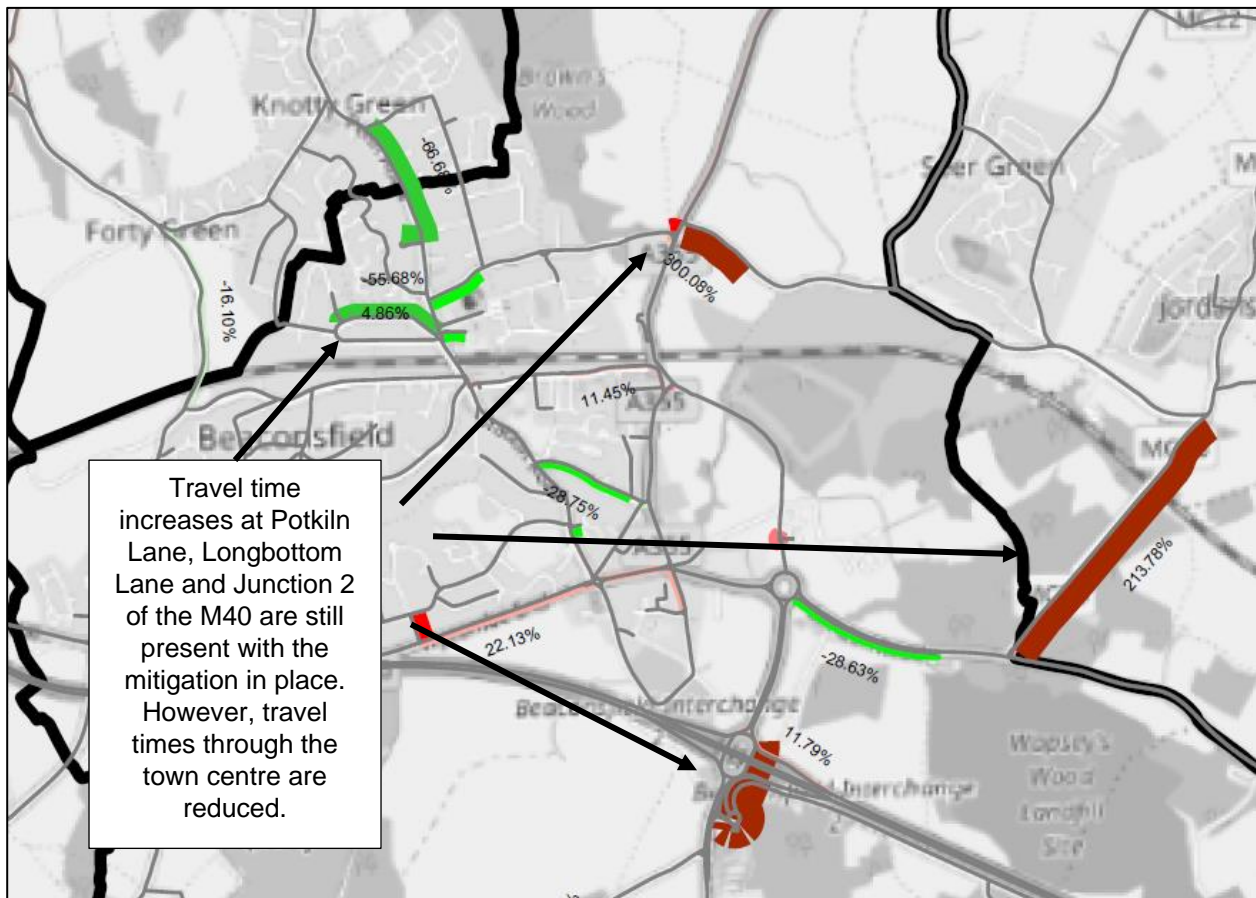


Figure 5-U Travel time changes from the DM to the DS run 1 scenario during the AM peak in Beaconsfield

5.2.3.5 Burnham/Farnham Royal/Farnham Common/Stoke Poges/Taplow

There are relatively significant increases in travel time in the PM peak when comparing the DS scenario with the DM; however the opposite is observed in the AM peak, where there are instead moderate reductions in travel time. This difference in result is due to the sensitivity of the A4 Bath Road/ Huntercombe Lane signalised junction. This junction is over capacity in both the DM scenario and the DS scenario. As a result any change in demand flow can radically alter the amount of queuing and delay at the junction.

For example, in the AM peak on the eastbound approach to the junction from the A4, there is a reduction in demand flow of approximately 150 vehicles compared with the DM (these trips have reassigned to alternative routes). This reduction in demand results in a reduction in queuing and delay back from the A4 Bath Road/ Huntercombe Lane junction. As a result the queueing now does not extend past the A4 Bath Road/ Lake End Road/ Lent Rise Road Roundabout, resulting in travel time reductions of up to 100% on the approaches.

However in the PM peak, demand flow increase by approximately 150 vehicles on the same approach to the junction, compared with the DM. This causes the opposite effect, and travel times increase on the approaches (up to 1000%) to the A4 Bath Road/ Lake End Road/ Lent Rise Road Roundabout.

This effect is not unexpected in models which have high levels of traffic or congestion, and highlights that the main constraint in the Burnham area, in terms of congestion, is the A4 Bath Road/ Huntercombe Lane junction.

There are no notable changes in travel time in Farnham Royal, Stoke Poges or Farnham Common in the DS scenario compared with the DM.

The Berry Hill junction improvements have been included in run 2 of the mitigation and comprise of signal timing optimisations and an alteration to the junction configuration. As a result there are moderate travel time

reductions (up to 90%) compared with the DM on the approaches to the junction, as the changes to the signals have increased the junction capacity. No other mitigation has been tested in this area.

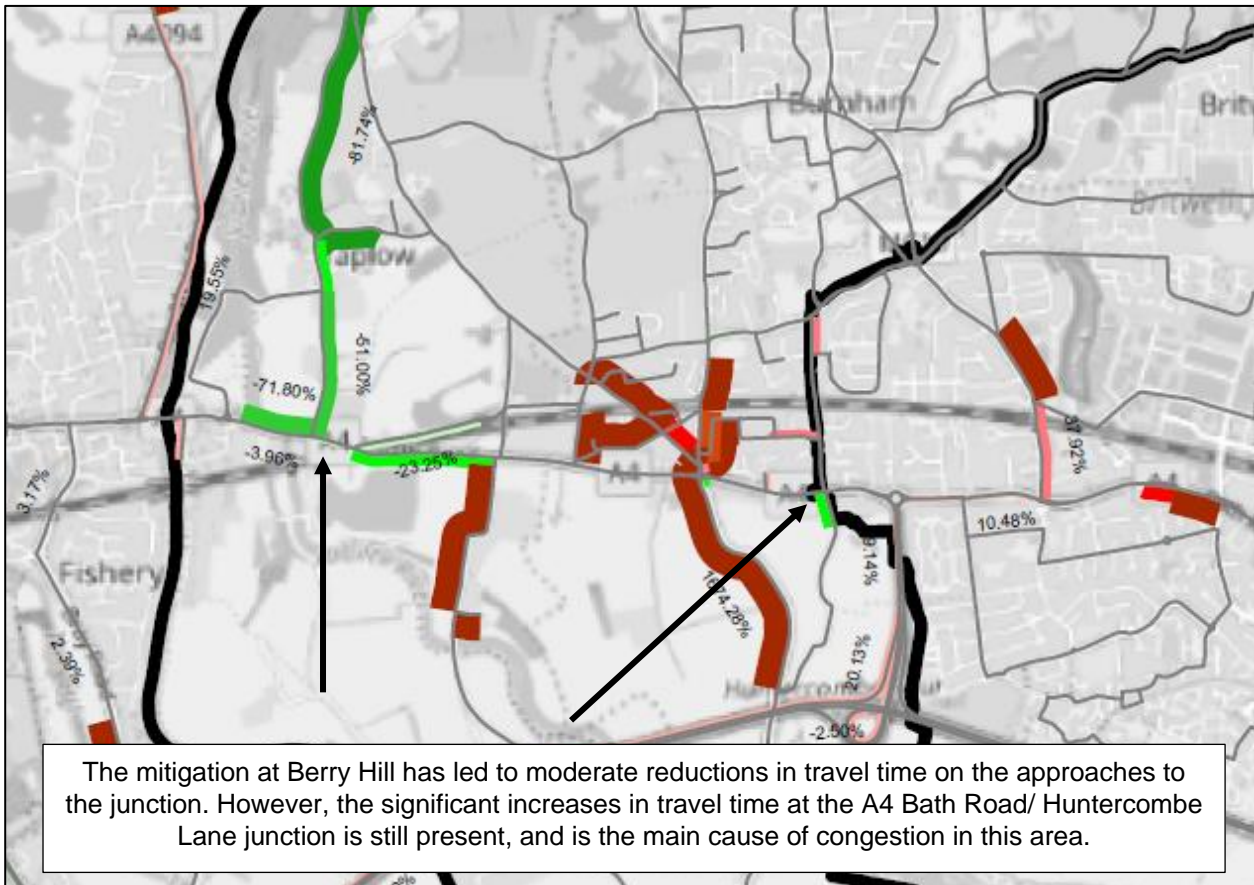


Figure 5-V Travel time changes from the DM to the DS run 2 scenario during the PM peak in Burnham

5.2.3.6 Holmer Green and Hazlemere

The addition of the local plan development does not lead to a worsening of conditions in this area, albeit the Hazlemere Crossroads are already congested in the DM scenario. There are no notable travel time increases in the Holmer Green area or at the Hazlemere Crossroads in the DS scenario compared with the DM.

Mitigation run 1 and run 2 both contain the Queensway Link. This mitigation is intended to remove some of the traffic demand from the Hazlemere Crossroads, which are heavily congested in the DM and DS scenarios. With the scheme in place, there is a moderate reduction in travel time on the southbound A404 (up to 80%) approaching the junction and on the westbound B474 (up to 40%), compared with the DM.

The travel time reduction on the A404 occurs because in the DM scenario southbound traffic on Holmer Green Road uses the Hazlemere Crossroads to access the B474. However, with the mitigation in place the link provides an alternative route to the north of the crossroads, and approximately 80 vehicles reassign to the new road. This reduces traffic on the circulatory of the Hazlemere Crossroads, increasing the capacity for vehicles approaching the junction on the southbound A404.

The travel time reductions on the westbound B474 occur because approximately 400 vehicles reassign to the Queensway Link. These vehicles originally used the Hazlemere Crossroads to access the northbound A404.

Figure 5-W illustrates the travel time reductions which occur at the Hazlemere Crossroads with the mitigation in place.

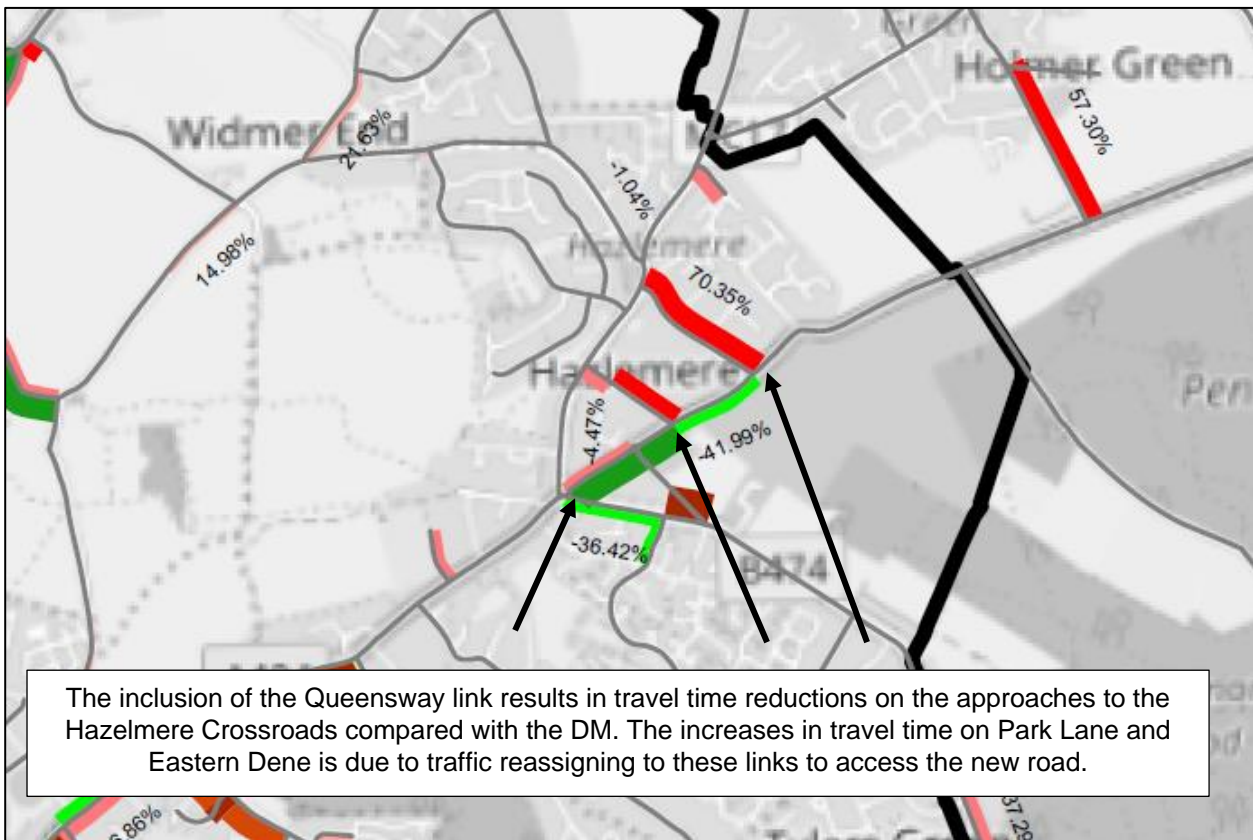


Figure 5-W Travel time changes from the DM to the DS run 1 scenario during the AM peak at the Hazelmere Crossroads

5.2.3.7 Iver area

The relatively moderate travel time reductions in Iver Heath shown in DS scenario when compared with the DM, are the direct result of the congestion originating from the Denham Roundabout, with the inclusion of the Land North of Denham Roundabout green belt site (see section 5.2.3.8 for more details) in the DS scenario. The travel time reductions on the approach to the 5 Points Roundabout from the A412 (up to 70%) and A4007 (up to 65%), occur because traffic demand is reduced as vehicles are unable to progress through the Denham Roundabout due to the congestion.

In Iver Heath there is also a significant travel time increase in the PM peak northbound on the A412 (up to 110%), which occurs due to increased demand flow (approximately 80 vehicles) on the approach to the A412/ Bangors Road North Roundabout. The additional demand flow at this junction results in significant delay, as the increase in vehicles exceeds the capacity of the junction.

In Iver there are relatively significant travel time increases at the Thorney Lane North/ B470 High Street/ B470 Iver Lane Roundabout and at the Ridgeway/ Thorney Lane North Junction in both the AM and PM peak. These travel time changes occur due to demand flow increases to and from the Area North of Iver Station green belt option site, and because of a demand flow increases on the B470 which is brought about by the additional wider development included in the DS scenario.

At the Thorney Lane North/ B470 High Street/ B470 Iver Lane Roundabout demand flows on the approach from B470 Iver Lane increase by approximately 150 vehicles in the DS scenario compared with the DM. This approach is already congested in the DM and the additional vehicles create further delay, resulting in travel time increases of up to 100% in the DS scenario. A similar trend is observed on the approach from Thorney Lane North, with approximately 100 extra vehicles resulting in a travel time increase of up to 300% compared with the DM.

The Ridgeway/ Thorney lane North Junction experiences travel time increases of up to 600% on the approaches, as the additional demand to and from the new development site exceeds the capacity of the existing signal/ junction arrangement.

Figure 5-X illustrates the travel time increase in Iver Heath and Iver in the DS scenario compared with the DM during the AM peak.

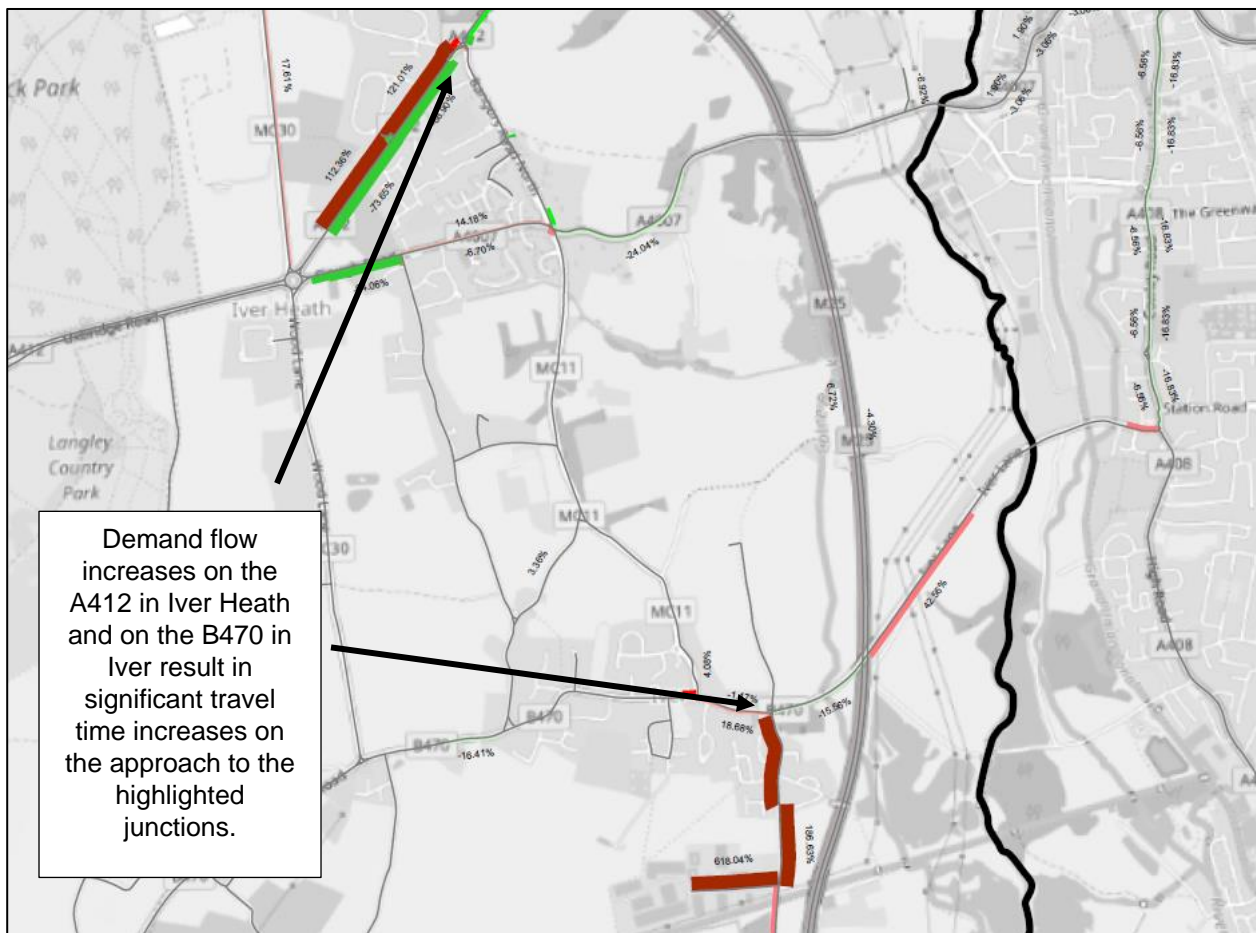


Figure 5-X Travel time changes from the DM to the DS scenario during the AM peak in the Iver area

Both run 1 and run 2 of the mitigation include improvements to the 5 Points Roundabout on the A412 at Iver Heath. This scheme partially signalises the roundabout and alters the junction configuration to provide additional capacity. Run 2 of the mitigation also includes an improvement to the A412/ Bangors Road North Roundabout to increase the junction capacity.

With the improvement schemes in place there are moderate travel time reductions on the approaches to the 5 Points Roundabout from the A412 north and A4007 (up to 60%) compared with the DM, as the increase in junction capacity results in less delay. The travel time increases on the approach to the A412/ Bangors Road North Roundabout are also reduced compared with the DS scenario over the DM. (up to 10% instead of 110%).

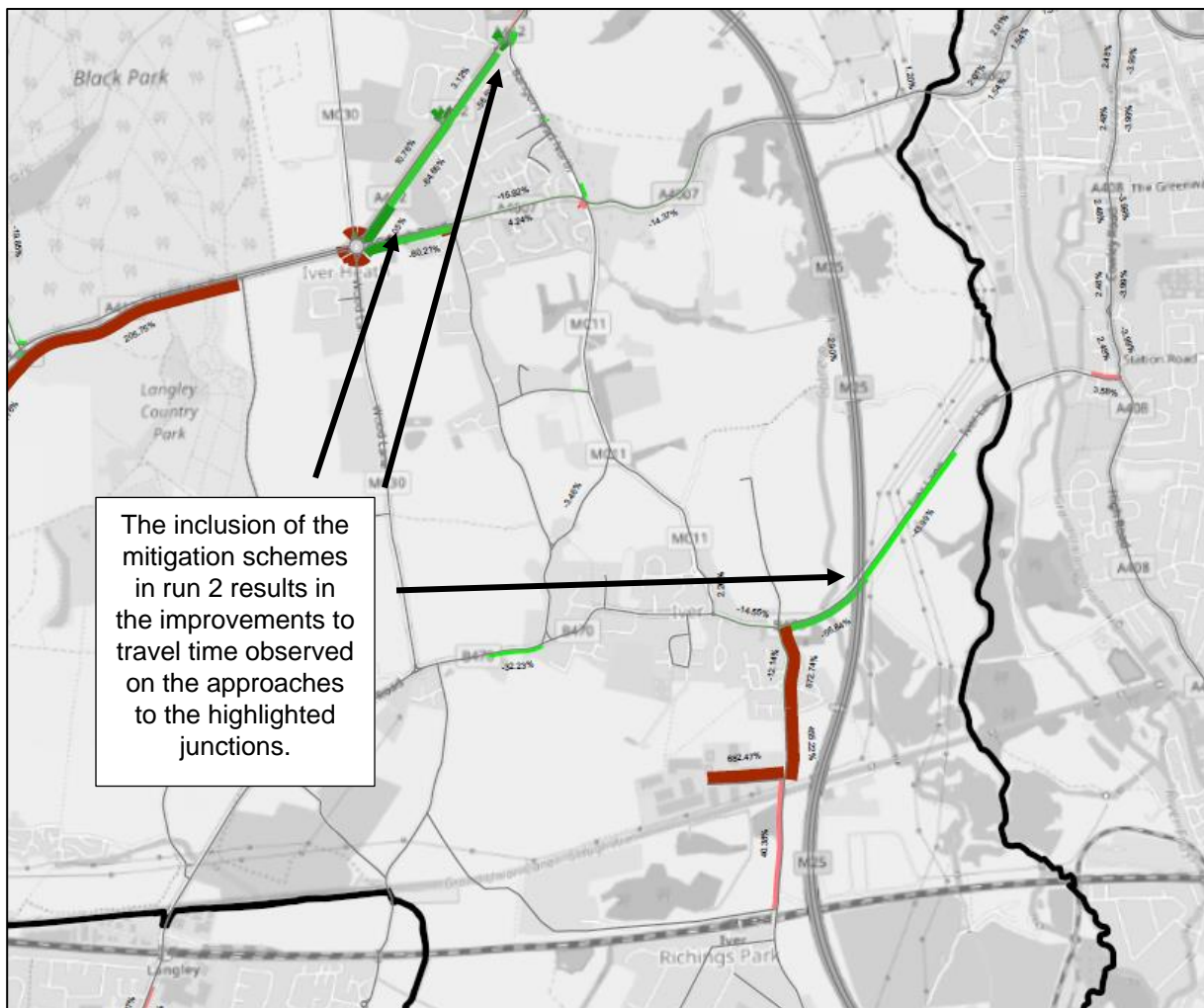
It should be noted that a mitigation included at the Denham Roundabout (see section 5.2.3.8 for more details) significantly reduces congestion in the Denham area present in the DS scenario. As a result additional traffic is able to reach Iver Heath in the mitigated scenarios, as vehicles are no longer held up in congestion at the Denham Roundabout. However, as the congestion at the Denham Roundabout is not present in the DM (as the additional development is not included), a comparison of the mitigated scenarios against the DM still gives an indication of the effectiveness of the individual schemes included in Iver Heath.

Mitigation run 2 includes the Iver Relief Road to the south of Iver. The relief road creates an additional link between Thorney Lane and Mansion Lane providing an alternative route for HGV traffic which avoids Iver High Street.

With the scheme in place in the AM peak there are moderate travel time reductions (up to 60%) on the approach to the Thorney Lane North/ B470 High Street/ B470 Iver Lane Roundabout from the B470 Iver Lane. This occurs because there is a reduction of approximately 100 vehicles using the junction from the B470 High Street, as this eastbound traffic has instead reassigned to the new relief road.

In the PM peak there are moderate travel time reductions (up to 60%) on the approach to the junction from Thorney Lane North. This occurs because westbound traffic which originally assigned to High Street from Thorney Lane North is now using the new Relief Road as an alternate route, reducing delays.

Figure 5-Y illustrates the travel time benefits of the mitigation at Iver Heath and Iver in the AM peak.



A412 is readily apparent, and the trend for increased congestion in the Iwer area with the Local Plan development scenario (without mitigation) in place is also clear.

5.2.3.8 The Denhams

There are significant increases in travel time in the Denham area as a result of the inclusion of the local plan development in the DS scenario, and in particular the Land North of Denham Roundabout green belt site. This results in the widespread travel time impacts present in both the AM and PM peak in this area.

In the DS scenario the additional traffic generated from the Land North of Denham Roundabout green belt site uses the A40 Oxford Road/ Old Mill Road junction to access the site. The junction does not have sufficient capacity to cope with the additional vehicles, and this results in queuing and delay back through the Denham Roundabout and onto the motorway, as well as on the A40 Oxford Road. Figure 5-Z illustrates the increases in travel time which occur in the DS scenario compared with the DM as a result of this.

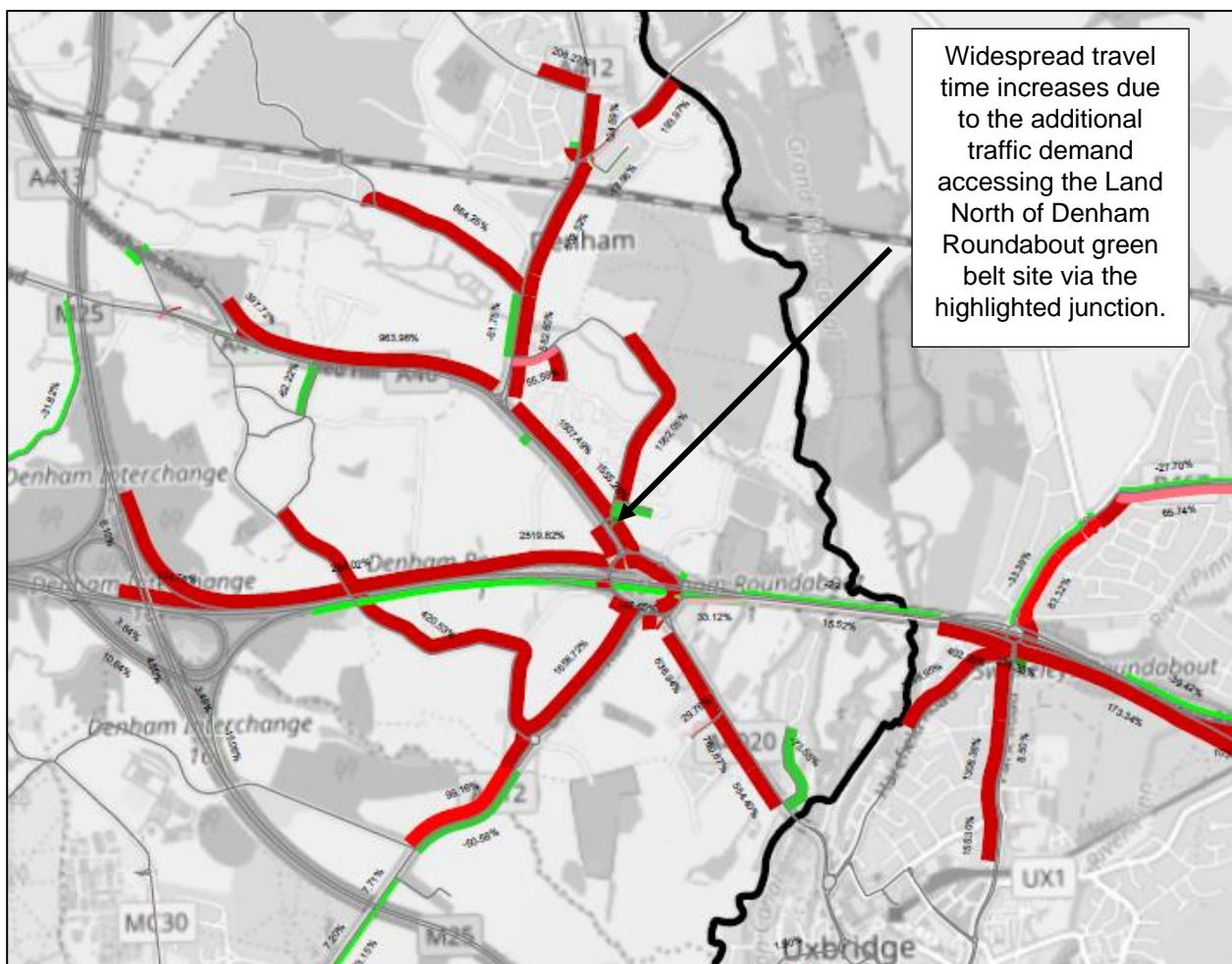


Figure 5-Z Travel time changes from the DM to the DS scenario during the Am peak in the Denham area

Mitigation run 1 and 2 addresses the congestion issues at Denham Roundabout by relocating the development access to Denham Court Drive. This significantly reduces the travel time increases observed in the immediate area surrounding the development, as the Denham Court Drive/ Denham Roundabout junction has a greater capacity, and is able to cope with the additional traffic demand generated by the development.

Figure 5-AA shows the improvements in terms of travel time which arise as a result of the mitigation, compared with the DM.

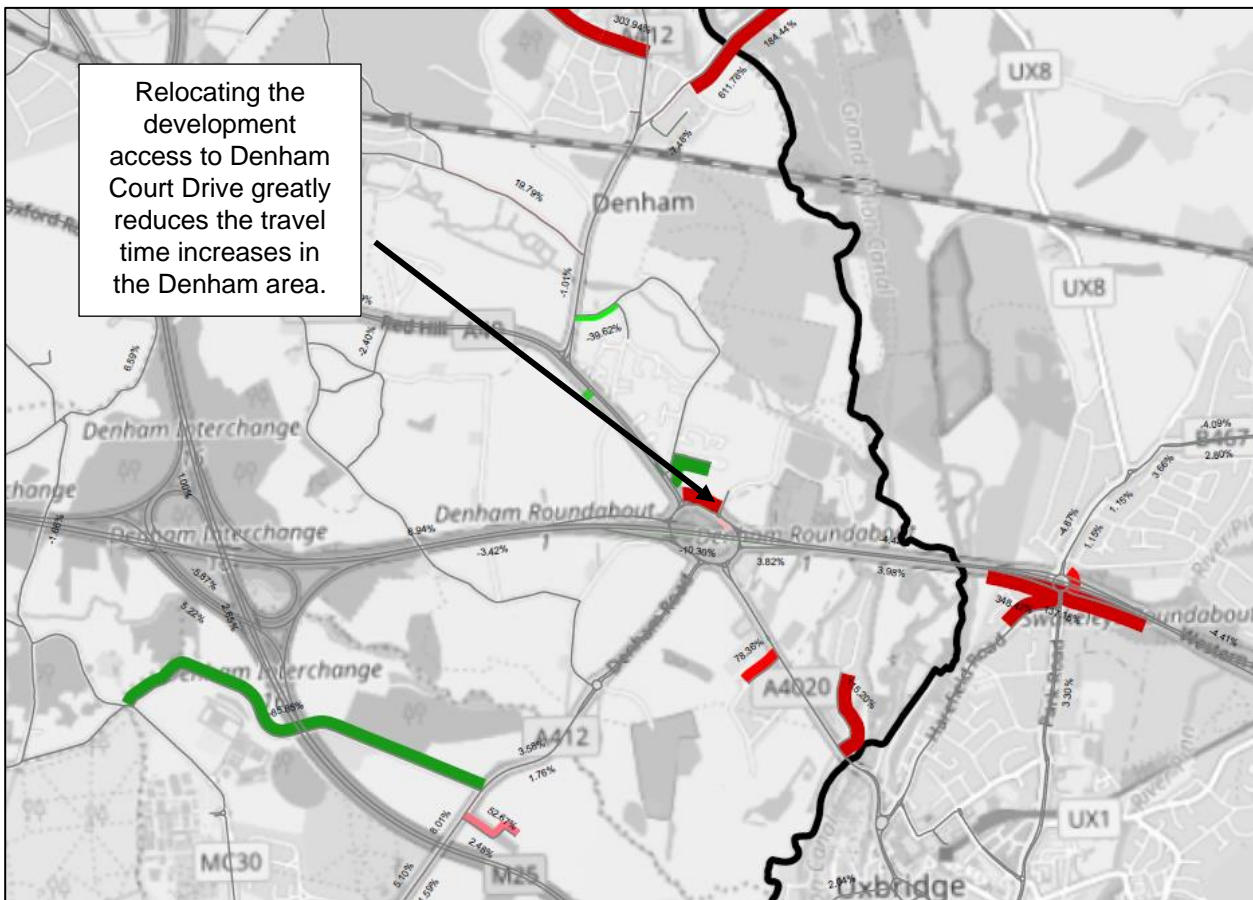


Figure 5-AA Travel time changes from the DM to DS run 1 scenario during the AM peak in the Denham area

5.2.4 Strategic Corridors

5.2.4.1 M40

A comparison of the DS scenario against the DM indicates that the M40 corridor experiences relatively slight increase in travel time (up to 20%) on the westbound approach to Junction 4, as a result of the local plan development. No other areas experience any notable increases in travel time, with the exception of the M40 at the Denham Roundabout, which is addressed with mitigation (see section 5.2.3.8) and at J2, which is not (see section 5.2.3.4). It should be noted that as with the DM, there are still stretches of the M40 which are heavily congested, however in most cases the inclusion of the local plan development does not impact these areas.

In both run 1 and run 2 of the mitigated scenarios there are slight increases in travel time (up to 30%) on the westbound approach to Handy Cross Junction. In addition, the A40 corridor improvements result in significant travel time improvements in the PM peak at J3 (see section 5.2.2.2).

The stretch of the M40 between junctions 3 and 4 is already heavily congested in the DM on the approach to Handy Cross (as shown in Figure 5-J). As a result slight changes in demand flow on this stretch of the M40 can translate to large changes in delay and travel time, which likely explains the differences in travel time between the DS, run1 and run2 despite no mitigation being tested at Handy Cross Junction.

Figure 5-BB illustrates the travel time changes on the M40 between junctions 3 and 4 with the mitigation in place.

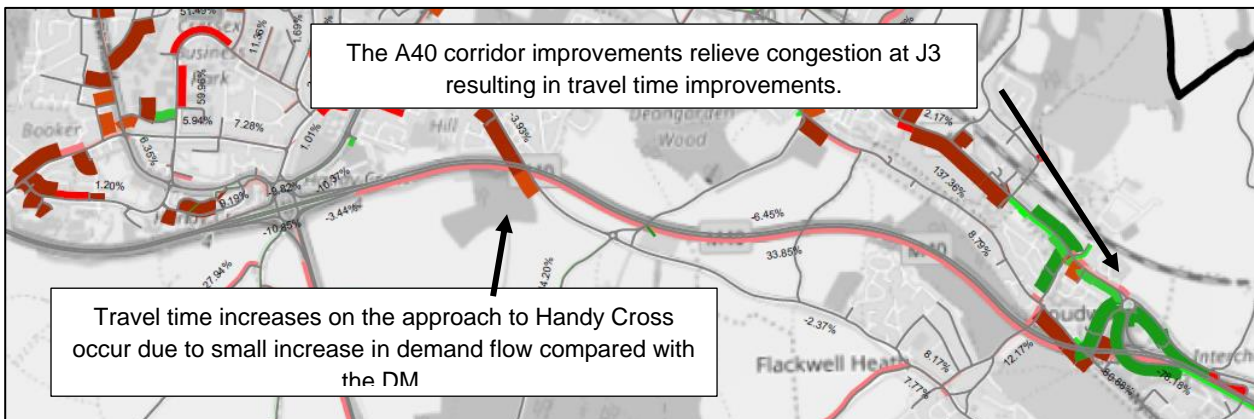


Figure 5-BB Travel time changes from the DM to DS run 1 scenario during the PM peak on the approach to Handy Cross

5.2.4.2 M4 and A4

There are relatively significant increases in travel time on the A4 in the Burnham area as discussed in section 5.2.3.5. Other sections of the A4 corridor experience slight increases in travel time (up to 10%) as a result of the local plan development.

The M4 corridor generally experiences relatively slight increases in travel time with the local plan scenario with or without the mitigation in place, with the exception of the eastbound approach to junction 7. This stretch of motorway experiences moderate travel time increase (up to 40%) across all scenarios, and is the result of queuing at the A4 Bath Road/ Huntercombe Lane junction in Burnham (see section 5.2.3.5).

Figure 5-CC illustrates the travel time increases on the eastbound approach to Junction 7 of the M4 compared with the DM scenario.

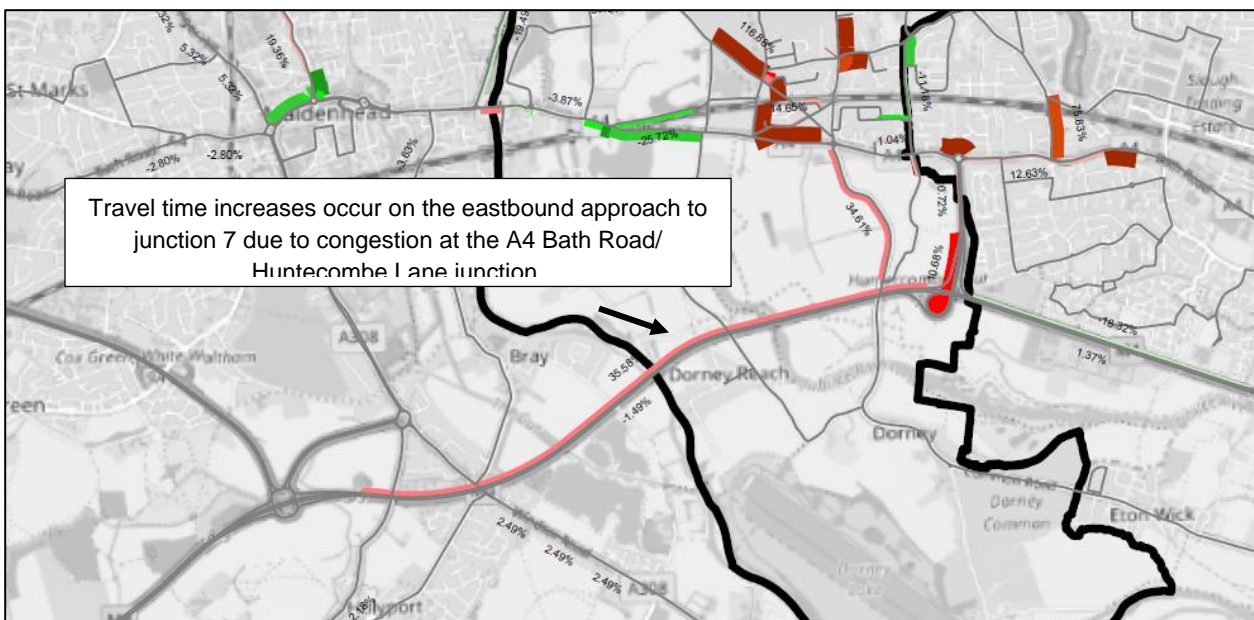


Figure 5-CC Travel time changes from the DM to the DS run 1 scenario during the AM peak on the M4 at Burnham

5.2.4.3 A413

The A413 corridor in general experiences slight travel time increases in the DS scenario compared with the DM, outside of the urban areas. However, there are significant travel time increases in Aylesbury (discussed in section 5.2.1.4) and moderate travel time increases in Wendover (discussed in section 5.2.1.6).

5.2.4.4 A421

There are significant increases in travel time on the A421 corridor between Buckingham and Milton Keynes which are discussed in detail in sections 5.2.1.1 and 5.2.1.2.

5.2.4.5 Other A roads, corridors and outside of Buckinghamshire County

There are no other notable increases in travel time in the DS scenario with and without mitigation compared with the DM on other A roads or corridors, aside from those mentioned above, or those in urban areas described earlier.

5.2.5 Impacts outside of Buckinghamshire

As the model only covers Buckinghamshire County in any detail, impact outside of the county have not been considered in detail at this stage. However it is likely that the proposed increases in development would impact traffic flows across the wider network.

Table 5-D highlights the main areas of change, in relation to demand vehicle flows, between the DS with and without mitigation and the DM. No distinction has been made between run 1 and run 2 of the mitigation as the different mitigations tested are unlikely to significantly alter demand flows outside of the county.

Urban area/corridor	Comments	
	DS	DS with mitigation
Milton Keynes	Moderate demand flow increases observed across the urban area, particularly on the A5, A509, A421, B4034 and A4146.	Increases in demand flow are less significant on the majority of A and B roads through the urban area as a result of A421 improvements and Bletchley Bypass.
Bicester	Slight demand flow increases on the A4421 to the north of Bicester and on the A41 west of Bicester.	Similar demand flow increases to the unmitigated scenario.
Henley on Thames	Minor demand flow increases on the A4155 south, in and out of Henley, and on A4130 into Henley. In the PM peak there is a minor reduction in demand flow southbound through Henley on the A321.	Minor reduction in demand flow on the A4155 north in the AM peak. Larger increase in demand on the A4130 into Henley in the PM peak.
Thame	Increases in demand flow observed on approaches to the Thame Rbt from the A418, A416 and on Aylesbury Rd in and out of the town centre in the AM peak. Generally small reduction in demand flow the PM peak.	Demand flow increases in the AM are lower and PM has a greater reduction overall compared with the DS.
Hemel Hempstead	Moderate increase in demand flow on the approaches to the Hemel Hempstead gyratory from the A41.	The impact of this is less significant with the mitigation in place.
Dunstable	Slight increases in demand flow on the A505 in both directions.	With the mitigation schemes in place there are further increases in demand flow on this road.

Urban area/corridor	Comments	
Leighton Buzzard	Only minor impacts in terms of demand flow in this area.	With the Bletchley Bypass in place there are increases in demand flow on Stoke Rd and West St into and out of the town centre.
Slough	Relatively minor changes in demand flow through Slough during the AM peak. However in the PM peak there are significant increases in demand flow on Bath Rd to junction 7 of the M4.	With the mitigation schemes in place the demand flow increases on Bath Rd are similar in the PM peak.
M4	In the AM peak there are moderate increases in demand flow on the M4 approaching junction 7. In the PM there are moderate increases in demand flow eastbound along the whole corridor.	With the mitigation in place the eastbound demand flow increases observed in the DS PM are present in both time periods.
M40	Significant increases in demand flow on the M40 in both directions in both peaks.	Similar impact with the mitigation in place.
A41	There is a significant increase in demand flow on the A41 between the Buckinghamshire border and Hemel Hempstead in both directions in the DS scenario.	Similar impact with the mitigation in place.
A43	Minor increases in both directions on the A43 between Brackley and Silverstone.	There is a minor increase in demand flow in the PM north-eastbound, and a minor reduction in demand flow south-westbound, between Brackley and Silverstone, on the A43.

Table 5-D Summary of impacts outside Buckinghamshire

Where there are changes in traffic demand, it is not possible to say, using the Countywide model, the significance of these changes for congestion and travel time.

6. Summary and conclusion

6.1 Summary of results

Table 6-B summarises the results of the modelling for the settlement areas and corridors previously described. It is important to note that the table highlights the extent to which the local plan development impacts an area in regards to travel time changes, as well as the extent to which mitigation has been successful at reducing the impacts observed in the DS scenario across the geographic area. In some cases, more detailed local modelling may be required to determine the exact scale of development impacts, and whether the currently proposed schemes will be effective.

A RAG (red, amber or green) rating has been applied to each area based on a purely qualitative assessment of the overall impact of the DS scenario in terms of increased travel time; red represents a significant impact, amber a moderate impact and green a slight impact. A second RAG rating has also been applied based on a qualitative assessment of the overall improvement, if any, the DS with mitigation scenario provides.

It is worth noting that if an area is already congested in the DM and the additional development in the DS does not change this then the RAG rating will be green. This does not mean that there is no congestion present, just that the additional local plan development does not impact the situation.

Table 6-A outlines a broad definition of each qualitative category. This rating is based only on the outputs produced as part of this phase of modelling.

RAG rating	Description
	Overall significant impact in terms of travel time increases on a number of key routes through the area compared with DM
	Overall moderate impact in terms of travel time increases on a number of key routes through the area compared with DM
	Overall slight impact in terms of travel time increases on a number of key routes through the area compared with DM

Table 6-A RAG rating description

District	Model areas	DS RAG rating	Run 1 RAG rating	Run 2 RAG rating	Comments
Aylesbury Vale District	Milton Keynes				There are significant travel time increases in all three scenarios on the A421 and adjoining minor roads. Neither mitigation scenario adequately mitigates the impact of the additional local plan development. This is because neither mitigation scenario includes both the Bletchley Bypass and the dualling of the A421.
	Buckingham				Buckingham is only slightly impacted in terms of travel time increases with the inclusion of the local plan development in the DS scenario. In general the mitigated scenarios provide slight to moderate travel time decreases across the Buckingham area.
	Winslow				Winslow is only slightly impacted by travel time

District	Model areas	DS RAG rating	Run 1 RAG rating	Run 2 RAG rating	Comments
					<p>increases with the local plan development scenario in place. As a result no mitigation options have been tested in this area.</p> <p>This result is not unexpected as the large development site to the north of Winslow, included for phase 2, has been removed for this phase of work.</p>
	Aylesbury				<p>There are significant travel time increases in the DS scenario with the local plan development in place, particularly to the east and south of the town. In addition, overall travel time increase are greater compared with phase 2, due to an increase in traffic to the Woodlands development from the west on the A41.</p> <p>The inclusion of the mitigation schemes in run 1 and run 2 results in some moderate travel time reductions, and in general a reduction in the scale of travel time increase compared with the DM, particularly on the A41 corridor. However, neither scenario fully mitigates the impacts of the DS development.</p>
	Haddenham				<p>There are no notable travel time changes in the Haddenham area in the DS scenario. As a result no mitigation options have been tested in this area.</p> <p>This result is not unexpected as the large development site to the west of Haddenham, included for phase 2, has been removed for this phase of work.</p>
	Wendover				<p>There are isolated travel time increases at High Street/ Aylesbury Road/ Tring Road Roundabout but the majority of Wendover is unaffected in the DS scenario.</p> <p>There are reductions in travel time and congestion on the B4009 through Wendover in the mitigated scenarios as a result of a small reduction in demand flow.</p>
Wycombe District	Princes Risborough				<p>There are moderate increases in travel time in the Princes Risborough area with the local plan development scenario in place.</p> <p>Implementation of the Relief Road and A4010 scheme, leads to reductions in congestion through the town centre, particularly around A4010/Longwick Rd roundabout, which is otherwise at capacity in DM scenario.</p> <p>The Expansion Study showed a greater impact on the town centre without the new infrastructure and greater congestion in the mitigated scenario, but the same overall effect of the relief road removing</p>

District	Model areas	DS RAG rating	Run 1 RAG rating	Run 2 RAG rating	Comments
					through traffic from the town centre.
	High Wycombe				<p>There are significant increases in travel time across the High Wycombe area with the local plan development scenario in place.</p> <p>Despite the inclusion of the mitigation, there are still significant increases in travel time remaining on key routes including the A40 corridor and town centre.</p> <p>However the results of this modelling work likely show a worst case scenario, as the model is known to be sensitive to changes in traffic flows and show greater overall levels of congestion in this area than observed.</p>
	Bourne End				<p>There are significant travel time increases in the Bourne End area as a result of congestion at the Thames River crossing.</p> <p>In the mitigation scenario, with Hollands Farm Link Road in place, there are reductions in travel times compared with the DS scenario as a result of the reassignment of traffic to the new route. However, the mitigation does not address the issue at the Thames River crossing.</p>
	Marlow and A404				<p>For the majority of the Marlow and Bisham area there are only slight increases in travel time in the DS scenario. However, there are localised areas of significant travel time increases particularly northbound on the A404 and on the approach to the Bisham Roundabout from Marlow.</p> <p>With the Westhorpe junction mitigation in place there are some localised reductions in congestion, however the wider impacts on the A404 and at the Bisham Roundabout area not addressed.</p>
Chiltern and South Bucks Districts	Chesham				<p>There are no notable travel time increases in the Chesham area in the DS scenario compared with the DM.</p> <p>With the A416 congestion management corridor in place in run 2, travel times are reduced on the minor roads along the corridor but increase on the A416.</p>
	Amersham				<p>No notable travel time increases in the Amersham area in the DS scenario compared with the DM.</p> <p>Run 2 of the mitigation includes the Gore Hill Roundabout scheme which results slight improvements in travel time compared with the DM.</p>
	Little Chalfont				<p>There are moderate travel time increases across the Little Chalfont area as a result of demand flow increases on the A404 and B442. Junctions along</p>

District	Model areas	DS RAG rating	Run 1 RAG rating	Run 2 RAG rating	Comments
					this corridor already experience congestion in the DM and the small increases in demand flow from the local plan development results in observed travel time increases. No mitigation has been tested in this area.
	Chalfont St Peter				There are no notable travel time increases in this area in the DS scenario compared with the DM. No mitigation has been tested in this area.
	Beaconsfield				There are significant increases in the travel time in the Beaconsfield area as a result of the local plan development. These impacts are observed across Beaconsfield. With the mitigation in place there are moderate travel time reductions through the town centre. However, there are still travel time increases in other areas of Beaconsfield and at J2 of the M40, as with the DS scenario.
	Burnham area				There are significant increases in travel time in the Burnham area which arise due to congestion at the A4 Bath Road/ Huntercombe Lane junction. This junction is very sensitive to small changes in demand flow and is already overcapacity in the DM. The mitigation at the Berry Hill junction reduces travel times compared with the DM but this does not improve the situation further to the east.
	Holmer Green and Hazlemere				There are no notable increases in travel time in the Holmer Green area in the DS scenario compared with the DM. With the Queensway Link in place in the mitigation scenarios, congestion at the Hazelmere Crossroads present in both the DM and DS scenarios is relieved.
	Iver area				There are significant increases in travel time on the approaches to key junctions in Iver and Iver Heath in the DS scenario compared with the DM. In the mitigated scenarios the travel time increases are reduced with the mitigation in place.
	The Denhams				There are significant travel time increases experienced in the Denham area in the DS scenario due to the access arrangements for the Land North of Denham Roundabout development. With the mitigation in place these travel time increases are greatly reduced, however there are still pockets of congestion present in the area.
Strategic Corridors	M40				The M40 corridor is only slightly impacted in terms of travel time increases in the DS scenario and mitigated scenarios compared

District	Model areas	DS RAG rating	Run 1 RAG rating	Run 2 RAG rating	Comments
					with the DM. It should be noted however that sections of the M40 are already heavily congested in the DM and as a result are sensitive to slight changes in demand flow.
	M4 and A4				Congestion on the A4 around Burnham impacts upon approaches to junction 7. This is not improved in the mitigation scenario.
	A413				There are moderate to significant increases in travel time where the corridor passes through Aylesbury and Wendover, however the rural sections are only slightly impacted in terms of travel time increases. The impacts are the same in the mitigated scenarios.
	A421				There are significant travel time increases at the eastern end of the corridor near to Milton Keynes. Neither mitigation run 1 nor run 2 reduces these impacts to any great extent, as both the Bletchley Bypass and dualling of the A421 are not modelled together.

Table 6-B Impact summary table

The settlement area that is most constrained as a result of development in the DS scenario is High Wycombe, where mitigation measures identified are not adequate to prevent additional congestion forming as a result of housing and employment growth. It is also worth noting that the potential for mitigation schemes in High Wycombe is limited due to the constrained nature of the urban environment, particularly through the town centre and on the A40 Corridor. There are also significant travel time increases on the A421 near Milton Keynes and in Burnham (for which further work would be required in this area in regards to mitigation options), where the mitigation tested is not sufficient to reduce congestion. In the majority of other areas the mitigation measures tested are successful in preventing significant increases in congestion as a result of the proposed developments. In addition, a number of areas see significant improvements over the DM scenario when mitigation measures are included. This includes Iwer Heath, Beaconsfield and Aylesbury.

6.2 Conclusions

The Countywide Model has been used to indicate where the phase three proposed local plan development for the districts in Buckinghamshire are likely to result in negative impacts on the highway network, in terms of increased journey times and congestion. The model has also been used to indicate the extent to which proposed transport improvement measures are likely to mitigate the impacts of the local plan development.

The extent to which the mitigation measures have been successful varies across the county, however in general, where mitigation has been included there has been a reduction in the scale of travel time increases compared with the DM situation.

It should be noted that when assessing impacts and the extent to which they are mitigated, there is no universal definition of how to define an impact, and what impacts are considered “acceptable” and “unacceptable”. It should also be noted that given the strategic nature of the Countywide model and the fact that it is an entirely synthetic model with variable levels of validation around the county, the impacts identified are appropriate for a

qualitative assessment. The model has been used to provide a relatively high level indication of the potential impacts of the local plan and proposed mitigations, commensurate with the requirements of local plan evidence base. A RAG analysis of the potential impacts has been provided in different areas, which is appropriate given the nature of the strategic model, but the quantification of the scale of impact based on the model (beyond the terms slight, moderate and significant) should be avoided.

Appendix A. Settlement plots

This appendix has been provided as separate PDF files due to the file size.

Appendix B. Countywide plots

This appendix has been provided as separate PDF files due to the file size.