BUCKINGHAMSHIRE COUNCIL

COUNTYWIDE STRATEGIC TRANSPORT MODEL (CSTM)

SUPPORTING STATEMENT

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Contents

1. INTRODUCTION

1.1 Guidance

1.1.1 The National Planning Practice Guidance (NPPG) sets out the need to establish a transport evidence base for Local Plans. It states:

> "It is important for local planning authorities to undertake an assessment of the transport implications in developing or reviewing their Local Plan so that a robust transport evidence base may be developed to support the preparation and/or review of that Plan ..."[1]

1.1.2 The Buckinghamshire Countywide Strategic Transport model (CSTM) has been used by the Council to assess the transport implications of growth scenarios throughout the development of the Vale of Aylesbury Local Plan (VALP). This statement sets out the validity of the CSTM for the purposes of assessing the high level strategic transport implications of the Local Plan and its consistency with the Department for Transport's (DfT) Transport Analysis Guidance (TAG) as and where appropriate.

1.1.3 This statement details the scenarios that have been tested in each phase of the modelling work, including development and infrastructure assumptions and provides analysis of the latest iteration of strategic modelling which supports the transport infrastructure requirements in Policy T3, as modified, and site specific polices within the VALP.

1.1.4 It should be noted that the transport evidence base has previously been debated during the Examination in Public of VALP (the Examination). This statement informs responses provided to representations to the proposed major modifications. As such, this statement should be read alongside the transport evidence submitted to date in relation to VALP (listed in Appendix 1).

[1] National Planning Practice Guidance Paragraph: 001 Reference ID: 54-001-20141010: https://www.gov.uk/guidance/transport-evidence-bases-in-plan-making-and-decision-taking

2. WHAT IS THE COUNTYWIDE STRATEGIC TRANSPORT MODEL (CSTM)

2.1 Transport Model

2.1.1 The modelling platform used for the assessment of the transport implications of VALP has been the existing CSTM. The model is considered to be robust in its current form as a basis for the high level strategic assessment of future year development scenarios.

2.1.2 The CSTM is a VISUM model with a base year of 2013. The highway assignment model was built to represent three modelled time periods (AM peak, PM peak and inter-peak). The key characteristics of the CSTM are set out in the Table 1 below:

KEY CHARACTERISTICS	COUNTYWIDE TRANSPORT MODEL 2013 BASE
Model Structure	Highway Assignment Model
Software Package	VISUM 15.0
Base Model Year	2013
Model Area	Buckinghamshire County and surrounding highway network
Time Periods	AM Peak (08:00) – 09:00) Inter-peak (Average hour between 10:00 and 16:00) PM Peak (17:00 – 18:00)
User Classes	3 – Car, LGV, HGV
Zoning System	865 zones in model
Calibration / Validation	Following TAG M3.1 principles, but not full compliance

Table 1: CSTM Key Characteristics

2.1.3 The CSTM covers all of Buckinghamshire and the surrounding network, as illustrated in Figure 1 below:

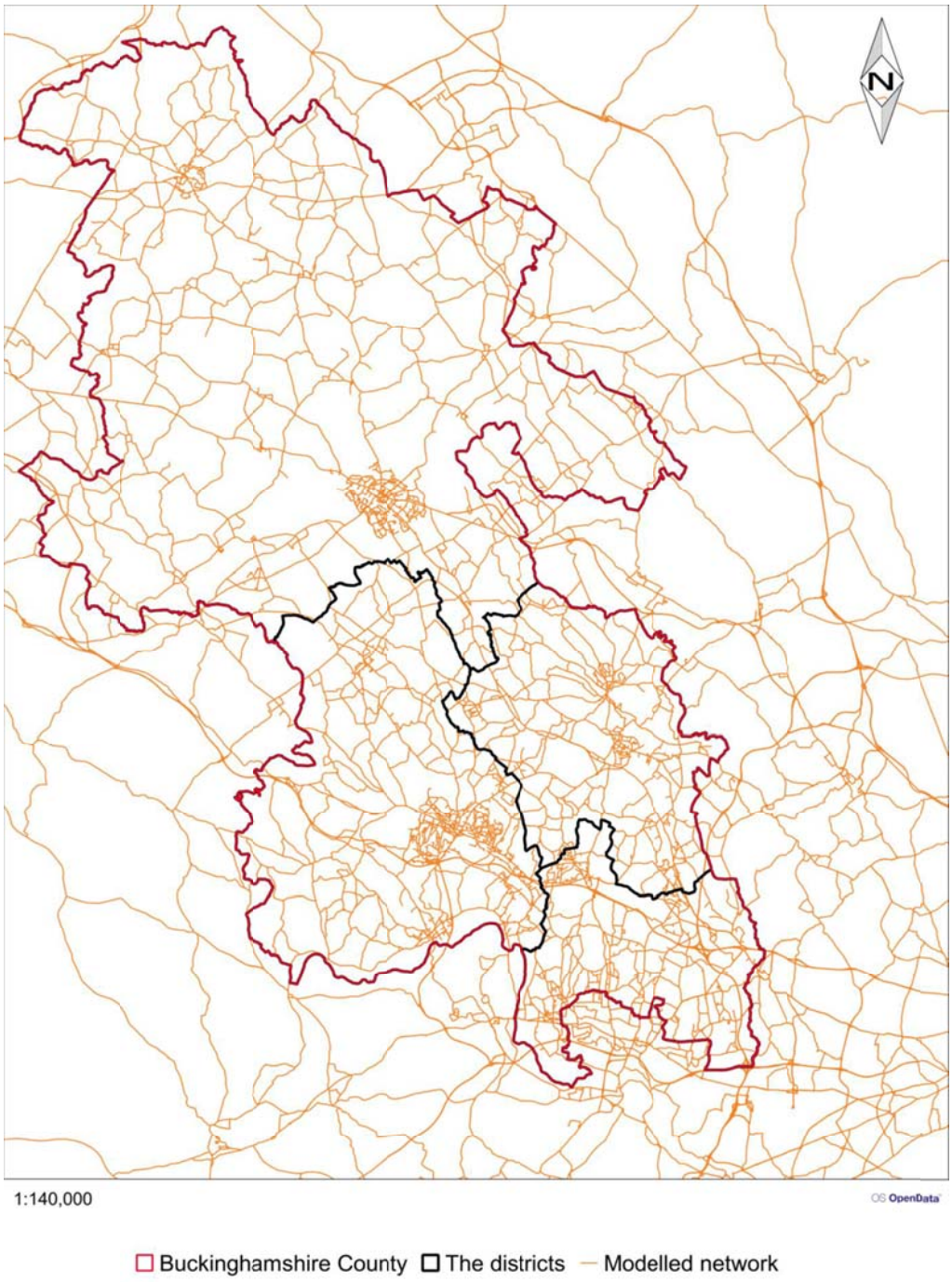

Figure 1: CSTM Coverage

2.1.4 Approximately 80% of the model zones are in Buckinghamshire and the remaining 20% are outside the county. The model therefore allows the Council to assess the transport implications of growth across Buckinghamshire (including three Local Plans), as well as understanding potential implications on bordering authorities. One of the key advantages of the Countywide model is that it allows a cumulative assessment of the implications of strategic development across the entire Council area.

2.2 Fitness for Purpose in Local Plan Modelling

2.2.1 Transport Analysis Guidance (TAG) has been created by the DfT to support scheme promoters in the development of evidence for transport business cases and funding applications. The guidance is therefore focused on a very specific purpose and its primary objective is to achieve consistency and comparability of modelling undertaken in support of transport investment decisions across the United Kingdom.

2.2.2 This statement summarises the most important requirements of the Local Plan modelling and how the CSTM has been developed with these requirements in mind. In many areas the model exceeds TAG recommendations and places additional focus on the areas important for Local Plan modelling such as its coverage, the diligence and attention paid to land use assumptions and the clarity of the comparison scenarios. This statement highlights the specific areas of the model which make it particularly suited to Local Plan analysis and draws out the conclusions about the significance of the validation results for forecasting in the context of Local Plan impacts.

2.2.3 The model is suitable and fit for the purpose of strategic planning such as the development of Local Plans. Furthermore, it should be noted that the achieved standard of the model is comparable with models sometimes used in early stages of transport business case development for major schemes (known as a Strategic Outline Business Case or SOBC) and early funding application submissions to the DfT. It also surpasses simple and ad-hoc tools often seen in Local Plan modelling (such as simplistic spreadsheet models or assumptions-driven analysis) in terms of sophistication and quality.

2.3 The role of TAG in transport scheme business case appraisal

2.3.1 Transport Analysis Guidance (TAG - formerly known as WebTAG) has been created by DfT to support scheme promoters in the development of an evidence base for transport business cases. It provides users with tools and principles that foster the consistency of the evidence behind investment decisions. TAG advises:

> *"Development of analysis using WebTAG guidance is a requirement for all interventions that require* government *approval. For interventions that do not require government approval this guidance would serve as a best practice guide"*[2].

2.3.2 However, TAG recognises that the analysis needs to be proportionate and fit-for-purpose[3]. In the appraisal of transport schemes, the modelling standards are usually improved as the scheme progresses through stages. Reporting requirements become stricter as the schemes approach the Final Business Case[4]. But the guidance recognises that it is not always proportionate to cover all requirements at the early stages.

[2] Para. 1.2.2. TAG, An Overview of Transport Appraisal, Jan 2014, DfT
[3] Section 3.3 of TAG, Guidance for the Senior Responsible Officer, May 2018, DfT
[4] Transport Business Case, DfT

2.3.3 This logic applies to strategic planning stages, where mitigation schemes are considered at a high level and are not subject to detailed transport business cases for submission to DfT. As transport schemes progress to planning application level or for government funding business cases then it will become increasingly important for the scheme impacts to be measured with greater precision. This is what TAG aims to achieve.

2.3.4 It is also worth noting that the principles embedded in TAG serve as a guide and should not be treated as a target or pass mark. TAG is explicit on the issue of modelling standards[5]:

"The achievement of the validation acceptability guidelines described in TAG does not guarantee that a model is 'fit for purpose' and, likewise, a failure to meet the specified validation standards does not mean that a model is not 'fit for purpose'. A model which meets the specified validation standards may not be fit for particular purposes and, conversely, a model which fails to meet to some degree the validation standards may be usable for certain applications. The test of fitness for purpose of a model is: can robust conclusions be drawn from the model outputs?"

2.3.5 The following sections describe the principles models should follow and how the CSTM was built (based on TAG best practice where applicable). As demonstrated within this statement, the modelling undertaken is fit for the purpose of identifying the impacts of Local Plan development and associated mitigation measures.

2.4 Guidance for Other Modelling Applications

2.4.1 TAG does not specifically refer to uses of modelling other than to support publicly funded business cases for transport schemes. For Local Plans some guidance is provided by National Planning Policy Guidance (NPPG) which says:

"An assessment should adopt the principles of WebTAG by assessing the potential impacts of development within the framework of WebTAG objectives. For most Local Plan assessments the full methodology recommended will not be appropriate. The Highways Agency's Project Appraisal Report System may provide some useful guidance on methods more appropriate in these cases. Assessments involving major new transport infrastructure should, however, employ the methods set out in WebTAG".

"Although this approach is typically applied when planning for local transport infrastructure, adopting this approach for Local Plan transport assessments will ensure that any proposed land allocation impact is considered in the context of two alternative scenarios – 'with development' and 'without development' – and will enable a comparative analysis of the transport effects of the proposed allocation."

2.4.2 The CSTM development has employed the methods set out in TAG as advocated in the NPPG above. The following sections describe the analytical needs of VALP, how

[5] Section 3.5 of TAG, Guidance for the Technical Project Manager, May 2018, DfT

the model was developed in line with TAG principles and why it is fit for purpose and robust for the assessment of VALP.

2.5 Summary of the Analysis Needed for VALP

2.5.1 The analysis of VALP impacts needs to focus on strategic questions. The objective is to:

- Understand the scale of impact of the development proposals on the level of service of the highway network in Aylesbury Vale.
- Understand to what extent the proposed mitigation schemes would likely reduce these impacts and what is likely to be required to facilitate the proposed development.

2.5.2 At the early strategic planning stage, a systematic approach is required to assess the order of magnitude of impacts and this is what the modelling tools need to be able to do. Therefore, fitness for purpose should be judged based on the needs of the Local Plan analysis. As a minimum the analysis needs to:

- Reflect the spatial dimension of the Local Plan. This means appropriate coverage of the model to understand the impacts on adjacent roads as well as the wider network.
- Reflect the local land use characteristics. This means the detailed representation of the local housing and employment assumptions in both the base travel patterns and in forecasting.
- Estimate the direction of change in network performance under different development scenarios.

2.5.3 An area-wide transport model with a detailed representation of the transport network should be expected to allow the analysis of impacts on the strategic as well as local roads. The CSTM responds to this need with its detailed representation of the highway network across the County and beyond (see Figure 1).

2.5.4 A detailed representation of the travel patterns and trip making, based on the detailed local housing and employment data is also needed. The CSTM base matrices have been developed using best practice modelling techniques, which capture the latest land use assumptions and use them directly in the trip matrix development. In this respect, the CSTM went further than TAG recommendations, which at the time of model development suggested the use of generic National Trip End Model (NTEM)[6] trip making data in the base year matrices. The model therefore exceeds what is typically seen in transport models and responds well to the Local Plan analytical needs. This detailed approach to the representation of housing and employment assumptions is also adopted in the forecasting.

2.5.5 Finally, a framework of scenarios, which distil the impact of development, has been employed. This follows TAG best practice of using a clearly defined comparator scenario (the Do-Minimum Scenario) against which the impacts of the development are measured, and the test scenario (the Do-Something scenario, and Do-Something 'with mitigation' scenario), which includes the proposed developments. This

[6] National Trip End Model developed by Department for Transport.

framework categorises the scale of impact and can identify key areas of constraint and congestion, and whether the mitigations act to reduce these constraints.

2.5.6 Using all elements of TAG is only mandatory for Government funded business cases to support transport schemes. However, given NPPG guidance on the adoption of the principles of TAG, it is important to emphasise that TAG principles and best practice were used in the development of CSTM. Therefore, to confirm robustness, each principle of TAG, how it was followed in CSTM and how it translates into fitness for purpose for VALP modelling are discussed below.

3. MODEL DESIGN

3.1 TAG principles and Methodology

3.1.1 TAG provides advice on the following topics of relevance to model design[7]:

- Overall consideration of fitness for purpose of a highway assignment model.
- The specification of the Fully Modelled and External Areas of the model.
- The design of the zoning system.
- The structure of the network representation, including centroid connector design.
- The time periods which should be modelled.
- The specification of the classes of user which should be assigned separately.
- The assignment method.
- The specification of generalised cost and the sources of the operating costs and values of time.
- Capacity restraint mechanisms, including the use of junction modelling and speed-flow relationships.
- The relationships of the highway assignment model with variable demand models and public transport assignment models

3.2 Incorporation of TAG principles in the Countywide Model

3.2.1 Fitness for purpose is fundamental to model development and use; an objective of the project was to produce model outputs that can be used to identify key areas of constraint and congestion across the County. With that purpose in mind, the design of the model incorporated many recommendations of TAG:

3.2.2 The geographical coverage and level of spatial detail in the model was set according to the advice in TAG. Specifically, the modelled area and its zones system were designed with the greatest levels of detail covering the whole of Buckinghamshire, consistent with sections 2.2 and 2.3 of TAG unit M3-1. As the distance from Buckinghamshire increases so the level of spatial aggregation increases.

3.2.3 The network coverage was designed in line with TAG such that it covers “all roads that carry significant volumes of traffic” and “of sufficient extent to include all realistic choices of route available to drivers”. The network was based on the Ordnance Survey’s Integrated Transport Network (ITN) and included all motorways, A-roads, B-roads and minor roads as categorised by ITN. Within urban areas a significant number of roads categorised as “local streets” were also included; in this way the guidance on network design was reflected in the model. The level of detail and coverage of the network is therefore robust and in line with best practice.

3.2.4 Centroid connectors are the means by which trips generated by the model are loaded onto the network. Within the model, the centroid connector design is consistent with TAG recommendations.

[7] Section 2.1.1 of TAG unit M3.1, May 2020, DfT

3.2.5 The modelled time periods are 8-9am, 5-6pm, and an average inter-peak hour between 10am and 4pm. The peak hour time periods were derived based on an analysis of count data. This approach is consistent with the best practice in TAG and is fit for purpose.

3.2.6 The model has five user classes: car commute, car business, car other, Light Goods Vehicles (LGV) and Heavy Goods Vehicles (HGV). This is consistent with TAG, which advises that unless there are special circumstances, “cars on business” and “other cars”, LGVs and HGVs should be separate user classes.

3.2.7 The assignment methodology used in the modelling was developed following TAG recommendations: It reflects established principles, set out in the guidance, for route choice, the calculation of delays on links and at junctions, and includes flow metering and blocking back.

3.3 Implications for Local Plan Assessment

3.3.1 As demonstrated above, the overall design and approach to the development of the model follows TAG principles and methods and as such is consistent with the requirements of NPPG. The model is therefore considered fit for the purpose of assessing Local Plan transport implications in this respect.

4. BASE MODEL NETWORK DEVELOPMENT AND VALIDATION

4.1 TAG principles and methodology

4.1.1 TAG provides advice on model network development, including sources of data. Most relevant to Local Plan modelling is the checklist of items to be used once the network has been coded[8]. This list, which has been followed in CSTM model development, includes:

- Check for appropriate junction types.
- Check that the appropriate number of entry lanes has been coded and that flaring of approaches, where appropriate, are accounted for.
- Check that turn restrictions have been correctly identified (these may vary by time period).
- Check that one-way roads and no entries, if applicable, have been correctly specified.
- Check that saturation flows are appropriate (particularly if turn rates appear excessively high or low compared to straight ahead).
- Check that link lengths, link types and cruise speeds for each direction of a link are consistent, and that the second and third do not vary unjustifiably along series of links.
- Compare crow-fly link lengths against actual lengths, check that the coded link length is between 1.1 and 1.3 times the crow-fly distance and inspect links which fall outside this range. It is often the case that analysts may re-locate nodes to enhance the representation of a junction onscreen. Whilst this does not affect the coded link length it will obviously affect the crow-fly distance. Given the eventual need to interface with other models for environmental assessment of noise and air quality, experience shows that it is preferable to ensure that traffic model nodes are positioned according to their geographical location.

4.1.2 Once these basic checks have been undertaken, more detailed pre-calibration checks should be carried out[9]:

- Standard network error checking processes undertaken by the modelling software.
- Consistency of coding if undertaken by more than one analyst.
- All key junctions and intersections to be formally reviewed.

4.1.3 As is detailed in Section 4.2 below, the more detailed pre-calibration checks were undertaken in line with the guidance. Once these checks have been completed, an initial version of the trip matrix can then be used for calibration checks. This should focus on ensuring that speeds and flows on network links and delays at junctions are as expected[10]. For links, these checks should include both speed and flow comparisons at locations where suitable observations are available (e.g. traffic

[8] Section 5.3.2 of TAG unit M3.1, May 2020, DfT
[9] Section 5.4 of TAG unit M3.1, May 2020, DfT
[10] Section 6.2.2 of TAG unit M3.1, May 2020, DfT

survey data). It may also be useful to check flow to capacity ratios. At junctions, remedial action should be considered for any turning movement where[11]:

- The capacity calculated by the model is less than the count.
- Calculated delays are significantly greater than observed delays.

4.1.4 As is detailed in Section 4.2 below, these checks were undertaken in the development of the CSTM. It was found that there were a small number of junctions where remedial action was required; this remedial action was undertaken in all cases, which is consistent with TAG.

4.1.5 Remedial action will usually involve reviewing the parameters which control the capacity of the movements affected, or possibly reviewing the position of nearby centroid connectors. Having made such adjustments, TAG recommends a second set of adjustments should be considered where[12]:

- Modelled flows are significantly below observed flows for a turning movement.
- Modelled delays are unacceptably lower than observed delays.

4.1.6 Adjustments should only be made to network descriptions if they can be justified and these should be documented. Arbitrary adjustments to measurable quantities (e.g. link length or junction geometry) should not be made. Artificial and/or excessive adjustment of cruise speeds, or link or junction capacities to give a closer fit to observed conditions is not recommended. Some adjustments were found to be necessary, but they were justified and documented as described in the following section.

4.2 The model's performance against the guidance

4.2.1 The source of the network data used in the CSTM is the Ordnance Survey's Integrated Transport Network (ITN) which is a source described in TAG. A variety of checks of the network are described, and where these rely on other data sources these are referenced (e.g. the use of Google Earth and Google Street View for checking the locations of one-way streets and banned turns, junction types, and lane allocations etc). Network calibration was undertaken making use of an early version of the trip matrix in line with TAG. A list of the checks undertaken is provided below along with the documented outcome:

[11] Section 6.2.3 of TAG unit M3.1, May 2020, DfT
[12] Section 6.2.4 of TAG unit M3.1, May 2020, DfT

CHECK	OUTCOME
VISUM network check performed by the modelling software)	Some dead-end roads and links with no succeeding link. These were left in as the dead end roads were stub links which were originally intended for a centroid connector but not used in the end. Leaving them in did not affect the assignment. Succeeding link errors referred to HGVs where some links were banned to HGVs, but the upstream link was not. Again, this did not affect the assignment and these were left in.
Checking that modelled link lengths were correct	All modelled link lengths were calculated automatically on importing from a shape file, based on the length of the link's polyline. Some network adjustments resulting in changes to the link lengths, so all lengths were recalculated again, based on the polyline length.
Banned turns – VISUM prevents banned turns from being used in the assignment. This check focussed on ensuring that these high delays only occurred on turns that were banned, and vice versa.	Some turns that were banned did not have unrealistic turn delays, and some that were not, did. Reasons for this were not clear at the time, however these were corrected by re-setting the junction impedance method, which re-set the calculated delays appropriately.
Links with different link types in opposite directions	There was found to be 110 links for which the link type differed by direction. 51 of these were errors and were corrected, the rest were links where there were different numbers of lanes in each direction, and therefore correctly had different link types.
Free flow link speeds – checked by plotting a thematic map of the link speeds in GIS	A number of rural links around Aylesbury were found to have a link speed that was too low. The link type originally given to these links was more suitable for an urban environment. A corrected link type was therefore ascribed to those links.
Number of lanes on a link – checked by plotting a thematic map	A very small number of links within the county had two lanes when they should have had one. These were corrected by changing to an appropriate link type. Outside the county, a number of motorway links had an incorrect number of lanes –for example on the M1 which was coded with three lanes instead of four. This was corrected by changing the link type to an appropriate value.
Link capacities – checked by plotting a thematic map showing link capacity in bands of 500 passenger car units (pcus).	The thematic map showed most urban areas with link capacities under 1,000 pcus, in line with expectations. Some urban areas in Amersham, Burnham and on the outskirts of Slough showed capacities around 1,000-1,500 pcus which was inconsistent with other urban areas in the model. These were therefore corrected by changing to an appropriate link type.
Centroid connector lengths	Connector lengths based on crow-fly distance. Link lengths in urban areas are relatively short, increasing in length in rural areas, and increasing outside of the county. All as expected, and no changes required.
Signalised junction cycle times	Using the timings given by the UTC system, 22 (out of 75) junctions had cycle times greater than two minutes. Noted that these were quite high but no changes made as lack of evidence that these are incorrect.
Link capacity greater than observed flow	On modelled links for which observed traffic count data was available, a comparison of the average observed flow against the modelled link capacity was made. For a small number of links, the capacity was found to be lower than the observed flow. The link capacity was therefore increased by changing to a different link type. This was done for the link in question and nearby links of a similar standard.

Table 2: Summary of network checks.

4.3 Implications for the Local Plan assessment

4.3.1 The CSTM used for the Local Plan assessment followed the principles and methods set out by TAG and is therefore consistent with the requirements of NPPG, robust and fit for purpose.

5. BASE TRIP MATRIX

5.1 TAG principles and methodology

5.1.1 Trip (demand) matrices contain information about the pattern and volume of trips between each origin and destination in the areas that subsequently load onto the network. Their quality therefore directly impacts the quality of the overall model. At the time of the development of the CSTM, little guidance was provided on this subject. TAG Unit M1.1 provided the principles of matrix development and focussed on the generation of zonal trip end data and travel costs[13], which were followed in the development of the model.

5.1.2 However, a new TAG Unit (M2.2) was released in May 2020. The new guidance provides detailed advice on the development of trip matrices, although by its own admission it is intended to provide a guide and not be prescriptive[14]. Nevertheless, the consistency of the model with these new principles is assessed retrospectively below.

5.1.3 The new guidance specifies that where base year matrices are required for long term strategic planning (as is the case for the matrices of the CSTM), they should be developed in Production-Attraction (P/A) format for home-based trip purposes. The guidance also provides detail on the processes for developing trip matrices, with most of this given over to the development of synthetic matrices. This advises that methods used to develop synthetic matrices often result in the desirable property of consistency between trip ends and detailed land use and demographic data[15]. This is a key requirement for forecasting using strategic models, where a non-uniform growth is forecast, linked with trip productions, and sometimes trip attractions. For this reason and to provide a suitable basis for forecasting, synthetic matrices should be developed at P/A level for home-based trip purposes when they are intended for use in base year matrix development for strategic models[16].

5.1.4 It also advises that synthetic matrices should not be used as the single source of data in developing base year demand matrices[17], and that methods can be applied to enhance the quality of the matrices by introducing into them further observed information on trip patterns from other sources. This can be either through the synthetic matrix calibration process or through combining the synthetic data with other data sources at a later stage (i.e. data fusion)[18]. To develop synthetic matrices, the guidance details the steps which should be followed. This includes the following:

- An estimate of zonal trip ends.
- A target (observed) Trip-Cost Distribution (TCD).
- An estimate of travel cost (expressed as time, distance, or generalised costs) between each zone pair.

[13] Section 4.3.1 of TAG unit M1.1, January 2014, DfT
[14] Section 1.1.3 of TAG unit M2.2, May 2020, DfT
[15] Section 3.3.5 of TAG Unit M2.2, May 2020, DfT
[16] Section 5.2.2 of TAG Unit M2.2, May 2020, DfT
[17] Section 5.2.5 of TAG Unit M2.2, May 2020, DfT
[18] Section 5.2.6 of TAG Unit M2.2, May 2020, DfT

5.1.5 The guidance in TAG M2.2 details that data for the development and validation of base year matrices generally falls into the categories of matrix data, zonal data, and traffic count data. The guidance sets out a range of data sources available for the development of modelled demand and their strengths and weaknesses. This is set out in Table 3. Finally, traffic count data is used to refine, calibrate and validate matrices (further detail on this can be found in Section 5).

DATA TYPE	KEY STRENGTHS	POSSIBLE WEAKNESSES
Existing Demand Matrices	No new data collection costs, limited processing time required. Potential value in representing external demand drawn from a larger regional model into a local model	Age of data, lack of adequate understanding on quality, different spatial geography requiring processing assumptions (weaknesses could vary depending on provenance and level of available documentation)
Tracking Data	Potentially large sample size, wide geographical coverage, capturing day-to-day variability in travel patterns	Sample error and errors from interpretative algorithms require interpretation, current MND does not include short trips and cannot provide fine spatial resolution, privacy filters limiting the detail, cost (depending on the source), detailed segmentation, current GPS sources contain only small samples of individuals with associated bias and expansion issues
Sectoral Data	Potentially high sample rate, providing information on vehicle type (age, emissions)	Both ticketing data to station or stage and ANPR/Bluetooth to large sectors require interpretation to zones, biases from expansion, detailed segmentation
Intercept Surveys	Ability to provide a detailed picture of the travel patterns and choices of interviewees, including origin, destination, home and work locations, vehicle type, occupancy, and route choice	Potentially labour intensive, time consuming and expensive, practical limitations associated with undertaking surveys, lack of day-to-day variability in the data, potential for response bias due to annoyance or lack of knowledge, limited geographical coverage, limits on the sample size, and accordingly, spatial accuracy of data
Household Interview Surveys	Ability to provide a rich and comprehensive picture of multimodal travel and activity patterns by residents within a study area	Developing spatially detailed demand matrices directly from this data is not generally practical due to typically small sample sizes, response bias, and cost.

Table 3: Reproduction of Table 1 from TAG Unit M2.2

5.2 The model's performance against the guidance

5.2.1 A review of data sources which informed the adoption of a synthetic matrix approach as set out in Table 3 was carried out. There were no existing trip matrices which covered the whole of the modelled area; tracking data at the time the model was developed was in its infancy and was not practically useful; and sectoral data and intercept surveys to cover the whole of the County were prohibitively expensive

and impractical to undertake. This left the use of Household Interview Surveys (namely the National Travel Survey) as the sole practical source of data; however, low sample size only permits its use in the calibration of synthetic matrices.

5.2.2 The development of the synthetic matrices used in the model was undertaken on a P/A basis, which is consistent with the approach recommended when forecasting for long term strategic planning purposes. The matrices developed were not the single source of data for the base year demand; the calibration process made use of Census Journey to Work data as well as National Travel Survey data. Because of this, and the impracticality of collecting other data sources, this calibration was used in preference to combine the synthetic matrices with other data. This approach is consistent with the guidance above[19] (which advises EITHER synthetic matrix calibration OR combining with other data sources).

5.2.3 The development of zonal trip end estimates to use in the synthetic matrices was undertaken using Census data, supplemented with planning data and other sources of land use information (including employment surveys). A trip end model which utilised elements of TEMPro and CTRipEnd (as advised by guidance[20]) was used to calculate the trip generation. In line with 5.2.30 of TAG Unit M2.2, the CSTM network was used to provide travel costs between zone pairs. Finally, a gravity model was calibrated according to the methodology described above, which also utilised an iterative process to identify appropriate parameters to minimise the errors between the observed and synthetic distribution, in line with guidance in 5.2.33 of TAG unit M2.2. The calibration of the gravity model also made use of k-factors, in line with 5.2.34 of the same unit. This constituted all elements advised by Figure 2 of TAG Unit M2.2, to produce P-A Demand matrices. These were then converted to Origin-Destination (O-D) format for the purposes of assignment.

5.3 Implications for the Local Plan assessment

5.3.1 Whilst the guidance on the development of trip matrices is relatively new (only released in May 2020), the processes followed in developing the demand for the CSTM are consistent with best practice that informed the development of that guidance. The model makes use of a synthetic trip matrix process, which uses calibration against multiple data sources (Census Journey to Work and National Travel Survey) and the development of the synthetic matrices follows the processes recommended in the guidance. The matrix development is therefore robust and suitable for its intended purpose.

[19] Section 5.2.6 of TAG Unit M2.2, May 2020, DfT
[20] Section 5.2.21 of TAG Unit M2.2, May 2020, DfT

6. MODEL CALIBRATION AND VALIDATION

6.1 TAG principles and methodology

6.1.1 The calibration and validation of the model falls into three broad categories described in the following sections:

- Network validation
- Trip matrix calibration and validation.
- Assignment validation.

6.1.2 It should be noted that this type of model (covering a wide-geographical area such as the whole county) does not have a specific geographical focus. Transport scheme-specific models focus their calibration and validation on a specific area relevant to the transport scheme in question. Area-wide models treat all areas even-handedly without a specific focus and it is accepted that such models often cannot reach all validation criteria in all parts of the model. Examples of such models are Highways England's Regional Traffic Models or other large county-wide models. Nevertheless, the performance of the CSTM against TAG recommendations is discussed here and where relevant, additional focus is placed on the areas important for the Local Plan analysis.

6.2 Network validation principles

6.2.1 TAG advises that the accuracy of the model will be dependent on the accuracy of the routes taken by trips in the model. The route choice of selected trips in the model should be checked[21] for plausibility. TAG provides guidance on the number of routes to be assessed, which is given as: (number of zones)$^{0.25}$ x the number of user classes. TAG also provides for certain conditions of those routes, which should be chosen such that they:

- Relate to significant numbers of trips.
- Are of significant length or cost (e.g. 20+ minutes).
- Pass through areas of interest (e.g. scheme impacted areas).
- Include both directions of travel (to sense check differences).
- Link different compass areas (e.g. north to south, east to west, etc.).
- Coincide with journey time routes as appropriate.

6.3 Performance against network validation guidance

6.3.1 Based on the model having 865 zones and three user classes for assignment, the guidance would imply that 17 routes should be checked. However, given the extensive coverage of the model, with intra-urban and inter-urban trips, a larger number of routes were checked (up to 106 routes, at various stages of the model development). To check inter-urban movements, Census Journey to Work data was used to identify key movements between urban areas within the County, and also movements between urban areas inside the county and those outside. In addition, all routes used in the journey time validation were also used for route checking.

[21] Section 7 of TAG unit M3.1, May 2020, DfT

6.4 Implications for the Local Plan assessment

6.4.1 The checking of routes within the model followed the methodology of TAG. The number of checks significantly exceeded the minimum suggested in TAG and confirmed that route choice within the model was plausible and demonstrated its fitness for modelling the impact of the Local Plan on route choice.

6.5 Trip matrix calibration and validation principles

6.5.1 TAG advises that it is essential to validate trip matrices by comparing assigned flows with traffic counts and that this should be done on a screenline or cordon basis[22]. In this context "screenline or cordon" refers to groups of links representing significant movements, for example, into and out of an urban area. The criterion for this is set out in Table 1 of TAG unit M3.1, and is reproduced below.

SCREENLINE FLOW VALIDATION CRITERION AND GUIDELINE	
CRITERIA	**GUIDELINE**
Differences between modelled flows and counts should be less than 5% of the counts	All or nearly all screenlines (i.e. 95%)

Table 4: Reproduction of Table 1 from TAG unit M3.1

6.5.2 TAG advises that where models do not achieve the guidelines the analyst should review the assumptions and data used to develop trip matrices but should not "force" compliance with the criteria. In reporting the analyst should explain why the model does not reproduce traffic volumes to these tolerances and should indicate the scale and nature of potential forecasting uncertainty and suitability of the model for its intended purpose[23].

6.5.3 TAG also advises that a process of "matrix estimation" may be required to achieve this and that the effect this has on the matrices should be carefully monitored and that this should not be significant. The criteria by which the significance of changes brought about by matrix estimation may be judged are specified in Table 5 of TAG unit M3.1, and this is reproduced below.

SIGNIFICANCE OF MATRIX ESTIMATION CHANGES	
MEASURE	**SIGNIFICANCE CRITERIA**
Matrix zonal cell values	Slope within 0.98 and 1.02; Intercept near zero; R2 in excess of 0.95
Matrix zonal trip ends	Slope within 0.99 and 1.01; Intercept near zero; R2 in excess of 0.98
Trip length distributions	Means within 5%; Standard deviations within 5%
Sector to sector level matrices	Differences within 5%

[22] Section 8.2.1 of TAG unit M3.1, May 2020, DfT
[23] Section 3.3.9 of TAG unit M3.1, May 2020, DfT

Table 5: Reproduction of Table 5 from TAG unit M3.1

6.5.4 TAG also says that all exceedances of these criteria should be examined and assessed for their importance for the accuracy of the matrices. Where they are not considered to be important, the reasons should be documented. Matrix estimation should not be allowed to make significant changes to the prior matrices in order that the validation standards are met. In these cases, the limits set out in Table 5 should be respected, the impacts of matrix estimation should be reduced so that they do not become significant, and a lower standard of validation reported[24].

6.6 Performance against matrix validation guidance

6.6.1 The comparison of modelled and observed flows across the Aylesbury and Buckingham screenlines is presented in Table 6 below:

LOCATION	DIRECTION	AM PEAK FLOW DIFFERENCE	IP FLOW DIFFERENCE	PM PEAK FLOW DIFFERENCE
Aylesbury	Inbound	-6.3%	-3.2%	-5.4%
Aylesbury	Outbound	-5.5%	-3.2%	-3.8%
Buckingham	Inbound	-3.8%	3.7%	-1.4%
Buckingham	Outbound	6.4%	6.3%	-2.6%

Table 6: Comparison between modelled and observed flows by screenline.

6.6.2 The results show that the performance of the model on the key screenlines relevant to Local Plan modelling is good. There are some exceedances of the suggested 5% threshold, but these are small. In line with the guidance, the model was not "forced" to meet the 5% criterion as it could risk significant changes of the matrix and undermine its integrity. The significance of matrix estimation changes is set out in Table 7 below.

TIME PERIOD	USER CLASS	SLOPE	R SQUARED
AM	Car	0.986	1
	LGV	1.050	1
	HGV	1.090	0.999
IP	Car	0.987	1
	LGV	1.042	1
	HGV	1.044	0.999
PM	Car	0.961	1
	LGV	1.021	1
	HGV	0.978	0.999

[24] Section 8.3 of TAG unit M3.1, May 2020, DfT

Table 7: Summary of matrix estimation changes to zonal trip ends

6.6.3 The summary demonstrates excellent results with regards to the guideline for R^2 and relatively small exceedances in the slope (particularly for LGVs and HGVs), which is an expected result given that these two user classes tend to require greater adjustment during the matrix estimation process due to their lower share within the overall traffic. **Error! Reference source not found.** below shows the changes in the average trip length that result from matrix estimation.

CRITERIA	CAR BEFORE	CAR AFTER	DIFF' (%)	LGV BEFORE	LGV AFTER	DIFF' (%)	HGV BEFORE	HGV AFTER	DIFF' (%)
AM average trip length	42.3	42.2	-0.2%	45.2	45.9	1.6%	153.5	147.5	-3.9%
AM trip length standard deviation	36.0	36.2	0.5%	43.4	45.3	4.5%	112.3	110.7	-1.5%
IP average trip length	34.8	35.1	0.8%	39.7	40.9	3.1%	156.0	150.4	-3.6%
IP trip length standard deviation	26.2	27.0	3.1%	41.6	45.5	9.3%	112.1	110.3	-1.5%
PM average trip length	43.1	43.0	-0.2%	45.1	45.8	1.6%	156.5	154.2	-1.5%
PM trip length standard deviation	39.8	40.1	0.7%	44.5	46.2	3.8%	112.0	111.3	-0.6%

Table 8: Summary of matrix estimation changes on trip length distribution

6.6.4 The summary shows that for trip lengths, the criteria for both average trip length and standard deviation trip length meets or is better than the guidelines for all except LGVs in the inter-peak. This reflects the reduced amount of data available to develop trip matrices for goods vehicles. On the whole, the results indicate that matrix estimation has not had a significant impact on trip length distribution, which is in line with the TAG recommendation.

6.7 Implications for the Local Plan assessment

6.7.1 In terms of matrix validation, the model has been assessed using TAG methodology, as required by NPPG, and therefore the Local Plan modelling is consistent with the guidance.

6.7.2 The model performance is consistent with the recommendations of TAG. In some instances, the recommended thresholds for the difference between modelled and observed screenline flows is exceeded, but these differences remain small and in a range of 1% around Aylesbury. Where this occurs, TAG requires the analyst to indicate the scale and nature of potential forecasting uncertainty. In this regard, the exceedance of the guideline around Aylesbury by only 1% will have a limited impact on the level of uncertainty; since the flow difference in the base model is lower than the observed data, which suggests a slight, but negligible underestimate of flows. Within the context of the Local Plan Assessment, and the fact that the model is being used to draw high level conclusions over the performance of the network in Aylesbury Vale as a whole, a difference of 1% applied to the flows in any of the forecast scenarios is not going to change the overall conclusions as to the level of highway impact in that scenario. Thus, not meeting the guideline here does not detract from the model's ability to serve its purpose.

6.7.3 The matrix estimation process was consistent with the guidance recommendation for cars. This means that the matrix estimation process did not introduce significant changes to the car matrix and they remain fit for purpose for forecasting. Trip matrices for LGVs and HGVs were adjusted to a greater degree and this is often seen in many models due to sparsity of LGV and HGV matrices. However, given there is only a small proportion of these trips on the network and the fact that the Local Plan forecasts focus on trips generated by developments (which tend not to generate large volumes of goods vehicle trips), this has no material impact on the quality of the model.

6.8 Assignment Calibration and Validation principles

6.8.1 To establish how well a model represents actual travel conditions, TAG guidelines include a methodology for comparing modelled flows with traffic counts, and modelled journey times with observed journey times, along set routes. The criteria for modelled flows are set out in Table 1 of TAG unit M3.1, along with a guideline (note, not a 'requirement'). This is reproduced below:

LINK FLOW AND TURNING MOVEMENT VALIDATION CRITERIA AND GUIDELINES		
CRITERIA	**DESCRIPTION OF CRITERIA**	**GUIDELINE**
1	Individual flows within 100 veh/h of counts for flows less than 700 veh/h	> 85% of cases
	Individual flows within 15% of counts for flows from 700 to 2,700 veh/h	
	Individual flows within 400 veh/h of counts for flows more than 2,700 veh/h	
2	GEH < 5 for individual flows	> 85% of cases

Table 9: Reproduction of Table 2 from TAG unit M3.1

6.8.2 Where the guideline value is not met, TAG says that the analyst should not impose constraints just to improve the base year accuracy of the model and goes on to say that the focus should be to ensure the model is suitable for its intended purpose[25]. The criterion for journey times is based on the comparison of modelled travel times along pre-specified routes against observed journey times along the same routes. The criterion is set out in Table 3 of TAG unit M3-1 and is reproduced below:

JOURNEY TIME VALIDATION CRITERION AND GUIDELINE	
CRITERIA	**GUIDELINE**
Modelled times along routes should be within 15% of surveyed times (or 1 minute, if higher than 15%)	> 85% of routes

[25] Section 3.3.12 of TAG Unit M3.1, May 2020, DfT

Table 10: Reproduction of Table 3 from TAG unit M3.1

6.8.3 For both the flow and the journey time criteria the guidance explains that achievement of the validation guidelines does not guarantee that a model is 'fit for purpose' and likewise, a failure to meet the specified validation standards does not mean that a model is not 'fit for purpose'[26], although it goes on to say that experience has shown that the level of model validation outlined in the guidance results in a robust standard of traffic model used for major transport scheme appraisal. It also says that the greater the difference in modelled flows from observed flows, noting that there will also be uncertainty and variation in observed flow data, the wider the uncertainty around the performance of the model and hence the resulting appraisal results. Practitioners should examine the extent to which this affects the robustness of their models on a case-by-case basis[27].

6.8.4 The guidance advises that an important consideration is to add wider context and interpretation to the model performance by including narrative about its fitness for purpose in addition to presenting validation statistics for links or cordons in tabular form. All significant discrepancies between modelled and observed data should be noted and a commentary provided in each instance. These commentaries should state whether or not the discrepancies might affect the model's usefulness for certain applications[28].

6.9 Performance against the matrix calibration and validation guidance

6.9.1 In terms of flow validation, the performance of the model is summarised in the Phase 1 Local Plan Modelling report. Table 11 below reproduces GEH results and to provide further context also shows a range of additional criteria, which are traditionally reported to show how the model performs against the criterion as well as the next criteria up. The GEH statistic gives due consideration to both the absolute and percentage difference in modelled and observed flows and achieving a small GEH reflects that the differences are small in either percentage or absolute terms.

6.9.2 The results across the entire modelled area show that whilst the GEH threshold of 5 is met for 88% of relevant links in the inter-peak, in the AM and PM peaks it is approximately 66/67%. However the recommendations are exceeded to a relatively small degree as approximately 80% of links fall in the next category (GEH below 7.5).

	AM	IP	PM
Total no. of link flow comparisons in the model	371	371	371
% Meeting criteria (GEH<5)	58	81	59
Total no. of link flow comparisons within Buckinghamshire	259	259	259

[26] Section 3.2 of TAG Unit M3.1, May 2020, DfT
[27] Section 3.3.13 of TAG Unit M3.1, May 2020, DfT
[28] Section 3.3.14 of TAG Unit M3.1, May 2020, DfT

	AM	IP	PM
% Meeting criteria (GEH<5)	66	88	67
% Meeting criteria (GEH<7.5)	81	94	78
% Meeting criteria (GEH<10)	89	97	87
% Meeting criteria (GEH<15)	98	100	95

Table 11: Flow Validation criteria for local plan model

6.9.3 It is essential to note that the validation statistics above are for all counts across the whole model area. Of greater relevance is the equivalent statistic for the areas which see the highest levels of growth in the Local Plan, e.g. Aylesbury. To further assess the relevance of these statistics for the purpose of Local Plan modelling in Aylesbury Vale the performance of the links around Aylesbury has been assessed in more detail below. This is set out in **Error! Reference source not found.**, **Error! Reference source not found.** and **Error! Reference source not found.** below. Green colour denotes links with GEH below 5. Amber shows GEH lower than 7.5 and red shows links with GEH above 7.5.

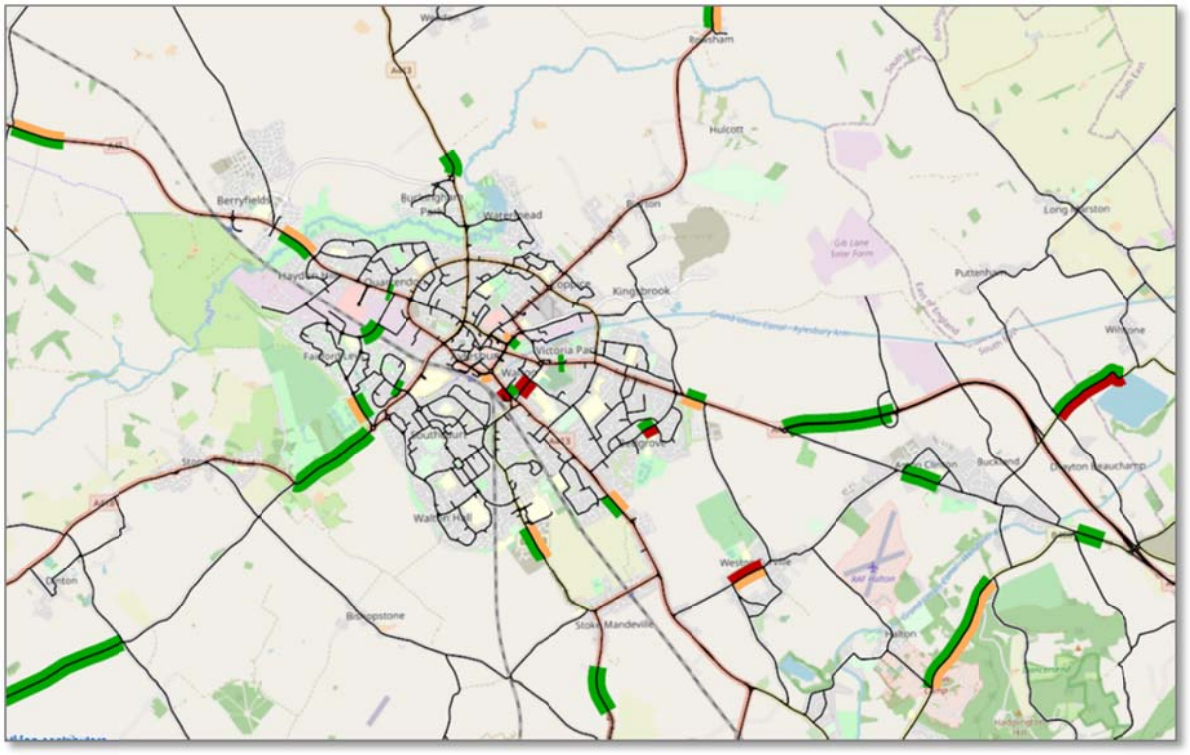

Figure 2: Validation of Link Flows around Aylesbury, AM peak period.

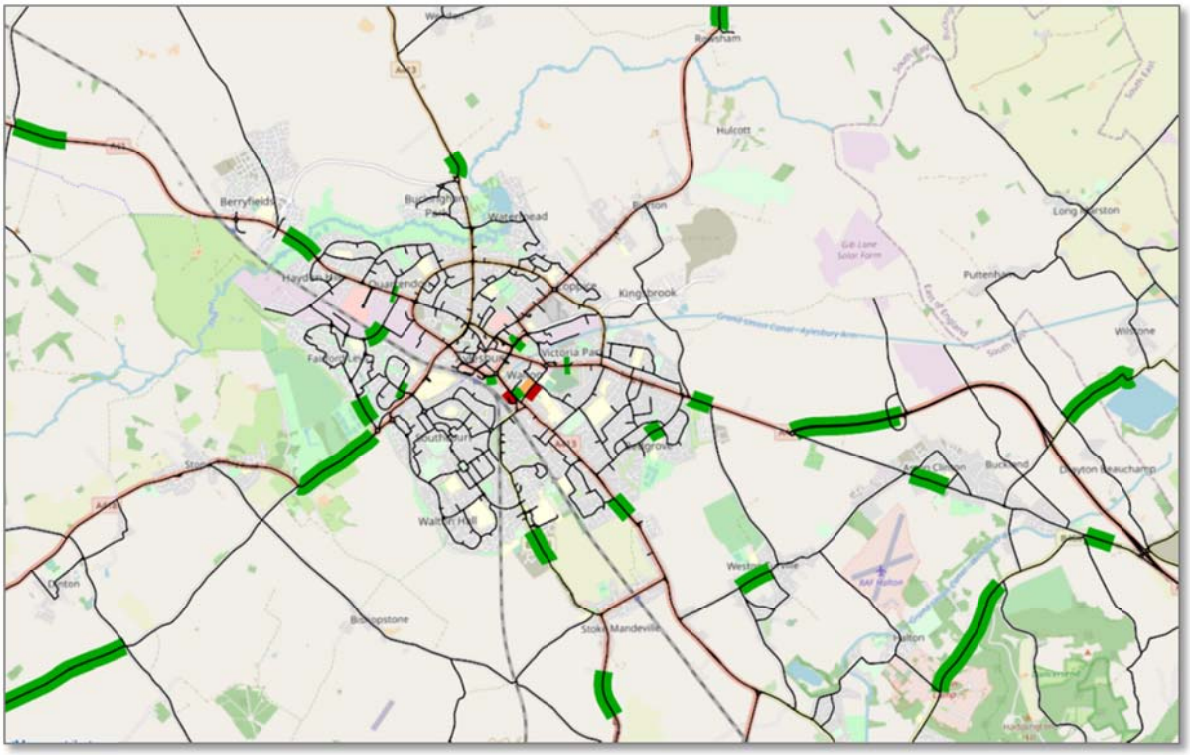

Figure 3: Validation of Link Flows around Aylesbury, Inter-peak period.

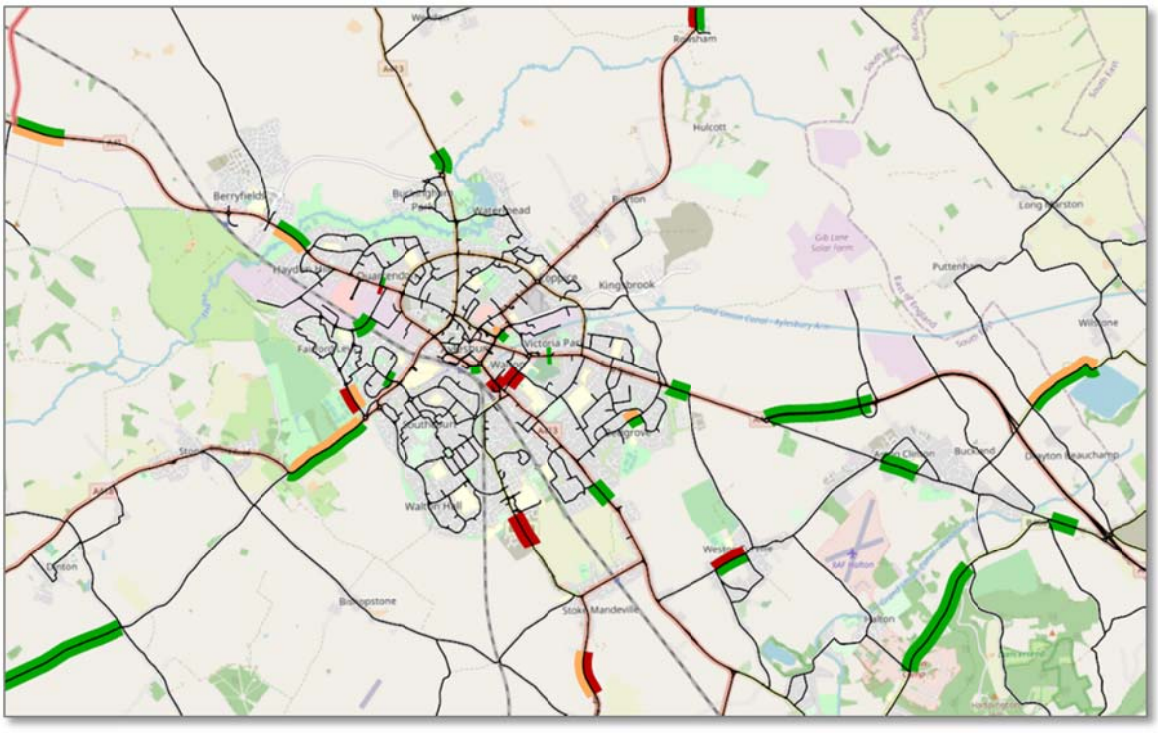

Figure 4: Validation of Link Flows around Aylesbury, PM peak period.

6.9.4 The results in Figure 2: Validation of Link Flows around Aylesbury, AM peak period.Figure 2 (Validation of Link Flows around Aylesbury, AM Peak) indicate a reasonable performance of the model around Aylesbury in AM peak. Figure 3 shows an excellent performance in the inter-peak period. Figure 4 shows that in the PM peak there are

a few more links around Aylesbury where GEH exceeds 7.5. However, these differences occur on smaller links with lower significance.

6.9.5 The main A-road radial links into Aylesbury as well as the inner ring road perform well and no systematic bias in the quality of the model can be observed in any specific part of the town. Note also from Table 6, in Section 6.6 that flows into and out of Aylesbury as a whole, as indicated by the screenline comparisons do not exceed a difference of 6% between modelled and observed flows in any time period. This further indicates there is no systematic underestimate or overestimate of flows in the model.

6.9.6 The model's journey time validation is reproduced below (Table 12), with additional context provided for journey time routes with differences above 15%:

	AM	IP	PM
No. Routes	58	58	58
% of routes with modelled and observed difference <15%	57%	62%	63%
% of routes with modelled and observed difference <20%	67%	77%	68%
% of routes with modelled and observed difference <25%	73%	87%	77%
% of routes with modelled and observed difference <30%	80%	90%	80%
% of routes with modelled and observed difference <35%	88%	90%	80%
% of routes with modelled and observed difference <40%	90%	97%	82%

Table 12: Journey time, modelled and observed comparison, CSTM area

6.9.7 As described earlier in paragraph 6.1.2, this type of model covers a wide area even-handedly (county-wide) and does not focus attention on any particular area which would be expected of models supporting transport scheme business cases, the principal focus of TAG). It is therefore reasonable to expect that the model results will not meet the recommended threshold of 15%. This type of model cannot achieve all criteria and this is common in other regional models such as Highways England's Regional Traffic Models. As such, it is important to understand the performance of the model on the routes that are most relevant to the analysis in which the model has been applied.

6.9.8 Given that the model covers the whole county, but local plan growth is focused on the Aylesbury Vale area, the routes that cross the towns of Aylesbury and Buckingham (which also extend to rural areas outside the towns) have been analysed in more detail. This is presented in **Table 13** below.

	AM	IP	PM
No. Routes	8	8	8
% of routes with modelled and observed difference <15%	63%	100%	50%
% of routes with modelled and observed difference <20%	88%	100%	75%
% of routes with modelled and observed difference <25%	88%	100%	88%
% of routes with modelled and observed difference <30%	100%	100%	88%
% of routes with modelled and observed difference <35%	100%	100%	88%
% of routes with modelled and observed difference <40%	100%	100%	88%

Table 13: Journey time, modelled and observed comparison, Aylesbury & Buckingham

6.9.9 The performance of the model on these routes shows that all inter-peak routes are within the recommended thresholds and 88% and 75% of routes are within 20% in the AM and PM peak models respectively. These results are considered a reasonable representation of journey times for the purposes of a Local Plan assessment and would not affect the outcomes of strategic assessments.

6.10 Implications for the Local Plan assessment

6.10.1 The development of the CSTM has followed the principles of TAG and is consistent with the requirements of NPPG in this regard.

6.10.2 Within the context of TAG, the guidance advises that an important consideration is to add wider context and interpretation to the model performance by including narrative about its fitness for purpose. The model was NOT used for a major transport scheme appraisal (DfT business cases); it was used for a Local Plan Assessment, specifically to make strategic assessments of the broad levels of congestion across the whole county (categorised as Red, Amber, Green analysis) and impact on the highway network occurring across relatively large areas. As such, it is considered fit for this purpose by the Council.

6.10.3 Differences between modelled and observed data have been demonstrated to be relatively small. Given that the model is used for high level analysis, reducing those differences further would not change the conclusions being drawn from the model in terms of the broad impacts of strategic site allocation assessments. More detailed assessments of localised impacts will be required at a later date during the planning application stages through the preparation of detailed Transport Assessments. These will consider the localised impacts of any allocated site proposals and the need for mitigation on parts of the local network.

7. FORECASTING

7.1.1 TAG unit M4 provides guidance on forecasting for Government transport scheme business cases and requires development assumptions to be capped to Government's central assumptions. The purpose of Local Plan modelling is to test the impact of new proposed developments at a strategic level. For that reason, the advice in Unit M4 does not apply and development assumptions specific to the Local Plan must be modelled.

7.1.2 Models are used to provide a systematic framework to establish the difference between two forecasts (Baseline and Test). In the Local Plan assessment, the forecast scenarios are "without-development" and "with-development" (and also "with-development and with-mitigation"), which are compared against each other to establish impacts of specific developments and mitigation measures. This scenario-based assessment, comparing scenarios without the Local Plan, with the Local Plan, and with the Local Plan AND mitigation schemes, is consistent with the requirements of NPPG and is best practice for forecasting for Local Plans.

7.1.3 The only other area where the forecast models are not consistent with TAG is Variable Demand Modelling (VDM), which has not been undertaken. VDM is a modelling technique which considers adjustment in vehicle travel patterns in response to travel conditions and congestion. This technique is required for Government-funded transport scheme business cases as it takes a more conservative view of the benefits that transport business cases deliver. Due to its complexity, not using this technique in modelling for strategic planning or option generation is proportionate, and to some extent more appropriate, as it presents the 'worst case' impacts of the developments (the demand for car travel does not reduce due to congestion).

8. MODELLING DEVELOPMENT CONCLUSIONS

8.1 Consistency with TAG Best Practice

8.1.1 This report summarises the consistency of the CSTM with best practice and recommendations of TAG. It has been developed to a high standard with a high level of detail and uses appropriate data sources. Its development followed the principles and methods recommended by TAG and widely recognised as best practice for this type of model.

8.1.2 The calibration and validation of the model followed, with diligence, all the steps set out in TAG and clearly documented the performance of the model against the guidelines. The guidelines have been met well for a large, area-wide model. Where the model results exceeded recommended guidelines explanations have been provided with regards to their impact on forecasting and the level of uncertainty this generates.

8.1.3 This is in line with the principles of the guidance, which has been recently updated to emphasise the importance of the fitness for purpose of the model rather than over-fitting it to guidelines. Where the model has not met the guidelines in its development it has been demonstrated that this does not affect its validity for high level Local Plan assessments. For instance there is up to a 1% exceedance in terms of screenline traffic flows compared to the guidance. As an example this means that around Aylesbury traffic flows could be up to 6% different compared to observed traffic flows rather than 5%. Such a small difference in traffic flows will not change the overall conclusions of Local Plan allocation assessments at a town or Aylesbury Vale area wide level.

8.1.4 In some cases modelled journey times are within 20% of observed journey times rather than 15% and a GEH is 7.5 rather than 5.0 for individual flows. It has been demonstrated that this will make no material difference to the consideration of area-wide impacts of strategic housing allocations and would not change the conclusions being drawn on the strategic impacts of proposed site allocations.

8.1.5 The model is therefore considered fit for its purpose of assessing the strategic high level implications of housing allocations and mitigation measures for the Local Plan.

8.2 Consistency with similar wide area strategic models

8.2.1 The Planning Inspector heard considerable evidence with respect to the points raised by both the objectors and Highway Authority on how the modelling was undertaken. The Local Planning Authority was not required by the Inspector to undertake further modelling, or to amend the CSTM model. This model has also been used to support the development of Local Plans in other parts of the County and has been used for the purpose of plan making, such as for the Wycombe Local Plan, which is now adopted.

9. WHAT WAS TESTED FOR VALP

9.1 VALP Stages

9.1.1 There have been a number of stages to the CSTM modelling that have been undertaken to support the VALP. At each stage, the proposed development and infrastructure has been reviewed to ensure that this is correctly represented within each modelled scenario. This is in line with the NPPG which states:

"An assessment of the transport implications should be undertaken at a number of stages in the preparation of a Local Plan: as part of the initial evidence base in terms of issues and opportunities; as part of the options testing; and, as part of the preparation of the final submission".

The following sections summarise the modelling stages undertaken to date to support the VALP.

9.2 Phase One (July 2016)

9.2.1 Jacobs completed work on the first phase (phase one) of the Countywide Local Plan Modelling in July 2016. Phase one of the modelling support work sets out the impacts of the 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 part of this 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.

9.2.2 Development growth within the districts has been generated both from data provided by the districts, as well as from The National Trip End Model (NTEM) dataset, version 6.2. NTEM is an industry standard tool provided by the Department for Transport for calculating future trip growth and is used in the majority of transport scheme business cases and for other transport planning purposes. Growth outside of Buckinghamshire has been based entirely on NTEM levels in all forecast scenarios. Forecast network updates were incorporated into the future year scenarios.

9.2.3 A number of infrastructure schemes were outlined by the districts to bring the 2013 base network to a 2033 forecast year. This includes additional infrastructure and alterations to existing roads and junctions across the county. As a result, it was necessary to update the full countywide network to reflect these changes as part of the production of the forecast models. Table 14 sets out the schemes included in the 2033 DM and DS forecast scenarios.

SCHEME	DESCRIPTION	SCENARIO
Southern Link Road (SLR)	Link road through Hampden Fields development	DS
HS2: Stoke Mandeville Bypass	New bypass off A4010	DM & DS
Stocklake Urban Link	Upgrade to existing Stocklake Road	DM & DS
Stocklake Rural Link	New link road connecting Stocklake Urban with ELR(N)	DM & DS
ELR (N)	New link road connecting Stocklake with A418	DM & DS
HS2: Realignment of A41 Bicester Road	New junction and realignment of existing A41	DM & DS
HS2: Realignment of Station Road	Station Road and surrounding roads realigned	DM & DS
HS2: Realignment of Perry Hill	Realignment of existing road	DM & DS

Table 14: Phase 1 infrastructure changes included in DM and DS scenarios - Aylesbury

9.2.4 Table 14 sets out the development in Aylesbury Vale that was included in the three scenarios (2033) that were modelled for phase one. As well as the development in Aylesbury Vale, the development proposed at the time (2016) in Chiltern, Wycombe and South Bucks was also included in the two DS scenarios.

Do Minimum (DM):

9.2.5 For phase one the modelling included all the existing completions and commitments that had resulted since the start of the plan period up until 31 March 2015 as the DM scenario. There were two DS scenarios which both included the suitable HELAA sites that weren't already commitments from HELAA version 2 (October 2015) as well as the strategic site options that were being included in the draft VALP. These included a greenbelt site in Wendover, a new settlement option either at Haddenham (DS1) or Winslow (DS2) as well as a provision for development to come forward in the smaller villages as identified in the draft VALP.

9.2.6 Table 15 is a summary table of developments with respect to allocation sites and the three scenarios.

DM				DS1					DS2	
Completions (between 1st April 2013 and 31 March 2015)			**2,414**	Suitable HELAA options not committed allocated in VALP	AGT 1	SMD 004	Land south of Stoke Mandeville Hospital	300	As DS1 but 4,000 at Winslow new settlement option rather than Haddenham new settlement option	
Commitments included in final VALP allocations	AYL 068	Land North of Manor Hospital, Bierton Road	83		AGT 1	SMD 005	Land around Red House Farm, Lower Road	60		
	AGT 5 BER 001	Berryfields Major Development Area	1,912		AGT 2	SMD 009	Land between Oxford Road and Wendover Road	144		
	AGT 4 WTV 020	Land to east of New Road	64		AGT 2	SMD 012	Land South of Bucks Sports and Social Club, Lower Road	276		
	AGT 4 WTV 025	Land Bounded By New Road And Aston Clinton Road	135		AGT 2	STO 016	Land between Oxford Road and Wendover Road	693		
Further sites not relating to allocations listed in appendices			**4,808**		AGT 3	WTV 017	Westonmead Farm , A41 London Road	120		

DM				DS1					DS2		
					AGT 4	WTV 019	Land Adjacent to Aston Clinton Holiday Inn	158			
					AGT 4	WTV 021	New Road	51			
					AGT 4	WTV 022	Land at Hampden Fields	3,060			
					AGT 6	BIE 018	Land East Of Aylesbury (Kingsbrook) Broughton Crossing Bierton	2,450			
						AYL 032	Ardenham Lane	12			
						AYL 052	PO Sorting Office, Cambridge Street	23			
						AYL 059	Land At Junction Of Buckingham Street And New Street	14			
						AYL 063	Hampden House, High Street	112			
						AYL 073	Land at Thame Road/ Leach Road, Aylesbury	18			
						BUC 043	Land West of AVDLP allocation BU.1, Moreton Road	130			
						BUC 046	Land off Osier Way (south of A421 and east of Gawcott Road) Buckingham,	360			
						HAD 007	Land north of Rosemary Lane	175			
						NLV 001	Site west of Far Bletchley, at the south western edge of Milton Keynes. Boundary A421 & A4034, disused railway and Whaddon Road. Adjoins residential of west Bletchley.	1,885			
						NLV005	Land South of Whaddon Road and West of Lower End, Newton Longville	30			
						QUA001	Land south west of 62 Station Road	12			
						STO008	Land to the south of Creslow Way	36			
						WHA 001	Shenley Road	2,000			
						WIN 001	Land to east of B4033, Great Horwood Road	585			

SUMMARY								
				Further suitable HELAA sites not committed (listed in appendices)	2,875		
				HELAA options total	**15,570**		
Completions (between 1st April 2013 and 31 March 2015)			**2,414**				
Commitments: Included in final VALP allocations			2,194	Smaller villages (20 dwellings each) in 44 locations	880		
Commitments: Further sites not relating to allocations listed in appendices			4,808	Haddenham new settlement option	4,000	Winslow new settlement option	4,000

DM		DS1		DS2	
Total Commitments	**7,002**	Green belt site near Wendover	800		
Total	**9,416**	**Total**	**21,250**	**Total**	**21,250**

Table 15: 2016 modelled scenarios DM DS1 DS2

9.3 Phase Two (March 2017)

9.3.1 Phase two of the modelling focussed on identifying improvements to the transport network in order to mitigate the impacts identified in phase one. Whilst the main focus of this work was mitigating highway impacts arising from the Local Plan developments within Buckinghamshire, impacts outside of the county, where deemed significant, were also noted. Such impacts were identified in terms of changes in traffic flow on strategic routes and can be seen in Appendix 2. It was found that in general the mitigation schemes resulted in less significant demand flows on strategic routes outside of Buckinghamshire. However, minor increases were seen on the A505 in Dunstable in addition to Leighton Buzzard with the Bletchley Bypass in place.

9.3.2 Two additional schemes completed post 2013, but omitted from phase one, were included in the DM and DS 2017 forecast scenarios. This includes the Collington Road/ Paradise Orchard / Martin Dalby Way double roundabout in Aylesbury and the Bath Road/ Mill Lane roundabout in Taplow.

9.3.3 The 2017 phase two traffic modelling assessed the same sites as phase one DS1 and DS2 for Aylesbury Vale, but with the addition of a new strategic site around Aylesbury for 1,100 dwellings. This was a site to the north of the A41 (made up of separate parcels: AGT3/WTV018, with WTV018 being a development parcel that makes up AGT3) that needed to be considered as an allocation option following further work and discussions that were part of an application on the site showing constraints could potentially be overcome. Details are provided in the table 16 below.

PHASE 2					
DM		DS1		DS2	
Same as phase one DM	9,416	Same as phase one DS1 with the addition of:	21,250	Same as phase one DS2 with the addition of:	21,250
		AGT3 WTV018	1,100	AGT3 WTV018	1,100
Total	**9,416**	**Total**	**22,350**	**Total**	**22,350**

Table 16: Phase 2 developments assessed within modelling

9.3.4 The methodology for producing the revised forecast matrices is for the most part consistent with phase one. However, for the DS scenarios, the larger housing and employment developments have been modelled as new zones, rather than the additional development being incorporated into the existing zone network. This effectively separates the trip generation arising from the DS developments from the DM trip generation, allowing a better understanding of the impacts of the DS development traffic on the network. At the request of Buckinghamshire County

Council, a number of other changes were made in respect to specific developments in Aylesbury Vale, as outlined below:

- The total trip generation for the Hampden Fields development has been adjusted to be consistent with the planning application.
- The total trip generation for the new settlements at Haddenham in the DS1 and Winslow in the DS2 have been adjusted using the TRICS trip rates previously used in the New Settlement Study (GL Hearn, 2016).
- The locations where traffic enters the network for the Haddenham development in the DS1 and the Winslow development in the DS2 have been adjusted to match the New Settlement Study (GL Hearn, 2016).

The DM development scenario remained unchanged for the second phase of work and remains as set out in Table 15. The DS scenarios were updated to reflect changes in the preferred options of the Local Plans.

9.3.5 Mitigation options taken forward for appraisal in both the DS1 and DS2 forecast scenarios are detailed in Table 17 below.

SCHEME NAME	SCHEME DESCRIPTION
North-East Link Road (NELR)	This aspirational scheme consists of a new east-west single carriageway link road to the north-east of Aylesbury, between the A413 and A418.
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.
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
South East Aylesbury Link Road (SEALR)	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.
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.
Western Link Road	This aspirational 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.
A41 Berryfields Junction	Signal timing optimisation has been carried out to better accommodate demand at this junction.
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.
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.
Stoke Road Signalised Junction	Signal timing optimisation has been carried out to better accommodate demand at this junction.

SCHEME NAME	SCHEME DESCRIPTION
Traffic calming between A418 and Stoke Mandeville	Traffic calming on Prebendal Avenue to reduce rat-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.
Aylesbury Town Centre Pedestrian Network and Public Realm Improvements	This improvement aims to increase safety and enhance the public realm in Aylesbury Town Centre.
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.
Buckingham Western Link	This scheme includes a new link road between the A421 and A422.
Buckingham Area Transport Strategy	Three separate mitigations have been included as part of the transport strategy. • 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
A421 Roundabout Capacity Improvements	Capacity improvements at the London Rd/ A421 Roundabout and Gawcott Rd/ A421 Roundabout to reduce congestion.
Haddenham Mitigation (DS1 only)	This scheme includes upgrading the following junctions to roundabouts (included in both DS scenarios). • Aston Rd/ Stanbridge Rd • Thame Rd/ Station Rd • Aylesbury Rd/ Station Rd • Aylesbury Rd/ Thame Rd • A418 / A4129
Winslow Mitigation (DS2 Only)	This scheme includes upgrading the following junctions to roundabouts (included in both DS scenarios). • A421 / B4033 Nash Rd • B4033 Nash Rd / Little Horwood Rd • Little Horwood Rd / Church St • A413 Sheep St / Winslow Rd
Winslow Development Road (DS2 only)	This scheme will implement the mitigation measures identified in New Settlement Study2 for Winslow, including a spine road for the new development to prevent rat-running through neighbouring villages and an improved junction with the A421. This is only included in DS2 mitigation scenario.
Winslow Relief Road (DS2 only)	This scheme will bypass the existing A413 passing through Winslow by providing a series of new single carriageway roads to the north and east of the town, connecting with existing infrastructure. The scheme also includes the closure of the southern end of Great Horwood Road and Little Horwood Road, diverting traffic onto the relief road. This scheme is only included in DS2 mitigation scenario.
A421 Corridor Capacity Improvements	A421 route upgrade to dual-2 lane standard between Buckingham and Milton Keynes.
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.
Bletchley By-Pass	This scheme consists of a new single-carriageway road joining the A421 and A4146 South West of Bletchley.

Table 17: Phase 2 infrastructure included in the DS mitigation forecast scenarios

9.4 Phase 3 (August 2017)

9.4.1 Phase 3 of the modelling assessed the development proposed in Table 18 that reflected proposals in the emerging VALP. Due to revised housing figures reflecting adjustments to national forecasts and the outcome of discussions relating to unmet housing need from adjacent plan areas, the total housing need reduced overall, making the allocation of a new settlement unnecessary and therefore both the Haddenham and Winslow sites were removed from the DS.

9.4.2 The DS scenario for phase three of the modelling was therefore updated to include new commitments and align with the latest work on site capacities and potential allocations to be included in the proposed Submission VALP. Since the phase 2 DS scenario, new sites had been submitted to the council, the HELAA had been updated and the overall housing need figure reduced as set out above. The development proposed in each of the 2 scenarios (referred to as Runs) under phase 3 are the same. An allowance was also made in the smaller villages to cover windfalls.

SITES ALLOCATED IN PROPOSED MAIN MODS VALP		ADDRESS	DM	2016 PH.1 DS1/DS 2	2017 (MAR) PH.2 DS	2017 (AUG) PH.3 DS	COMMENTARY
	AYL068	Land North of Manor Hospital, Bierton Road	83				
AGT5	BER001	Berryfields Major Development Area	1,912				
AGT4	WTV020	Land to east of New Road	64				
AGT4	WTV025	Land Bounded By New Road And Aston Clinton Road	135				
AGT1	SMD004	Land south of Stoke Mandeville Hospital		300	300	409	The capacity of the site in terms of density and extent was increased as part of the HELAA review for version 3
AGT1	SMD005	Land around Red House Farm, Lower Road		60	60	70	The capacity of the site in terms of density was increased as part of the HELAA review for version 3
AGT1	SMD006	Land north of Stoke Mandeville adjacent Lower Road				400	The site was reviewed as part of the work for HELAA version 3 and now considered suitable
AGT1	SMD007	Land south of Aylesbury adjacent Wendover Road				252	The site was reviewed as part of the work for HELAA version 3 and now considered suitable
AGT1	SMD008	Land between railway line and Wendover Road				270	The site was reviewed as part of the work for HELAA version 3 and now considered suitable
AGT1	SMD016	Land straddling railway line north of Stoke Mandeville				168	A newly promoted site that was considered suitable
AGT2	SMD009	Land between Oxford Road and Wendover Road		144	144	168	The capacity of the site in terms of density was increased as part of the HELAA review for version 3
AGT2	SMD012	Land South of Bucks Sports and Social Club, Lower Road		276	276	276	No change
AGT2	STO016	Land between A418 & Princes Risborough Railway Line		693	693	1,282	The capacity of the site was increased following further work for the Proposed Submission VALP.
AGT3	BIE022	Manor Farm, land south of GU Canal Aylesbury Arm				350	A newly promoted site that was considered suitable
AGT3	WTV017	Westonmead Farm , A41 London Road		120	120	120	No change

SITES ALLOCATED IN PROPOSED MAIN MODS VALP		ADDRESS	DM	2016 PH.1 DS1/DS 2	2017 (MAR) PH.2 DS	2017 (AUG) PH.3 DS	COMMENTARY
AGT3	WTV018	'Woodlands' forming most of College Farm, College Road North			1,100	1,100	No change
AGT4	WTV019	Land Adjacent to Aston Clinton Holiday Inn		158	158	158	No change
AGT4	WTV021	New Road		51	51	51	No change
AGT4	WTV022	Land at Hampden Fields		3,060	3,060	3,060	No change
AGT6	BIE018	Land East Of Aylesbury (Kingsbrook) Broughton Crossing Bierton		2,450	2,450	2,450	No change
	AYL032	Ardenham Lane		12	12	12	No change
	AYL052	PO Sorting Office, Cambridge Street		23	23	23	No change
	AYL059	Land At Junction Of Buckingham Street And New Street		14	14	14	No change
	AYL063	Hampden House, High Street		112	112	112	No change
	AYL073	Land at Thame Road/ Leach Road, Aylesbury		18	18	18	No change
	AYL115	Rabans Lane adjacent railway ln				200	A newly promoted site that was considered suitable
	BUC043	Land West of AVDLP allocation BU.1, Moreton Road		130	130	130	No change
	BUC046	Land off Osier Way (south of A421 and east of Gawcott Road) Buckingham,		360	360	420	The capacity of the site in terms of density was increased as part of the HELAA review for version 3
	CDN001	Land north of Aylesbury Rd and r/o Great Stone House				6	HELAA version 3 looked at smaller settlements which now included Cuddington
	CDN003	Dadbrook Farm, Dadbrook Cl				20	A newly promoted site that was considered suitable
	HAD007	Land north of Rosemary Lane		175	.175	315	The capacity of the site in terms of density and extent was increased as part of the HELAA review for version 3
	HAL003	RAF Halton				1,000	A newly promoted site that was considered suitable
	ICK004	Land off Turnfields				20	The site was reviewed as part of the work for HELAA version 3 and now considered suitable
	MMO006	Land east of Walnut Drive and w of Foscote Rd				170	The site was reviewed as part of the work for HELAA version 3 and now considered suitable
	NLV001	Site west of Far Bletchley, at the south western edge of Milton Keynes. Boundary A421 & A4034, disused railway and Whaddon Road. Adjoins residential of west Bletchley.		1,885	1,885	1,885	No change
	NLV005	Land South of Whaddon Road and West of Lower End, Newton Longville		30	30	30	No change
	QUA001	Land south west of 62 Station Road		12	12	21	The capacity of the site in terms of density and extent was increased as part of the HELAA review for version 3
	QUA014	Land adjacent 110 Station Rd				8	A newly identified site through the Neighbourhood Plan work that was considered suitable

SITES ALLOCATED IN PROPOSED MAIN MODS VALP		ADDRESS	DM	2016 PH.1 DS1/DS 2	2017 (MAR) PH.2 DS	2017 (AUG) PH.3 DS	COMMENTARY
	QUA015	Land around Melling Farm, Station Rd				6	A newly identified site through the Neighbourhood Plan work that was considered suitable
	QUA016	Land adjacent Leafwood, Station Rd				10	A newly identified site through the Neighbourhood Plan work that was considered suitable
	STO008	Land to the south of Creslow Way		36	36	42	The capacity of the site in terms of density was increased as part of the HELAA review for version 3
	WHA001	Shenley Road		2,000	2,000	1,600	The capacity of the site in terms of density was reduced following further consideration and information from the site promoter
	WHI009	Holt's Field, North Marston Lane				22	The site was reviewed as part of the work for HELAA version 4 and now considered suitable
	WIN001	Land to east of B4033, Great Horwood Road		585	585	585	No change
Further allocation options considered for submission plan listed in appendices						2,085	
Total Local Plan options			**19,338**				
Smaller villages (20 dwellings each) in 44 locations			880				

Table 18: Development assessed within the Phase 3 modelling

9.4.3 For phase 3, two separate mitigation scenarios were developed, referred to as Run 1 and Run 2. The mitigation measures vary between each of the runs to enable a comparison between the different effects of combinations of mitigation measures in relation to the same proposed development. The transport mitigation included in the two modelled runs is set out in Table 19 below:

9.4.4 The list of mitigation options previously shortlisted for the Countywide Local Plan forecasting phase two work was carried over for this phase of the work. However, some mitigation measures were not included due to changes in the development scenarios for phase three (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 three).

SCHEME NAME	SCHEME DESCRIPTION	RUN 1	RUN 2
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 West Aylesbury 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	**No**	**Yes**

SCHEME NAME	SCHEME DESCRIPTION	RUN 1	RUN 2
	roundabout on the new Stoke Mandeville bypass and a new entry to the A418 roundabout.		
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 A418 and Stoke Mandeville	Traffic calming on Prebendal Avenue to reduce rat-running between A418 and Stoke Road.	**Yes**	**Yes**
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. • 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 Roundabout and Gawcott Rd/ A421 Roundabout 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**

Table 19: Phase 3 infrastructure included within DS with mitigation forecast scenarios

9.4.5 Table 20 below provides a summary of mitigation schemes included in each mitigation forecast scenario:

RUN 1	RUN 2

RUN 1	RUN 2
Aylesbury Run 1 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. **Buckingham/ Milton Keynes** Run 1 does not include any schemes in Buckingham except the A421 roundabout improvements but includes the Bletchley Bypass.	**Aylesbury** Run 2 includes the complete circle of link roads as well as the improvements at the A41 Berryfields Junction and on the A413. **Buckingham/ Milton Keynes** 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.

Table 20: Phase 3 summary of mitigation schemes included in each mitigation forecast

9.5 North East Bucks Local Plan Tests (May 2019)

9.5.1 After the Inspector had indicated in his interim findings that he considered that there was a need for strategic development close to Milton Keynes further modelling was undertaken to inform the selection of a location to address his findings. Five new 'Do something' (DS) scenarios were developed to test the impact of new combinations of development in North East Buckinghamshire (the North East Bucks Tests (NEBT)).

9.5.2 For each of the above scenarios, a 'with mitigation' version was also produced which includes the list of mitigations as per the transport proposals included in Phase 3 run 1. This work did not supersede any of the Local Plan modelling undertaken to date, the purpose of this study was only to assess the cumulative impacts of the changes in development proposals around North East Buckinghamshire and identify areas where these may result in significant changes to travel times.

9.5.3 For the NEBT, the model had two additional zones created (for the new development sites) and five further DS scenarios developed:

- DS1 – the same as the existing 'Do something' from August 2017 Phase 3, shown on table [insert] above but with Shenley Park/Road included at 1,800 dwellings instead of 1,600 dwellings. This also includes any relevant site specific transport infrastructure for the development;
- DS2 – as per DS1 above, but with 1,400 dwellings at Shenley Park and the addition of 1,200 dwellings at Eaton Leys;
- DS3 – the same as DS1 above but with 1,200 dwellings at Shenley Park and the addition of 1,100 dwellings at Salden Chase Extension;
- DS4 – the same as the previous Countywide Phase 3 'Do something' but with Shenley Park removed and the addition of 1,200 dwellings at Eaton Leys; and
- DS5 - the same as DS1 above but with Shenley Park removed and the addition of 1,100 dwellings at Salden Chase Extension.

9.5.4 As well as assessing the development scenarios DS 1 to 5 an additional sensitivity test was also developed, with the aim of reviewing the impacts on the road network if the Bletchley Bypass is not implemented. Throughout the document this sensitivity test will be referred to as the Bletchley Bypass removal sensitivity test.

9.5.5 Table 21 below provides a summary of the Countywide Model Phase 3 DS land use assumptions and the absolute differences between the employment and housing figures for the NEBT when compared to the previous Phase 3 tests.

NE BUCKS PLAN MODELLING						
	DM	**DS1**	**DS2**	**DS3**	**DS4**	**DS5**
	Same as phase one DM	Same as phase 3 DS with the addition of: (WHA001 was in phase 3 DS but capacity varies as below)	Same as phase 3 DS with the addition of: (WHA001 was in phase 3 DS but capacity varies as below)	Same as phase 3 DS with the addition of: (WHA001 was in phase 3 DS but capacity varies as below)	Same as phase 3 DS with the addition of: (WHA001 was in phase 3 DS but capacity varies as below)	Same as phase 3 DS with the addition of: (WHA001 was in phase 3 DS but capacity varies as below)
GRB002 Eaton Leys			1,200		1,200	
NLV020 Salden Chase extension				1,100		1,100
WHA001 Shenley Park		1,800	1,400	1,200		
Total	**9,416**	**20,407**	**21,207**	**20,907**	**19,807**	**19,707**

Table 21: Revised forecast scenarios for North East Bucks Local Plan Modelling

9.5.6 Table 22 below outlines each mitigation option taken forward for appraisal in Aylesbury Vale for the NEBT. The table also includes a separate column for the schemes included in the Bletchley Bypass removal sensitivity test.

SCHEME NAME	SCHEME DESCRIPTION	RUN 1	BLETCHLEY BYPASS REMOVAL SENSITIVITY TEST
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**
South East Aylesbury Link Road (SEALR)	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**
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 A418 and Stoke Mandeville	Traffic calming on Prebendal Avenue to reduce rat-running between A418 and Stoke Road.	**Yes**	**Yes**
Aylesbury Town Centre Pedestrian Network	This improvement aims to increase safety and enhance the public realm in Aylesbury Town Centre.	**Yes**	**Yes**

SCHEME NAME	SCHEME DESCRIPTION	RUN 1	BLETCHLEY BYPASS REMOVAL SENSITIVITY TEST
Improvements			
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**
A421 Roundabout Capacity Improvements	Capacity improvements at the London Rd/ A421 Roundabout and Gawcott Rd/ A421 Roundabout to increase capacity.	**Yes**	**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**

Table 22: Run 1 Mitigation and Bletchley Bypass removal sensitivity test options for Aylesbury Vale

9.6 Phase Four (May 2020)

9.6.1 The fourth phase of modelling work modelled further revisions to the development assumptions in an updated DS scenario along with a revised set of mitigation options to reflect the proposed modifications to VALP. Thus, two new scenarios, a DS and a 'DS with mitigation' were developed. The revisions were limited to developments and mitigation schemes within the Aylesbury Vale District.

9.6.2 The mitigation schemes identified in the Phase 3 and NEBT modelling as being necessary were again tested in a 'DS with mitigation' scenario to assess the extent to which these proposed mitigations offset the revised development impacts; this scenario is referred to as "DS run 1a". The DS scenario and DS run 1a were then compared against the DM scenario from phase 3 (which was itself unchanged from phase 2) in order to assess increased congestion and travel times. This showed that no further highway mitigations were needed.

9.6.3 The DM scenario remains unchanged from the previous phase of work; however, Phase 3 Run 1 excluded the South West Link Road and a modelling run that included the required link roads was required. The fourth phase of modelling reflects the allocations in the Proposed Main Modifications VALP and also updated the committed development to a base date of 31 March 2018, matching that included within the Proposed Main Modifications VALP. Some of the previous site allocation options included in the third phase of modelling work weren't included in the final allocations proposed and have therefore been taken out, or the capacity on other sites revised as appropriate. A summary table (Table 23) can be seen below.

Sites allocated in Proposed Main Mods VALP		Address	DM	Phase one DS1/DS2	Phase two DS	Phase three DS	Phase four DS	Commentary
AYL068		Land North of Manor Hospital, Bierton Road	83					
AGT5	BER001	Berryfields Major Development Area	1912					
AGT4	WTV020	Land to east of New Road	64					
AGT4	WTV025	Land Bounded By New Road And Aston Clinton Road	135					
AGT1	SMD004	Land south of Stoke Mandeville Hospital		300	300	409	1,000	These HELAA parcels are allocated for 1,000 in total. Part of SMD004 has permission for 125 dwellings, which is included in the 1,000 total and the remaining allocation is expected to deliver 875.
AGT1	SMD005	Land around Red House Farm, Lower Road		60	60	70		
AGT1	SMD006	Land north of Stoke Mandeville adjacent Lower Road				400		
AGT1	SMD007	Land south of Aylesbury adj Wendover Road				252		
AGT1	SMD008	Land between railway line and Wendover Road				270		
AGT1	SMD016	Land straddling railway line north of Stoke Mandeville				168		
AGT2	SMD009	Land between Oxford Road and Wendover Road		144	144	168	1400	These HELAA parcels were allocated together and an application has been submitted for 1400 homes.
AGT2	STO016	Land between A418 & Princes Risborough Railway Line		693	693	1282		
AGT2	SMD012	Land South of Bucks Sports and Social Club, Lower Road		276	276	276	190	A parcel of AGT2 which received permission for 190 home and is under construction
AGT3	AST037	College Farm, Aylesbury					250	The site is now allocated in VALP as part of AGT3
AGT3	BIE022	Manor Farm, land south of GU Canal Aylesbury Arm				350	350	No change

AGT3	WTV017	Westonmead Farm , A41 London Road		120	120	120	157	The site has permission for 157 homes.
AGT3	WTV018	'Woodlands' forming most of College Farm, College Road North			1,100	1,100	1,000	The site has a resolution to grant planning permission for 1,100 but the final 100 are due to be delivered outside of the plan period (i.e. after March 31 2033)
AGT4	WTV019	Land Adjacent to Aston Clinton Holiday Inn		158	158	158	108	At the time of drafting the VALP Main Modifications in 2019, this site had a pending application for 108 homes.
AGT4	WTV021	New Road		51	51	51	51	No change
AGT4	WTV022	Land at Hampden Fields		3,060	3,060	3,060	3,000	The 60 bed care home was previously included but should not be counted as part of the main supply of Use Class C3 dwellinghouses.
AGT6	BIE018	Land East Of Aylesbury (Kingsbrook) Broughton Crossing Bierton		2,450	2,450	2,450	2,450	No change
	AYL032	Ardenham Lane		12	12	12	63	Part of the site received permission for 9 homes and the remainder is allocated for 54 homes.
	AYL052	PO Sorting Office, Cambridge Street		23	23	23	23	No change
	AYL059	Land At Junction Of Buckingham Street And New Street		14	14	14	14	No change
	AYL063	Hampden House, High Street		112	112	112	112	No change
	AYL073	Land at Thame Road/ Leach Road, Aylesbury		18	18	18	18	No change
	AYL115	Rabans Lane adj railway ln				200	200	No change

	BUC043	Land West of AVDLP allocation BU.1, Moreton Road		130	130	130	130	No change
	BUC046	Land off Osier Way (south of A421 and east of Gawcott Road) Buckingham,		360	360	420	420	No change
	CDN001	Land north of Aylesbury Rd and r/o Great Stone House				6	8	This site has permission for 8 homes.
	CDN003	Dadbrook Farm, Dadbrook Cl				20	15	The capacity of the site allocation was reduced for VALP proposed submission
	HAD007	Land north of Rosemary Lane		175	175	315	269	The capacity of the site allocation was reduced as part of the VALP Main Modifications
	HAL003	RAF Halton				1,000	1,000	No change
	ICK004	Land off Turnfields				20	30	This site has permission for 30 homes.
	MMO006	Land east of Walnut Drive and w of Foscote Rd				170	170	No change
	NLV001	Site west of Far Bletchley, at the south western edge of Milton Keynes. Boundary A421 & A4034, disused railway and Whaddon Road. Adjoins residential of west Bletchley.		1,885	1,885	1,885	1,855	This site has a resolution to grant planning permission subject to S106 agreement for 1,855 homes.
	NLV005	Land South of Whaddon Road and West of Lower End, Newton Longville		30	30	30	17	This site has a pending application for 17 homes.
	QUA001	Land south west of 62 Station Road		12	12	21	13	This site has permission for 13 homes.
	QUA014	Land adj 110 Station Rd				8	24	These HELAA parcels have been allocated together to come forward as a single scheme.
	QUA015	Land around Melling Farm, Station Rd				6		

	QUA016	Land adj Leafwood, Station Rd				10		
	STO008	Land to the south of Creslow Way		36	36	42	26	The capacity of the site was revised as part of the VALP Main Modifications.
	WHA001	Shenley Road		2,000	2,000	1,600	1,150	The site was selected as an allocation for 1,150 as part of the VALP Main Modifications.
	WHI009	Holt's Field, North Marston Lane				22	22	No change
	WIN001	Land to east of B4033, Great Horwood Road		585	585	585	315	The capacity of the site allocation was reduced as part of the VALP Main Modifications
Additional commitments (either a new site or increased capacity since DM base)							3,193	
Total Local Plan Allocations and commitments							**19,043**	
Smaller villages (20 dwellings each) in 44 locations							880	
Total							**19,923**	

Table 23: Summary Table of Developments

9.6.4 Table 24 below outlines each mitigation option included within Aylesbury Vale for Run 1a for the Phase 4 modelling.

SCHEME NAME	SCHEME DESCRIPTION
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.
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.
South East Aylesbury Link Road (SEALR)	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.
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.

SCHEME NAME	SCHEME DESCRIPTION
Severance of Worcester Street / Collington Avenue	The scheme tests a reduction in capacity on the Willows to encourage traffic to use the A41 at Berryfields.
A41 Bicester Road PPTC (Including A41 Berryfields Junction)	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. Signal timing optimisation has been carried out to better accommodate demand at this junction.
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.
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.
Stoke Road Signalised Junction	Signal timing optimisation has been carried out to better accommodate demand at this junction.
Traffic calming between A418 and Stoke Mandeville	Traffic calming on Prebendal Avenue to reduce rat-running between A418 and Stoke Road.
Aylesbury Town Centre Pedestrian Network Improvements	This improvement aims to increase safety and enhance the public realm in Aylesbury Town Centre.
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.
Buckingham Area Transport Strategy	Additional left turn slip at the A422 Stratford Rd/ A413 roundabout Route upgrade on the A421 and A413 to dual – 2 lane standard
A421 Roundabout Capacity Improvements	Capacity improvements at the London Rd/ A421 Roundabout and Gawcott Rd/ A421 Roundabout to increase capacity.
Shenley Park Link Road in Milton Keynes	This scheme will implement a new link road to the A421 adjacent to the V1 to discourage rat running through Whaddon.

Table 24: Mitigation proposals included in the Phase 4 DS with mitigation forecast scenario

9.6.5 To summarise, the phase 4 modelling (run 1a) comprised;

- Revised Local Plan land use assumptions for Aylesbury Vale (see table 23);
- Assumptions for all other districts and areas outside of Buckinghamshire unchanged from the Phase 3 DS3 scenario;
- Tests the impact of a partial orbital route around Aylesbury as reflected by the proposed mitigation required under revised Policy T3; and
- Tests the impact of the Shenley Park Link Road.

10. HOW THE OUTPUTS WERE ASSESSED BY BUCKINGHAMSHIRE COUNCIL

10.1 Impacts of Local Plan Developments

10.1.1 Determination of the impacts of the Local Plan developments is considered in terms of;

- The assessment of the impacts on traffic congestion, i.e. have the levels of congestion increased or decreased on a specific road or junction.
- The assessment of the impacts on travel (journey) time i.e. has journey time increased or decreased on a specific road or junction.
- Where on the network are the respective impacts shown to be and are these impacts of concern to the Council.

10.1.2 Note that these factors are not independent. In order to ensure the robustness of the modelling results, they have been assessed together in order to determine the inter-relationships between the outputs.

10.2 Analysing changes in congestion

10.2.1 Congestion has been assessed within the modelling as a 'congestion ratio', which has been calculated for all modelled links in each scenario and time period based on a scale between 1 (Low impact) to >4 (High Impact)[29]. The congestion ratio is a ratio of travel time in an assessment scenario compared to free flow conditions on each link (i.e. road). The free flow time on a link is derived from the link length and free flow speed (the link speed when there is no delay in the network).

10.2.2 A RAG rating (red, amber or green) has been applied to each area; red represents a significant impact, amber a moderate impact and green a slight impact. Links are plotted according to the following criteria (Table 25):

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% higher than in the uncongested situation
Amber	2-4	Travel times are between 100% and 400% higher than in the uncongested situation
Red	>4	Travel times are more than 400% higher than in the uncongested situation

Table 25: Congestion ratio criteria

10.2.3 The model highlights areas which may be impacted by the Local Plan development, but does not go into detail on the scale of the impact in quantitative terms. The use of the model in providing this sort of information is entirely in proportion to the requirements of the Local Plan assessment, and cognisant of the resources used in building the model.

[29] There is no clear definition of congestion and therefore the 'congestion ratio' aims to quantify the impact of congestion within the model outputs.

10.3 Change in travel time assessments

10.3.1 The change in travel time plots show the difference in link travel times between two scenarios (for example 'Do Something' vs 'Do Minimum') as a percentage. It therefore shows the level of additional delay which may occur in the DS scenario. It is worth noting that where an area is already congested in the DM model, travel times will be more sensitive to smaller increases in trips. 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. those links for which the congestion ratio is greater than 2 (and thereby marked with an amber or red band as described in Table 25). This ensures that only those areas which experience material changes to travel times are shown.

10.3.2 Countywide Strategic Model outputs have been produced comparing:

- 'Do Something' with the 'Do Minimum';
- 'Do Something with mitigation', with the 'Do Minimum', and;
- 'Do Something with mitigation', with the 'Do Something'.

10.3.3 The 'Do Something with mitigation' changes in travel time plots compared with the 'Do Minimum' show the impact of the development plus the mitigation over the 'Do Minimum' case, and so indicate what happens with development and transport mitigation. The 'Do Something with mitigation' changes in travel time plots compared with the 'Do Something' indicate the impact of the proposed transport mitigation on the network at the time of the forecast scenario.

10.3.4 The impacts (positive or negative) at key junctions and roads were considered in respect to journey time and congestion ratios. Results for changes in travel time are generally presented as percentage changes (as opposed to a RAG assessment). If the link affected is quite a short distance, this can show a relatively high percentage in increased delay even though the actual change in travel time can be minor. Therefore, the change in travel time needs to be considered alongside the congestion ratio outputs for the relevant settlements in order to provide a more complete picture of the likely implications of new growth.

11. WHAT THE OUTPUTS TELL US

11.1 Model Outputs

11.1.1 The Countywide Model is the evidence base used to consider the implications of Local Plan allocations on the transport network within Buckinghamshire. The model has also been used to determine and test possible transport improvement measures needed to support the proposed site allocations.

11.1.2 In general, the model outputs demonstrate that where mitigation has been included there has been a reduction in travel times compared to the DM situation. A summary of results is provided for each of the phases referred to above; however the greatest focus is on the most recent phase 4 modelling within the Aylesbury Area which reflects the VALP as now proposed to be modified.

11.2 Phase 1 (July 2016)

11.2.1 A number of settlement areas and strategic routes were identified as experiencing moderate to significant impacts in terms of increases in travel time in the do something scenarios. Without mitigation to alleviate or relieve the identified impacts at these locations, it was considered likely they would experience an increase in congestion and delay as a result of the development outlined in the do something scenarios. A summary of impacts can be seen in Table 26 below.

MODEL AREAS	RAG RATING	COMMENTS
Milton Keynes		Significant increases in travel time in DS2 along the A421 and adjoining roads
Buckingham		Slight increases in travel time on Bourton Road, A413 and Needlepin Way in DS scenarios.
Winslow		Significant increases in travel time in the DS2 with additional development to the North of Winslow. Travel time increases in and around Horwood and Little Horwood
Aylesbury		Moderate increases in travel time in the DS scenarios to the South and East of Aylesbury, particularly on the A413, A41, A418 and B4443. Amber rating given as model is known to over-estimate congestion in this area.
Haddenham		With additional development present in the DS1 there are large increases in travel time on Woodways Road and Ford Road to the East of the town, as well as on the A4129 in the direction of Thame.
Wendover		Moderate increase in travel time on the B4009 through Wendover in the DS scenario

Table 26: Phase 1 Impact Summary Table

11.2.2 The key settlement areas which appeared to experience the biggest increases in journey times as a result of development in the DS scenarios include west of Milton Keynes, Winslow and Haddenham.

11.2.3 Settlement areas and associated links which have been assigned a red or amber rating were subject to further investigation and modelling through the next phase of the assessment.

11.3 Phase 2 (March, 2017)

11.3.1 Table 27 below summarises the results of the modelling for the settlement areas and corridors within Aylesbury Vale. It is important to note that the table highlights the extent to which the mitigation has been successful at reducing the impacts observed in the DS scenario across the geographic area.

MODEL AREAS	DS RAG RATING	DS+ MITIGATION RAG RATING	COMMENTS
Milton Keynes			Significant reductions in delays on the A421 due to dualling, the new grid road and the Bletchley bypass. Some additional queuing on minor roads as a result of increased demand flows on the A421.
Winslow			New development spine road and relief road lead to reductions in journey time in Winslow, but still significant congestion on routes to A421, and at the A421/ Spine Road Roundabout.
Aylesbury			Reductions in journey times on most corridors approaching Aylesbury as well as in town centre due to reassignment onto orbital routes, with exception of A418 Oxford Road where the Roundabout with the new western link roads is operating over capacity.
Haddenham			Significant additional congestion on A418 to Thame compared with DM, but reduced in the DS with mitigation as a result of improvements at the Thame Roundabout and around Aylesbury.
Wendover			Reductions in travel time and congestion on the B4009 through Wendover in the DS+ mitigation scenario.

Table 27: Phase 2 Impact Summary Table

11.3.2 The settlement area that is most constrained as a result of development in the DS with mitigation scenario is Haddenham. Haddenham remains significantly constrained, with the mitigation measures identified being insufficient to address congestion on the A418. 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 Do Minimum scenario when mitigation measures are included. Milton Keynes and Winslow areas now show less congestion.

11.4 Phase 3 (August, 2017)

11.4.1 The A421 dualling and the Bletchley Bypass mitigation proposals were tested together in Phase 2 of the Countywide modelling, which showed significant reductions in delays on the A421 due to dualling, the new grid road and the Bletchley Bypass. However, these options were not taken forward together. Phase 3 tested what the contribution of each of the schemes provided by way of

mitigation and so they were tested independently, one each in the different with mitigation scenarios.

11.4.2 There are significant travel time increases on the A421 near Milton Keynes, 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. A summary of impacts can be seen in Table 28.

MODEL AREAS	DS RAG RATING	RUN 1 RAG RATING	RUN 2 RAG RATING	COMMENTS
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 increases with the local plan development scenario in place. As a result no mitigation options have been tested in this area. 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.
Aylesbury				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 increases are greater compared with phase 2, due to an increase in traffic to the Woodlands development from the west on the A41. 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.
Haddenham				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. 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.

MODEL AREAS	DS RAG RATING	RUN 1 RAG RATING	RUN 2 RAG RATING	COMMENTS
Wendover				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. 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.
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 28: Phase 3 Impact Summary Table

11.4.3 For Winslow the new development spine road and relief road lead to reductions in journey times, but still significant congestion on routes to the A421 and at the A421/ Spine Road Roundabout. There are reductions in journey times on most corridors approaching Aylesbury as well as in the town centre due to reassignment onto orbital routes, with the exception of A418 Oxford Road where the roundabout with the new western link roads is operating over capacity. There is significant additional congestion on the A418 to Thame compared with DM, but this is reduced in the DS with mitigation as a result of improvements at the Thame Roundabout and around Aylesbury. Lastly there are overall reductions in travel time and congestion on the B4009 through Wendover in the DS with mitigation scenario.

11.4.4 As shown in Table 28, the tests for the A421 impacts showed that neither the A421 dualling option nor the Bletchley Bypass showed significant benefits in isolation and so neither option was taken forward. The options were also not considered together given that their delivery would be unviable on the basis of the dwelling numbers proposed.

11.5 North East Bucks Local Plan Tests (May, 2019)

11.5.1 The results show that there are likely to be no further negative impacts in terms of increased journey times and congestion in the area, than was observed as in the previous Phase 3 work. 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, with general increases along the A421, due to increased demand flow facilitated by the Bletchley Bypass and the new grid road. There is however a general decrease in travel time along Stoke Road.

11.5.2 The results of the removal of the Bletchley Bypass show that there is an increase in congestion on roads in close proximity to where the proposed Bypass would join the existing infrastructure, such as Stoke Road. There is slightly more congestion along the A421 corridor specifically in the PM peak. The RAG results of the modelling for each scenario can be seen in Table 29 below.

SCENARIO	DS RAG RATING	WITH MITIGATION RAG RATING	COMMENTS
DS1			The roads impacted by the local plan in NE Aylesbury in the DS1 scenario are the A421, Coddimoor Lane and Whaddon road. These have significant increases in travel times. However, Stoke Road is impacted positively observing a decrease in travel time in the DS1 scenario. The run 1 mitigation adds to travel times, due to increased demand on the A421 as a result of new infrastructure.
DS2			DS2 follows a similar pattern to DS1. There are further significant increases in travel on Whaddon Road where it joins the A421. The with mitigation scenario shows a decrease in travel time along Stoke Road, however there is an increase in travel time on the A421 between Standing Way/Whaddon Road roundabout and Coddimoor Lane which is not seen in the DS1 with mitigation.
DS3			There are travel time increases in both the AM and PM peak, especially significant on the A421 in the PM. Coddimoor Lane observes only slight increase in travel time and the A421 has a significant increase in travel time on the A421 which is greater than that of DS2. The 'with mitigation' shows the same CTT as DS1 and DS2.
DS4			In the DS4 scenario there is less increase in travel time than in DS1-3, albeit the increases are still significant. The majority of impact falls on the Milton Keynes side of the district boundary. There is a significant increase in travel on Whaddon Road where in joins the A421. In the with mitigation scenario there are increases along the A421 as with the other mitigation scenarios, increases in travel time of Coddimoor Lane but decreases on Stoke Road.
DS5			DS5 shows similar increases in travel times as all other scenarios. However, the impacts on Coddimor Lane are not quite as severe. The 'with mitigation' scenario shows a greater increase in travel time along the A421, however there is a significant decrease in travel time on Stoke Road.

Table 29: Impact Summary Table – NE Aylesbury Vale District

11.5.3 In addition to the results provided in Table 29, a RAG rating has been applied to qualitatively assess the impact on traffic from each of the three developments in North East Bucks. To assess the individual impact of each development, appropriate 'with development' and 'without development' DS and DS mitigation scenarios were chosen for comparison. **Error! Reference source not found.** summarises the individual impact of each development:

DEVELOPMENT	COMPARISON	DS RAG RATING	WITH MITIGATION RAG RATING	BLETCHLEY BYPASS REMOVAL	COMMENTS

Shenley Park	DS2 (with development) vs DS4 (without development)				There are moderate increases in journey times along the A421 corridor when the development is included.
Salden Chase Extension	DS3 (with development) vs DS (without development)				There are moderate increases in journey times along the A421 corridor when the development is included.
Eaton Leys	DS2 (with development) vs DS (without development)				The development has a slight impact on journey times along the A421 corridor and A5 corridor.

Table 30 - Individual development impacts summary table

11.5.4 Reviewing the extracted plots and overall traffic patterns in the models shows that of the developments that were assessed, Eaton Leys has the least impact on traffic in the NE of the Aylesbury Vale district.

11.6 Phase 4 (May, 2020)

11.6.1 The Phase 4 Local Plan assumptions were tested in the Countywide Strategic Model to determine the implications on the transport network. The model was also used to indicate the extent to which the proposed transport improvement measures identified in proposed amended policy T3 are likely to mitigate the impacts of the updated Local Plan assumptions.

11.6.2 A summary of the phase four model outputs can be seen in Table 31 below:

MODEL AREAS	DS RAG RATING	RUN 1a RAG RATING	COMMENTS
Aylesbury			There are significant travel time increases in the DS scenario with the local plan development in place and the absence of mitigation scenarios, particularly to the East and South of the town The inclusion of the mitigation schemes in Run 1a results in improvements on the Lower Road and A41 corridors compared to the DM. There are some pockets where travel times are higher than in the DM however the net effect is that congestion levels overall are no worse than in the DM, and are arguably improved.
Milton Keynes			There are moderate travel time increases in the DS scenario on the A421 and adjoining minor roads like Coddimoor Lane and Whaddon Road. The mitigation schemes offer only a marginal level of improvement such that the impact of the mitigation scenario compared to the DM is largely unchanged

Table 31: Phase 4 Impact Summary Table

11.6.3 In Aylesbury, the modelling shows that the mitigation measures RAG rating is green. The modelling demonstrates that the mitigation measures are effective at limiting the significant effects of Local Plan development. Notable benefits are observed to the south east of Aylesbury on the A41 corridor and on the Lower Road corridor where the addition of the orbital mitigation links allows reassignment away from the radial corridors. There are pockets of Aylesbury which are indicated to experience increased congestion in the mitigation scenario, most notably small sections on New Road, A413 Wendover Road and the Stocklake Urban link road, however, these are not extensive and considering Aylesbury as a whole, the net effect of the mitigation scenario on congestion is positive.

11.6.4 To the south-west of Milton Keynes, Local Plan development has a moderate negative impact on congestion with travel time increases on the A421 and some adjoining roads. These impacts largely remain in the mitigation scenario. However, given that the impacts are moderate rather than significant these should be considered alongside the planning merits of the allocation. It should be noted that the RAG rating has changed from red in Phase 3 to amber in Phase 4 due to some improvements to journey times as a result of the overall housing numbers reducing for the Phase 4 assessments.

12. SHENLEY PARK DEVELOPMENT

12.1.1 The requirement to allocate a site in close proximity to Milton Keynes resulted from the Inspector's Interim Findings on the basis that the VALP spatial strategy and the associated allocations did not fully recognise the strategic role of Milton Keynes. A site selection process was carried out as part of the preparation of the main modifications. Further assessment of the Shenley Park proposal is contained within this chapter.

12.1.2 In order to establish and quantify the moderate impact of the Shenley Park development it is useful to interrogate the various model outputs in further detail. This includes further analysis of the Flow Difference Plots, the Congestion Ratio outputs and the Travel Time Changes. Further analysis on each output in included below:

Travel Time Changes

12.1.3 The plots below (Figures 5 & 6) show the differences in link travel times between the DM and the DS with mitigation (Run 1a) scenarios as a percentage. The change is only shown for those links on which the travel time is more than twice the free flow time in either scenario, or in other words, those links for which the congestion ratio is greater than 2.

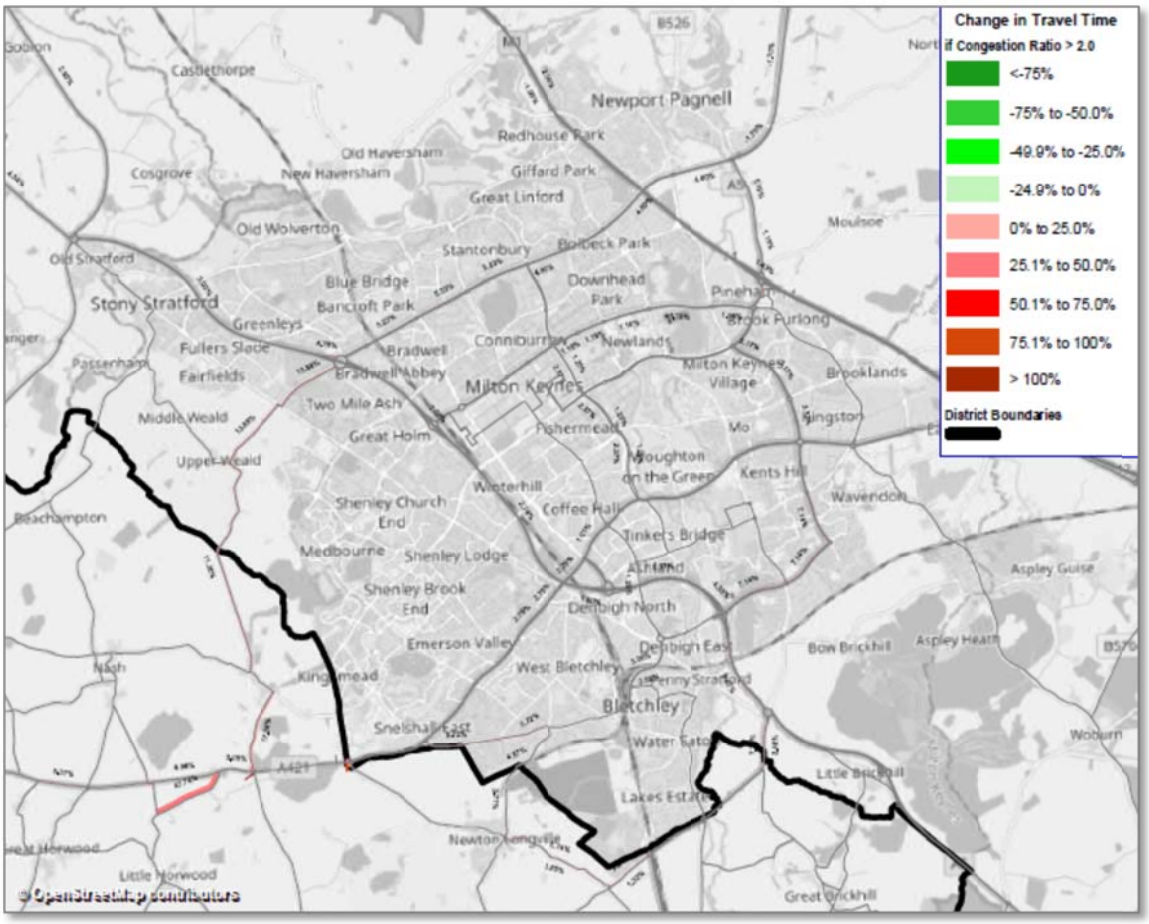

Figure 5: 2033 DS Run 1a scenario travel times – AM Peak

12.1.4 Figure 5 above shows that in the AM 2033 DS Run 1a scenario travel times are increased in close proximity to the Shenley Park site on Coddimoor Lane and Warren Road, which is to be expected. It is however evident that as you move away from the site, within Milton Keynes and towards Newton Longville to the south and Whaddon to the north, the changes to travel time are not of a significant level and do not therefore show up in the data extracts.

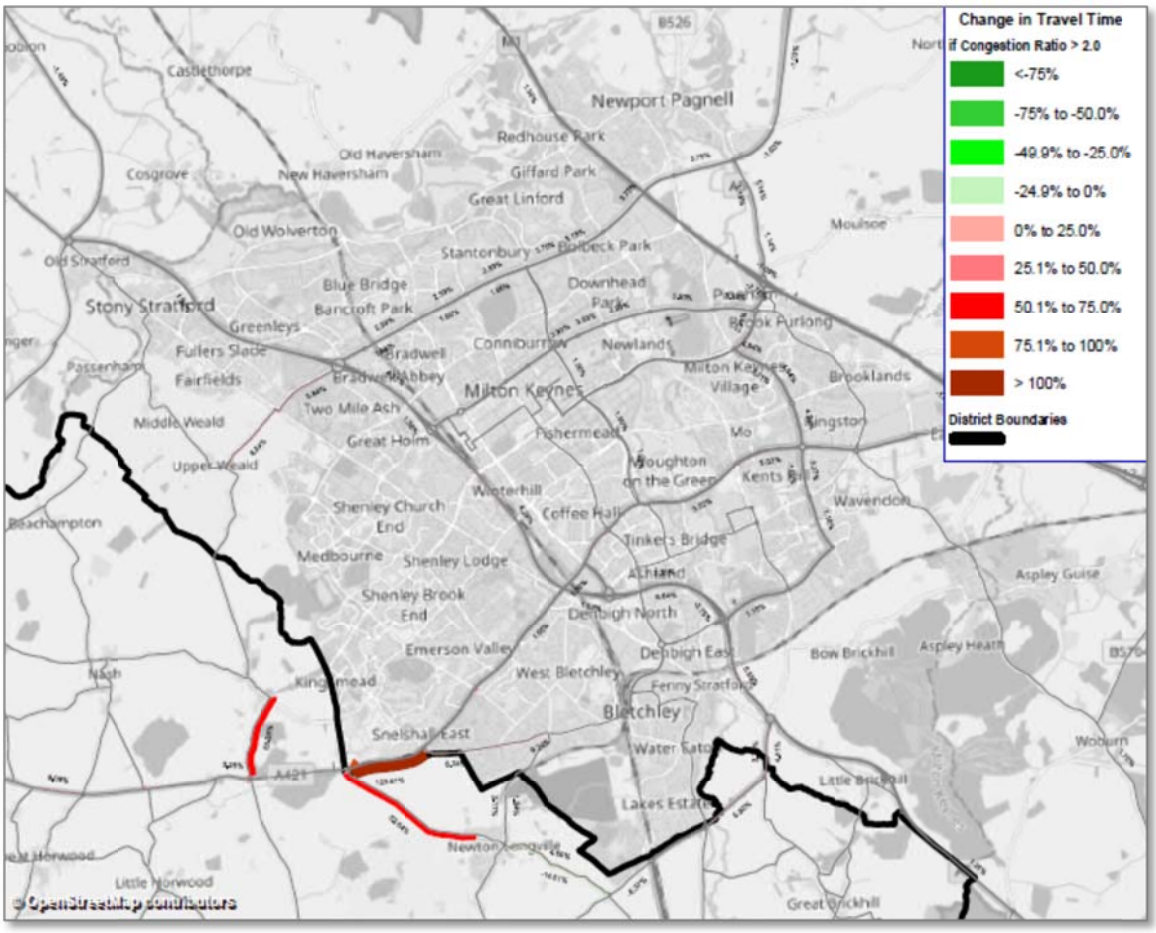

Figure 6: 2033 DS Run 1a scenario travel times – PM Peak

12.1.5 Figure 6 above shows that in the PM 2033 DS Run 1a scenario travel times again increase along Coddimoor Lane, the A421 and Whaddon Road in close proximity to the Shenley Park site, however as with the AM peak hour scenario, the changes to travel time quickly become less significant as you move further away from the site and into Milton Keynes and Whaddon itself.

Congestion Ratios

12.1.6 Figure 7 below shows the congestion ratio outputs for the AM peak hour DM scenario.

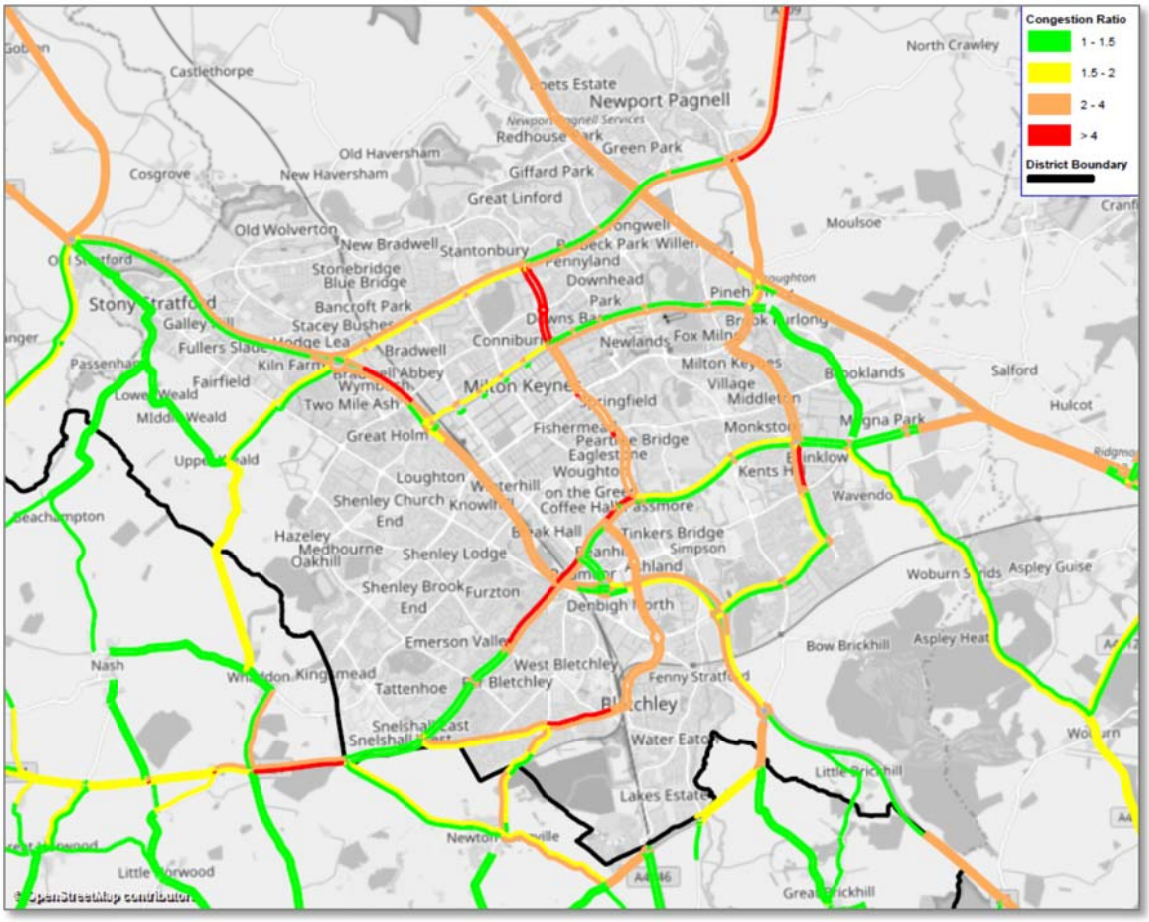

Figure 7: 2033 DM scenario Congestion Ratio – AM Peak

12.1.7 It is evident from the above extract that there are a number of links, particularly within Milton Keynes, that are already subject to congestion, with the ratios showing orange (2 – 4) and red (>4) in a number of locations. As a result, those links that are already showing congestion are likely to be very sensitive to even minor changes in traffic flows. Therefore, a link that shows a change from Orange to Red when development traffic is added is not necessarily subject to a material increase in flows, it may be that the link is already subject to congested conditions, and thus even a small (non-material) increase could trigger a change.

12.1.8 In order to provide a direct comparison, the congestion ratio outputs for the AM peak hour DS Run 1a scenario are included overleaf.

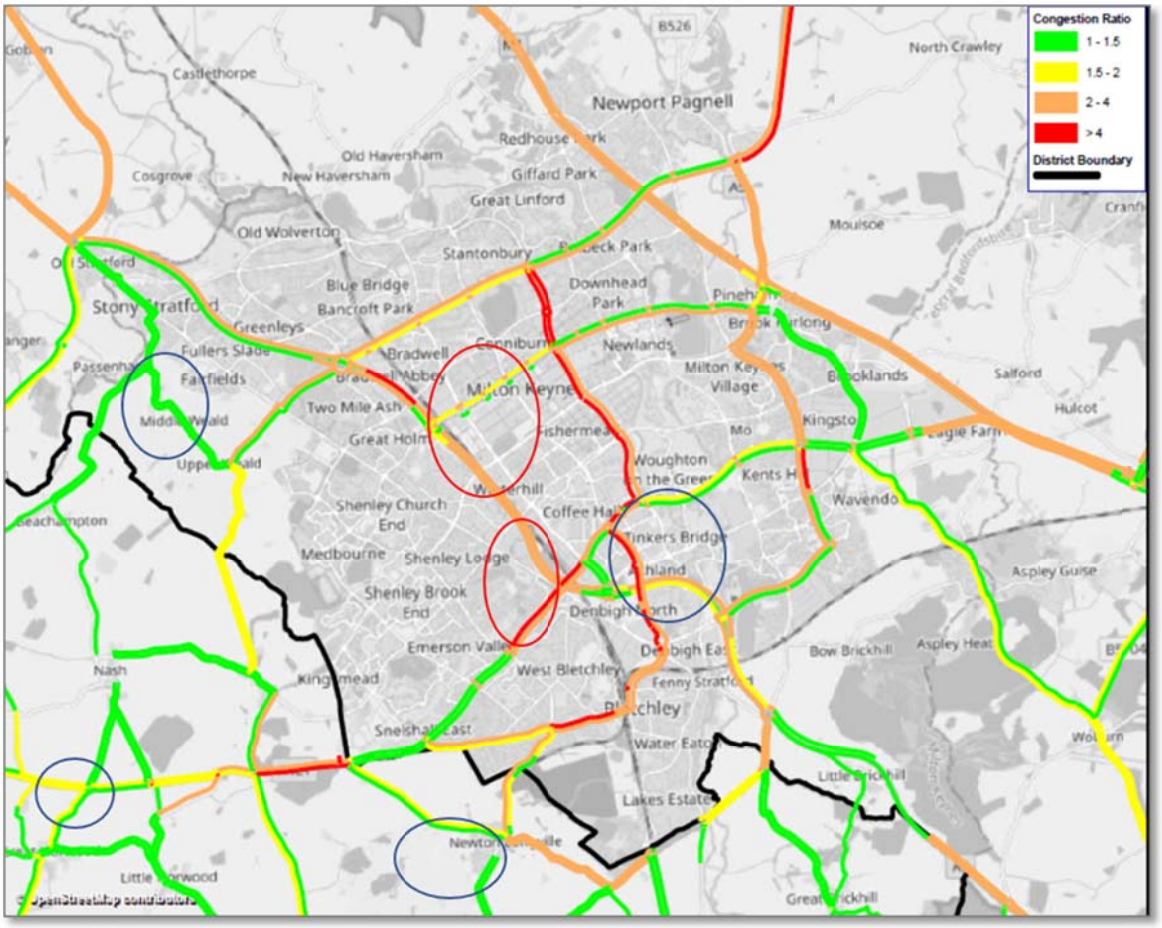

Figure 8: 2033 DS Run 1a scenario congestion ratio – AM Peak

12.1.9 A direct comparison between the two outputs (Figure 7 & 8) for the AM peak period shows that in the DS Run 1a scenario there are only limited locations where congestion ratios increase. The main area (circled in red on Figure 8 above) is on the links along the B4034 link through the centre of Milton Keynes, which is shown to change from orange to red in the northbound direction. The fact that these links were already shown to have an orange level of congestion means that they would be likely to be more sensitive to even small changes in the levels of flow.

12.1.10 It is also evident in the DM scenario that the section of the B4034 to the north of the A509 is already subject to red levels of congestion ratio; therefore, as explained above, a slight increase to the level of traffic flow could trigger an increase to the congestion ratio of the joining links to the south. There are also only limited locations (circled in blue) where the congestion ratios increase from yellow to orange. It is again important to note that these links are already subject to levels of congestion, therefore are more sensitive to changes in levels of traffic flow. Figure 9 below shows the congestion ratio outputs for the PM DM scenario.

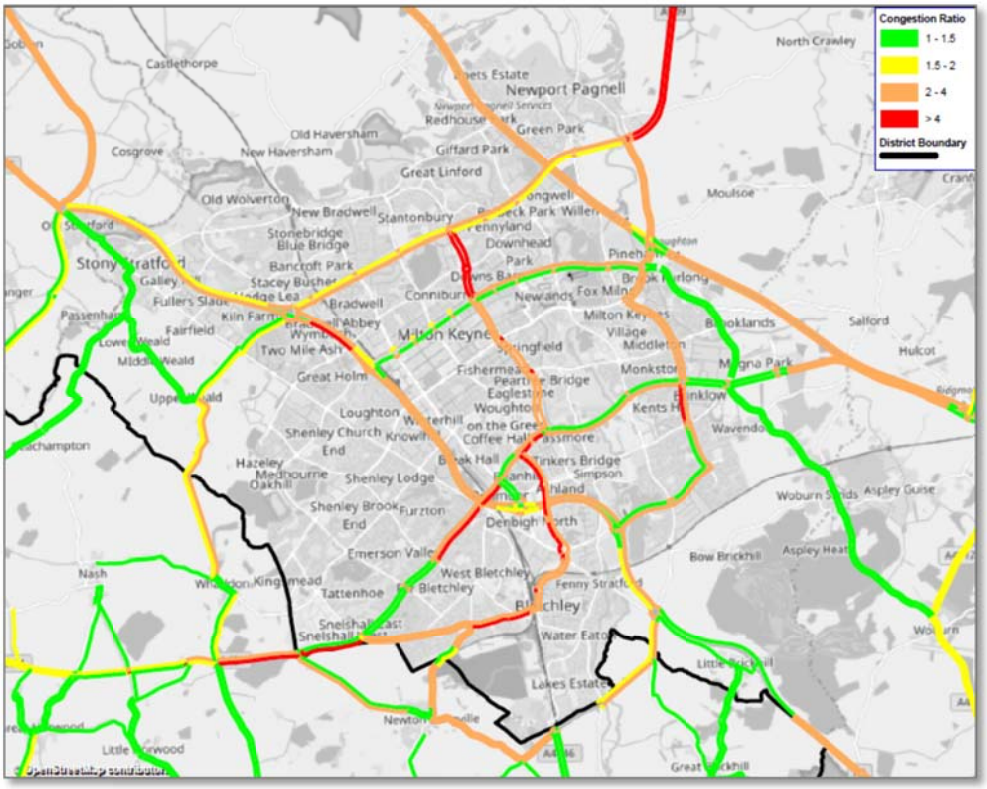

Figure 9: 2033 DM scenario congestion ratio – PM Peak

12.1.11 As with the AM 2033 DM scenario, the PM scenario also shows that there are a number of links within Milton Keynes that are already showing red congestion ratio levels, meaning that these links are likely to be more sensitive to changes in traffic flow levels. There are also a number of links within Milton Keynes that are already subject to orange congestion ratio levels.

12.1.12 To provide a direct comparison with the PM DM scenario, the PM DS Run 1a congestion ratio output is shown in Figure 10 below.

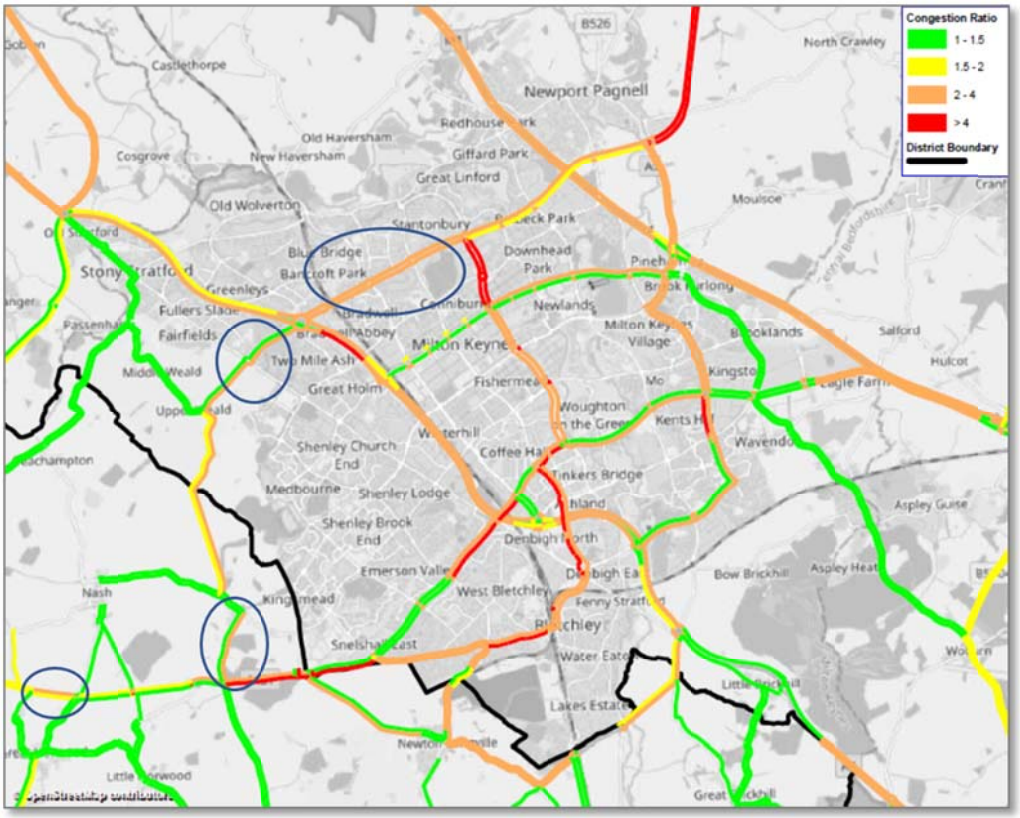

Figure 10: 2033 DS Run 1a scenario congestion ratio – PM Peak

12.1.13 It is evident after comparing the two data sets that there appears to be no additional links subject of red levels of congestion ratios with the addition of development traffic, despite there being a number of links already subject to orange levels of congestion ratios. It is also evident that there are only a limited number of links (circled in blue) where the congestion ratios have increased from yellow to orange. Overall it does not appear that there is a significant change in the levels of congestion ratios within Milton Keynes in the PM peak as a result of development traffic.

12.1.14 In order to better understand what the changes in congestion ratios actually mean, and what changes to traffic flow levels have resulted in the congestion ratio increase, it is useful to look at the difference in actual flows between the two scenarios.

Flow Differences

12.1.15 As stated above, in order to better understand what the impacts are of the increases in congestion ratios, it is useful to look at the difference in flows, between the DM and DS Run 1a scenarios, along the links around the proposed Shenley Park site and within Milton Keynes.

12.1.16 The extracts below show the actual flows and changes to flows as a direct result of Local Plan development, including development at Shenley Park and mitigation measures. The extracts are concentrated around the area of the Shenley Park development and show the difference in flows to the east of the site, heading into

Milton Keynes and also to the south of the site towards Newton Longville and north towards Whaddon.

Figure 11: 2033 DM scenario actual flows – AM Peak

12.1.17 Figure 11 above shows the actual flows in the AM 2033 DM scenario, while the extract below shows the difference in flows between the AM 2033 DS Run 1a and the AM 2033 DM scenarios.

Figure 12: Difference in flows between the 2033 DS Run 1a and the 2033 DM scenarios – AM Peak

12.1.18 The access to the Shenley Park site is marked on Figure 12 above.

12.1.19 Figure 13 below shows the actual flows in the 2033 PM DM scenario.

Figure 13: 2033 DM scenario actual flows – PM Peak

12.1.20 Figure 14 below shows the difference in flows between the 2033 PM DM scenario and the 2033 PM DS Run 1a scenario.

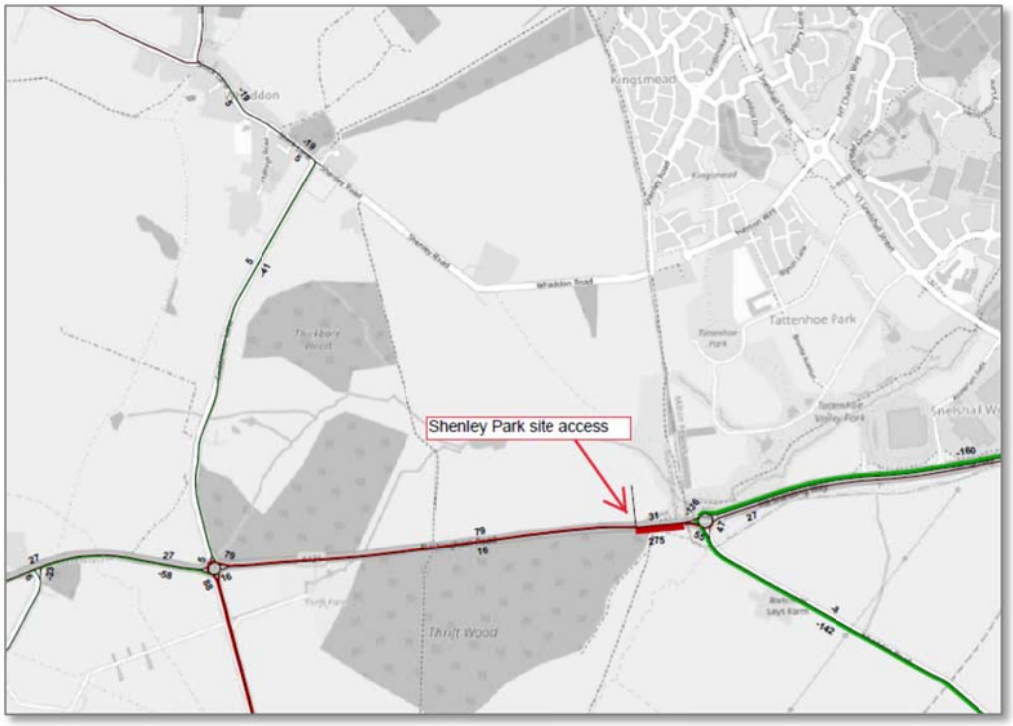

Figure 14: Difference in flows between the 2033 DS Run 1a and the 2033 DM scenarios – PM Peak

Changes to flows in the vicinity of the site access

12.1.21 The comparisons below quantify the differences in AM and PM flows on the A421 away from and towards the site access, as percentages of total flows.

	AM FLOWS	PM FLOWS
DM	1,563	1,419
DS Run 1a	1,743	1,450
Difference	180	31
Percentage Change	11.5%	2.2%

Table 32: Eastbound flows on A421 to east of Shenley Park access (towards MK)

	AM FLOWS	PM FLOWS
DM	1,284	1,326
DS Run 1a	1,411	1,601
Difference	127	275
Percentage Change	9.9%	20.7%

Table 33: Westbound flows on A421 to east of Shenley Park access (away from Milton Keynes)

	AM FLOWS	PM FLOWS
DM	2,847	2,745
DS Run 1a	3,154	3,051
Difference	307	306
Percentage Change	10.7%	11.1%

Table 34: Two-way flows on A421 to east of Shenley Park access

	AM FLOWS	PM FLOWS
DM	1,563	1,419

	AM FLOWS	PM FLOWS
DS Run 1a	1,635	1,498
Difference	72	79
Percentage Change	4.6%	5.6%

Table 35: Eastbound flows on A421 to west of Shenley Park access (towards site access)

	AM FLOWS	PM FLOWS
DM	1,181	1,108
DS Run 1a	1,197	1,124
Difference	16	16
Percentage Change	1.4%	1.4%

Table 36: Westbound flows on A421 to west of Shenley Park site access (away from site access)

	AM FLOWS	PM FLOWS
DM	2,744	2,572
DS Run 1a	2,832	2,622
Difference	88	95
Percentage Change	3.2%	3.7%

Table 37: Two-way flows on A421 to west of Shenley Park access

12.1.22 **AM Impact** – It is evident from the tables above that the proposed development at Shenley Park will have a maximum impact of 11.5% on existing flows on the A421, which is in the eastbound direction on the link to the east of the access. However, when taking the two-way way flows on the same link, the impact is 10.7%. This increase in flows is not considered to be material and is likely to further reduce as the development traffic disperses beyond the local junctions and onto the wider network.

12.1.23 **PM Impact** – It is evident from the tables above that the proposed development at Shenley Park is not shown to be material on three of the four flow directions leading to and from the site access. The A421 westbound flows to the east of the site access experience a 20.7% increase, however this increase is unsurprising as the link is immediately adjacent to the site access. When taking into account the impact on the two-way flows on this link, it can be seen that this is only 11.1%. Any measure to mitigate the impact of this increase can be dealt with through the planning process when an application is submitted.

Changes to flows at the Bottledump roundabout

12.1.24 The tables below look at the changes in flows at the Bottledump roundabout located to the east of the site access. The eastbound and westbound flows to the west of the Bottledump roundabout are included in Tables 31 and 32 above.

	AM FLOWS	PM FLOWS
DM	1,868	1,760
DS Run 1a	2,039	1,920
Difference	171	160
Percentage Change	9.2%	9.1%

Table 38: Eastbound flows on A421 to east of roundabout (into Milton Keynes)

	AM FLOWS	PM FLOWS

	AM FLOWS	PM FLOWS
DM	1,780	1,568
DS Run 1a	1,771	1,595
Difference	-9	27
Percentage Change	-0.5%	1.7%

Table 39: Westbound flows on A421 to east of roundabout (away from Milton Keynes)

	AM FLOWS	PM FLOWS
DM	3,648	3,328
DS Run 1a	3,810	3,515
Difference	162	187
Percentage Change	4.4%	5.6%

Table 40: Two-way flows on A421 to east of roundabout

	AM FLOWS	PM FLOWS
DM	544	272
DS Run 1a	560	264
Difference	16	-8
Percentage Change	2.9%	-2.9%

Table 41: Southbound flows on Whaddon Road to south of roundabout (towards Newton Longville)

	AM FLOWS	PM FLOWS
DM	352	402
DS Run 1a	419	260
Difference	67	-142
Percentage Change	19%	-35.3%

Table 42: Northbound flows on Whaddon Road to south of roundabout (away from Newton Longville)

	AM FLOWS	PM FLOWS
DM	896	674
DS Run 1a	979	524
Difference	83	-150
Percentage Change	9.3%	-22.3%

Table 43: Two-way flows on Whaddon Road to south of roundabout

12.1.25 **AM Impact** – The tables above show that the impact of the development flows on each arm of the junction is generally less than 10%. It is noted that the impact on the northbound flows on Whaddon Road to the south of the junction is 19%, however the flows in the DM scenario are only 352 vehicles throughout the whole hour period, therefore a relatively small increase in traffic could have a large percentage change. In reality, the addition of 67 vehicles spread throughout the entire hour period on top of what is already a relatively low flow, is unlikely to have a material impact on how this link currently operates. Further to this, if the impact on the two-way flows is taken into account then this is only shown to be 9.3%.

12.1.26 **PM Impact –** The tables above show that the impact on all arms on the junction are generally below 10%. The increase of 20.7% to the westbound flows to the west of the junction, as shown in Table 1 above, is already explained in the paragraph covering the PM Impact in the vicinity of the site access junction. It is also evident

that Whaddon road is subject to a reduction to flows in both directions, with a 35.3% reduction seen to the northbound flows to the south of the junction, which is likely to be as a result of the reassignment of traffic due to the presence of the Shenley development and its associated traffic.

Changes to flows at the A421/Coddimoor Lane/Whaddon Road junction

12.1.27 The tables below look at the changes in flows at the A421/Coddimoor Lane/Whaddon Road roundabout junction. The changes in flows on the A421 to the east of this junction are already covered in Tables 3 and 4 above.

	AM FLOWS	PM FLOWS
DM	1,157	1,131
DS Run 1a	1,184	1,158
Difference	27	27
Percentage Change	2.3%	2.4%

Table 44: Eastbound flows on A421 to west of roundabout (towards Shenley Park site)

	AM FLOWS	PM FLOWS
DM	1,007	1,003
DS Run 1a	1,059	945
Difference	52	-58
Percentage Change	5.2%	-5.8%

Table 45: Westbound flows on A421 to east of roundabout (away from Shenley Park site)

	AM FLOWS	PM FLOWS
DM	2,164	2,134
DS Run 1a	2,243	2,103
Difference	79	-31
Percentage Change	3.7%	-1.5%

Table 46: Two-way flows on A421 to west of roundabout

	AM FLOWS	PM FLOWS
DM	401	520
DS Run 1a	462	525
Difference	61	5
Percentage Change	15.2%	1%

Table 47: Northbound flows on Coddimoor Lane to north of roundabout (towards Whaddon)

	AM FLOWS	PM FLOWS
DM	509	536
DS Run 1a	465	495
Difference	-44	-41
Percentage Change	-8.6%	-7.6%

Table 48: Southbound flows on Coddimoor Lane to north of roundabout (away from Whaddon)

	AM FLOWS	PM FLOWS
DM	910	1,056
DS Run 1a	927	1,020
Difference	17	-36
Percentage Change	1.9%	-3.4%

Table 49: Northbound flows on Coddimoor Lane to north of roundabout

	AM FLOWS	PM FLOWS
DM	258	420
DS Run 1a	222	508
Difference	-36	88
Percentage Change	-14%	21%

Table 50: Northbound flows on Whaddon Road to south of roundabout (away from Mursley)

	AM FLOWS	PM FLOWS
DM	391	243
DS Run 1a	545	307
Difference	154	64
Percentage Change	39.4%	26.3%

Table 51: Southbound flows on Whaddon Road to south of roundabout (towards from Mursley)

	AM FLOWS	PM FLOWS
DM	649	663
DS Run 1a	767	815
Difference	118	152
Percentage Change	18.2%	22.9%

Table 52: Northbound flows on Whaddon Road to south of roundabout (away from Mursley)

12.1.28 **AM Impact** – The tables above show a non-material impact on the A421 arms of the junction. The flows on the Coddimoor Lane arm of the junction show a 15.2% increase in the northbound direction (towards Whaddon), but an 8.6% decrease in the southbound direction (away from Whaddon). When the two-way flows on Coddimoor Lane are taken into account it can be seen that there are 910 two-way movements in the DM scenario and 927 two-way movements in the DS Run 1a scenario, which is only an additional 17 two-way movements throughout the whole hour period. This equates to a 1.9% increase to the two-way DM flows toward and from Whaddon, which is not considered to be material.

12.1.29 A similar situation can be seen on the Whaddon Road arm of the junction. The percentage increase on the southbound flows is 39.4%, while there is a 14% decrease on northbound flows. Firstly, it is important to note that the flows in the DM scenario are low, therefore even a modest increase to flows could show a higher impact in percentage terms. Secondly, it is also important to again consider the impact on two-way flows.

12.1.30 On the Whaddon Road arm of the junction the two-way flows are 649 in the DM scenario and 767 in the DS Run 1a scenario, which is an increase of 118 two-way movements over the whole hour period. This equates to an 18.2% increase in two-way flows. While this percentage impact may seem more significant than the impact on other arms of the junction, the flows in the DM scenario are low on this arm, and as suggested above, even a small increase in flows may exaggerate the impact in percentage terms. Further to this, any measures required to mitigate the impact of development will be identified and dealt with as part of the planning process when an application comes forward.

12.1.31 **PM Impact** – The tables above show that there will be a minimal impact on the A421 flows leading to and from the junction both to the east and west of the junction. The change to flows on the Coddimoor Lane arm of the junction show that the development impact in minimal, with a decrease in southbound flows (away from Whaddon) to the north of the junction. The flows on the Whaddon Road arm to the south of the junction show that, in percentage terms, the change in flows appears more material (21% northbound, 26.3% southbound). A review of the DM flows on this arm of the junction show that they are relatively low, with only 243 southbound movements and 420 northbound movements shown over the entire hour. As a result of these low base flows, it is easy for even a relatively modest increase in flows to have a seemingly more significant impact in percentage terms. In reality, an increase of 64 vehicles to the southbound flows and 88 vehicles to the northbound flows, spread over the entire hour period, will still result in flows that are relatively low (307 and 508 vehicles respectively). Any adverse impacts resulting from this increase to flows can be highlighted and dealt with as part of the planning process when an application is submitted.

Shenley Park Summary

12.1.32 It should be noted that the Countywide Model has been used for the Local Plan Assessment to provide a high level indication of the likely scale of impact over a wide area. There will consequently be some level of uncertainty when drilling down into details on specific links, such as traffic flows and increases in traffic flow. The analysis presented therefore contains some level of uncertainty. However, even within this range of uncertainty, it is concluded that the modelling does not indicate any level of impact due to development which could not be suitably addressed as part of the planning process when an application is submitted.

12.1.33 The above information shows that there will be increases to travel times in the vicinity of the proposed Shenley Park site, which is to be expected. There are links, mainly within Milton Keynes, where congestion is shown to increase, however, a review of the change in flows in the vicinity of the site and leading into Milton Keynes has shown that the percentage change in flows leading into and out of Milton Keynes is less than 10%. This suggests that the changes in congestion ratios that take place within Milton Keynes are as a result of smaller increases in traffic on an already congested network, rather than significant development traffic flows resulting in congestion where there is not currently congestion.

12.1.34 While other roads leading to smaller settlements within Buckinghamshire, such as Whaddon and Newton Longville, experience increases in traffic flow levels, some experience decreases, which are likely to be a result of the mitigation measures included in the DS scenario redistributing trips. It is also important to recognise that any adverse impacts on the local highway network that may result from the proposed Shenley Park development will be identified and dealt with as part of the planning process when an application is submitted.

13. HOW THE MODELLING LED TO THE DEVELOPMENT OF POLICY T3

13.1.1 As discussed in section 9, the phase 4 modelling (run 1a) tested the following;

- The revised local plan land use assumptions for Aylesbury Vale.
- The transport mitigation measures to support the Local Plan allocations including a partial orbital route around Aylesbury.
- The benefits of the Shenley Park Link Road.

13.1.2 The mitigation measures were tested in a 'DS with mitigation' scenario to assess the extent to which they offset the development impacts. Table 24 (section 9 above) sets out the mitigation measures included in each scenario. The DS with mitigation scenario and the DS scenario were then compared against the DM scenario from Phase 3 (which was itself unchanged from Phase 2). The assessment was based on a comparison between the scenarios in terms of changes to congestion and travel time.

13.1.3 The mitigation measures tested in phase 4 consisted of measures shown in previous phases of modelling to be required to unlock strategic housing and employment floorspace. The phase 4 modelling demonstrates that the tested infrastructure package is essential to deliver the sustainable growth identified in the Local Plan. For this reason, Policy T3 incorporates infrastructure that has been tested, is required, and is subject to known delivery mechanisms. Table 53 below summarises the essential protected and supported transport schemes under the further modified Policy T3:

EVIDENCE BASE	REQUIRED MITIGATION MEASURES	DELIVERY PARTNER	DELIVERY MECHANISM /FUNDING
AYLESBURY			
Kingsbrook Masterplan/Aylesbury Transport Strategy	Stocklake improvement (rural section) and Eastern Link Road (N)	BC/ Developer	Developer contributions
Kingsbrook and Woodlands Masterplans/ Aylesbury Transport Strategy	Aylesbury, Eastern Link Road (S)	Bucks Advantage /Developer	Developer contributions/BC Capital Fund/LGF
Buckinghamshire County Model/Aylesbury Transport Strategy	Southern Link Road (dual carriageway between A41 and A413)	BC/ Developer	Developer contributions
Buckinghamshire County Model/Aylesbury Transport Strategy/HS2 Hybrid Bill	Stoke Mandeville A4010 Realignment	HS2	HS2
Buckinghamshire County Model/Aylesbury Transport Strategy/ DfT Retained scheme	South East Aylesbury Link Road (A413 to B4443 Lower Road dual carriageway) (SEALR)	BC	Developer contributions/HS2/LGF
Buckinghamshire County Model/Aylesbury Transport Strategy	South East Aylesbury Link Road Phase 2 (dualling of link between SW Aylesbury Link Road and Lower Road)	HS2/BC	HS2/ Developer contributions/BC

Buckinghamshire County Model/Aylesbury Transport Strategy	South West link (between Stoke Mandeville A4010 realignment and A418)	Developer	Developer contributions
Aylesbury Transport Strategy	Priority Public Transport Corridor A41 Bicester Road	BC	Developer contributions
Aylesbury Transport Strategy	Priority Public Transport Corridor A41 Tring Road	BC	Developer contributions
Aylesbury Transport Strategy/Aylesbury Garden Town	Aylesbury town centre improvements to the pedestrian network and public realm: a. Cambridge Street b. Exchange Street c. Friarage Road d. Vale Park Drive e. Upper Hundreds Way f. Walton Street g. Canal Basin h. Town Centre cycle parking	BC	Developer contributions / grants
Aylesbury Transport Strategy	Remodelling the bus station to increase capacity and reconfiguring of the pedestrian access between the railway station/bus station and town centre.	BC/EWR/Developers	EWR Consortium/DfT/Network Rail/BC/CIL/Other
Aylesbury Transport Strategy	Aylesbury town-wide cycle network improvements	BC, Sustrans	Developer contributions
National Infrastructure Commission -"Partnering for Prosperity: A new deal for the Cambridge Milton Keynes-Oxford Arc"	East West Rail – Bicester, to Winslow, MK and Aylesbury. Includes new station at Winslow.	NIC	EWR Consortium/DfT/Network Rail/ BC/CIL/Other
Aylesbury Transport Strategy	Traffic calming on Prebendal Avenue to reduce rat-running between A418 and Stoke Road	BC/Developers	Developer contributions /BC/CIL/Other
BUCKINGHAM			
Buckingham Transport Strategy	Route upgrade on the A421 and A413 to dual – 2 lane standard (between Radcliffe Road roundabout and A421/A413 roundabout (east))	Developers	Developer contributions and grant funding
Buckingham Transport Strategy	Buckingham Left turn slip at A422/A413/Stratford Road roundabout	Developers	Developer contributions
Buckingham Transport Strategy	Buckingham Town-wide cycle network improvement	BC, Sustrans	Developer contributions
Buckingham Transport Strategy	Buckingham to Silverstone Park cycle route	BC, Sustrans	Developer contributions

Buckingham Transport Strategy	Infrastructure to facilitate increase in bus frequency to Winslow Station	BC, Bus operators, EWR Alliance	Operators – possible commercial service
EDGE OF MK (NORTH EAST AYLESBURY VALE)			
Buckinghamshire County Model	New roundabout access on A421 to serve Shenley Park, and subject to more detailed traffic modelling possible dualling between new access and Bottledump roundabout and link road through the site connecting the A421 with H6 and/or H7	MK, BC, Developers	Developer contributions

13.1.4 The transport schemes set out in the Table above are reflected in an updated policy T3 as proposed to be modified. This incorporates a number of additional changes to T3 which are required to reflect the results of the Phase 4 (run 1a) modelling. Table 54 below sets out the changes compared to T3 as originally proposed to be modified (November 2019) and the reasons for the amendments. Throughout table references to BCC and AVDC have been replaced with Buckinghamshire Council (BC) to reflect new organisation. References to status of critical/necessary have been removed.

Evidence Base	Required Works	Delivery Partner	Indicative Cost	Delivery Mechanism /Funding	Anticipated Date /timescales	Status	Change in Further Modified T3 (Sep 2020)	Reason for Change
AYLESBURY	**AYLESBURY**	**AYLESBURY**	**AYLESBURY**	**AYLESBURY**	**AYLESBURY**	**AYLESBURY**	**AYLESBURY**	**AYLESBURY**
Kingsbrook Masterplan/Aylesbury Transport Strategy	Stocklake improvement (rural section) and Eastern Link Road (N)	~~BCC, AVDC~~ BC/ Developer	£11-19m	Developer contributions	Being built as part of s38 – likely to be completed by 2021	~~Critical~~		Clarification
Kingsbrook and Woodlands Masterplans/ Aylesbury Transport Strategy	Aylesbury, ~~remainder of~~ Eastern Link Road (S)	Bucks Advantage/ Developer	Approx. £38m	Developer contributions/BC~~C~~ Capital Fund/LGF	Completed 5 years after work commences of 1st home ~~(by 2021)~~	~~Critical~~		Clarification
~~Buckinghamshire County Model/Aylesbury Transport Study~~	~~North East Link Road/ Aylesbury~~	~~BCC, AVDC, LEP~~	~~Approx. £35m~~	~~Through Oxford-Cambridge Expressway~~	~~By 2033~~	~~Necessary~~	Deleted	Phase 3 modelling report demonstrated that this link was not essential infrastructure to mitigate VALP growth and it was removed from submitted VALP.
Buckinghamshire County Model/Aylesbury Transport Study	Southern Link Road (dual carriageway between A41 and A413)	~~BCC, AVDC,~~ BC/ Developer	Approx. £17+m	Developer contributions	By 2023	~~Critical~~		Clarification
Buckinghamshire County Model/Aylesbury Transport Study/HS2 Hybrid Bill	Stoke Mandeville A4010 Realignment	HS2		HS2	By 2023	~~Critical~~		Clarification
Buckinghamshire County Model/Aylesbury Transport Study DfT Retained scheme	Aylesbury South East Link Road (A413 to B4443	BC~~C Developer~~	£23,550,000	Developer contributions/HS2/LGF	By 2023	~~Critical~~		Clarification

Evidence Base	Required Works	Delivery Partner	Indicative Cost	Delivery Mechanism /Funding	Anticipated Date /timescales	Status	Change in Further Modified T3 (Sep 2020)	Reason for Change
	Lower Road dual carriageway) (SEALR)							
Buckinghamshire County Model/Aylesbury Transport Study	South West link (between Stoke Mandeville A4010 realignment and A418)	Developer	£14m-£31m	Developer contributions	Medium Term (2018 – 2023)	~~Critical~~		
Buckinghamshire County Model/Aylesbury Transport Study	South East Aylesbury Link Road Phase 2 (dualling of link between SW Aylesbury Link Road and Lower Road)	HS2/BC	TBC	HS2/ Developer contributions/BC	By 2023		Required	Further work carried out in support of SEALR has demonstrated this is essential infrastructure to support VALP growth
~~Buckinghamshire County Model/Aylesbury Transport Study~~	~~Western link (between A418 and A41)~~	~~BCC, AVDC, LEP~~	~~£11m-£23m~~	~~Likely to require grants (i.e. DfT)~~	~~Long term (by 2033)~~	~~Critical~~	Deleted	Phase 3 modelling report demonstrated that this was not essential infrastructure to mitigate VALP growth and it was removed from submitted VALP.
Aylesbury Transport Strategy	Priority Public Transport Corridor A41 Bicester Road	BC~~C~~	£7m	Developer contributions	Initial works by 2020	~~Necessary~~		
Aylesbury Transport Strategy	Priority Public Transport Corridor	BC~~C~~	£8m	Developer contributions	Long term by 2033	~~Necessary~~		

Evidence Base	Required Works	Delivery Partner	Indicative Cost	Delivery Mechanism /Funding	Anticipated Date /timescales	Status	Change in Further Modified T3 (Sep 2020)	Reason for Change
	A41 Tring Road							
~~Aylesbury Transport Strategy~~	~~Public Transport Corridor A413 Buckingham Road capacity~~	~~BCC~~	~~£4m~~	~~Developer contributions~~	~~By 2021~~	~~Necessary~~	Deleted	Could not demonstrate this was deliverable following removal of Winslow site
Aylesbury Transport Strategy/Aylesbury Garden Town	Aylesbury town centre improvements to the pedestrian network and public realm: a. Cambridge Street b. Exchange Street c. Friarage Road d. Vale Park Drive e. Upper Hundreds Way f. Walton Street g. Canal Basin h. Town Centre cycle parking	BC~~C, AVDC~~	£12m-£84m	Developer contributions / grants	~~Aylesbury Transport Strategy/~~Aylesbury Garden Town programme	~~Necessary~~		Clarification
~~Aylesbury Transport Strategy~~	~~Improvements to the Royal Bucks Hospital roundabout (A418, A413, A41 junction)~~	~~BCC~~	~~£2m-£16m~~	~~Developer contributions~~		~~Necessary~~	Deleted	Could not demonstrate this was deliverable
~~Aylesbury Transport Study~~	~~Accessibility improvements to Stoke Mandeville railway station.~~	~~Developer~~	~~<£5m~~	~~Developer contributions~~	~~Developer~~	~~Necessary~~	Deleted	These are being delivered through development site specific walking and

Evidence Base	Required Works	Delivery Partner	Indicative Cost	Delivery Mechanism /Funding	Anticipated Date /timescales	Status	Change in Further Modified T3 (Sep 2020)	Reason for Change
								cycling connectivity policies
~~Aylesbury Area Transport Study~~	~~Bridge improvements at junction of Old Stoke Road and B4443~~	~~BCC~~	~~£40m~~	~~Grant Funding~~	~~BCC~~	~~Necessary~~	Deleted	Could not demonstrate this was deliverable. Focus is on the delivery of orbital route
Aylesbury Transport Strategy	~~Remodelling the bus station and reconfiguring of the pedestrian access between the railway station/bus station and town centre. To include demolition and redevelopment of immediate areas.~~	BC/EWR/ Developers	£5m	EWR Consortium/DfT /Network Rail/BC/CIL/Other ~~BCC/CIL~~	~~Developers~~ Aylesbury Garden Town programme	~~Critical~~	Reworded as follows: Remodelling the bus station and reconfiguring of the pedestrian access between the railway station/bus station and town centre.	Provides greater flexibility on options for bus station redevelopment
Aylesbury Transport Strategy	Traffic calming on Prebendal Avenue to reduce rat-running between A418 and Stoke Road	BC/Developers	TBC	Developer contributions /CIL/Other	By 2033		Required	Phase 3 modelling demonstrated that mitigation would be needed in this area
Aylesbury Transport Strategy	Aylesbury town-wide cycle network improvements	BC,~~C, AVDC,~~ Sustrans	£1.6m	Developer contributions	Incremental implementation throughout plan period	~~Necessary~~		
National Infrastructure Commission -"Partnering	East West Rail – Bicester, to	NIC	£5m-£50m (dependent on	EWR Consortium/DfT	Scheme due to be complete	~~Critical~~		

Evidence Base	Required Works	Delivery Partner	Indicative Cost	Delivery Mechanism /Funding	Anticipated Date /timescales	Status	Change in Further Modified T3 (Sep 2020)	Reason for Change
for Prosperity: A new deal for the Cambridge Milton Keynes-Oxford Arc"	Winslow, MK and Aylesbury. Includes new station at Winslow.		whether this is for the station cost or the cost of the whole line)	/Network Rail/~~Local authorities~~BC/CIL/Other	between ~~by end~~ 2024 early 2026			
BUCKINGHAM	**BUCKINGHAM**	**BUCKINGHAM**	**BUCKINGHAM**	**BUCKINGHAM**	**BUCKINGHAM**	**BUCKINGHAM**	**BUCKINGHAM**	**BUCKINGHAM**
Buckingham Transport Strategy	Buckingham Town-wide cycle network improvement	BC~~C,~~ ~~AVDC,~~ Sustrans	£1.3m	Developer contributions	Incremental implementation	~~Necessary~~		
Buckingham Transport Strategy	Buckingham to Silverstone Park cycle route	BC,~~C,~~ ~~AVDC,~~ Sustrans	£3m	Developer contributions	s106 obligation to be met – must be completed Stage 1 65,000 sqm occupation All – by 158,000 sqm occupation	~~Necessary~~		
~~Buckingham Transport Strategy~~	~~A413 Buckingham Road Improvements~~	~~Developers~~	~~TBC~~	~~Developer contributions~~	~~Long term by 2033~~	~~Necessary~~	Deleted	Not deliverable due to lack of funding
Buckingham Transport Strategy	~~Buckingham Route upgrades on A421 and A413~~ Route upgrade on the A421 and A413 to dual – 2 lane standard (between Radcliffe Road roundabout and A421/A413 roundabout (east)	Developers	TBC	Developer contributions and grant funding	Medium term		Required	Phase 3 modelling report demonstrated that this is essential infrastructure to support VALP growth

Evidence Base	Required Works	Delivery Partner	Indicative Cost	Delivery Mechanism /Funding	Anticipated Date /timescales	Status	Change in Further Modified T3 (Sep 2020)	Reason for Change
Buckingham Transport Strategy	Buckingham Left turn slip at A422/A413/Stratford Road roundabout	Developers	£1.0m-£1.5m	Developer contributions	Medium term 2018 - 2023	~~Necessary~~		
~~Widen Lee Rd Footpath~~	~~Quainton NDP~~	~~S106~~	~~£30k~~		~~2017-18~~	~~Necessary~~	Deleted	Not essential infrastructure to support VALP growth
~~Quainton NDP~~	~~Traffic calming in village centre~~	~~BCC~~	~~£50k est~~	~~S106~~	~~2017-18~~	~~Necessary~~	Deleted	Not essential infrastructure to support VALP growth
Buckingham Transport Strategy	Infrastructure to facilitate increase in bus frequency to Winslow Station	BC~~C~~, Bus operators, EWR Alliance	<£5m	Operators – possible commercial service	Long term	~~Necessary~~		
EDGE OF MK NORTH EAST AYLESBURY VALE	**EDGE OF MK NORTH EAST AYLESBURY VALE**	**EDGE OF MK NORTH EAST AYLESBURY VALE**	**EDGE OF MK NORTH EAST AYLESBURY VALE**	**EDGE OF MK NORTH EAST AYLESBURY VALE**	**EDGE OF MK NORTH EAST AYLESBURY VALE**	**EDGE OF MK NORTH EAST AYLESBURY VALE**	**EDGE OF MK NORTH EAST AYLESBURY VALE**	**EDGE OF MK NORTH EAST AYLESBURY VALE**
Buckinghamshire County Model	~~New roundabout access on A421 to serve Shenley Park and subject to more detailed traffic modelling possible dualling between new access and Bottledump roundabout~~	MK, BCC, developers	£TBC	Developer contributions	Long term by 2033 tbc	~~Necessary~~	Reworded as follows: <u>New roundabout access on A421 to serve Shenley Park and subject to more detailed traffic modelling</u>	Reworded to provide further clarification

Evidence Base	Required Works	Delivery Partner	Indicative Cost	Delivery Mechanism /Funding	Anticipated Date /timescales	Status	Change in Further Modified T3 (Sep 2020)	Reason for Change
							possible dualling between new access and Bottledump roundabout and link road through the site connecting the A421 with H6 and/or H7.	

Table 54: Main modifications to VALP (November 2019) outlining further modified T3 in response to updated modelling

14. CONCLUSIONS

14.1.1 The traffic model clearly provides a sufficient basis for the high level strategic assessment of future year development scenarios at a Buckinghamshire wide level, something that a more detailed geographically specific model could not do. This is essential when considering the implications of a VALP area wide assessment of housing allocation implications. The model can be used to identify future transport issues, but the exact scale of the issues should not be, and has not been, quantified on the basis of the model data. Indeed, in assessing the local plan impacts, the scale of impact has generally been identified in terms of slight, moderate or significant (through a RAG analysis).

14.1.2 The traffic impacts have not been assessed on the basis of a detailed planning application and when an application is made the traffic environment will need to be assessed on the basis of the traffic situation at the time of the application. In accordance with NPPG, to determine and mitigate the localised impacts of a specific development on the local highway network at the time of a planning application a Transport Assessment (TA) or a Transport Statement (TS) is required. Such a document is also required as part of the VALP planning application validation checklist, making clear that a further level of assessment is required and that the allocation of a site is not a detailed planning application which considers the detailed implications of the development of any allocated site

14.1.3 In summary, based on TAG principles and National Planning Practice Guidance for Local Plans, the model used is fit-for-purpose for strategic Local Plan assessment. The Countywide Transport Model has informed the development of the site allocations in the VALP and Policy T3 as proposed to be amended through at least 5 iterations of the plan as has been explained in this statement. The latest Phase 4 modelling that has been undertaken in support of VALP and the main modifications to Policy T3 show that the strategic transport impacts of VALP are acceptable.

APPENDIX 1

VALP Transport Evidence

Submission Stage

REFERENCE	DATE	TITLE
CD/TRA/001	July 2017	Buckinghamshire Countywide Local Plan Modelling (Jacobs, July 2016)
CD/TRA/001a1	July 2017	Buckinghamshire Countywide Local Plan Modelling (Jacobs, July 2016) - Appendix A
CD/TRA/001a2	July 2017	Buckinghamshire Countywide Local Plan Modelling (Jacobs, July 2016) - Appendix B
CD/TRA/002	March 2017	Buckinghamshire Countywide Local Plan Modelling (Jacobs, March 2017)
CD/TRA/002a1	March 2017	Buckinghamshire Countywide Local Plan Modelling (Jacobs, March 2017) - Appendix A
CD/TRA/002a2	March 2017	Buckinghamshire Countywide Local Plan Modelling (Jacobs, March 2017) - Appendix B
CD/TRA/003	August 2017	Buckinghamshire Countywide Local Plan Modelling (Jacobs, August 2017) -
CD/TRA/003a1	August 2017	Buckinghamshire Countywide Local Plan Modelling (Jacobs, August 2017) – Appendix A Vol 1
CD/TRA/003a2	August 2017	Buckinghamshire Countywide Local Plan Modelling (Jacobs, August 2017) – Appendix A Vol 2
CD/TRA/003a3	August 2017	Buckinghamshire Countywide Local Plan Modelling (Jacobs, August 2017) – Appendix A Vol 3
CD/TRA/003a4	August 2017	Buckinghamshire Countywide Local Plan Modelling (Jacobs, August 2017) – Appendix A Vol 4
CD/TRA/003a5	August 2017	Buckinghamshire Countywide Local Plan Modelling (Jacobs, August 2017) – Appendix B Vol 1
CD/TRA/003a6	August 2017	Buckinghamshire Countywide Local Plan Modelling (Jacobs, August 2017) – Appendix B Vol 2
CD/TRA/003a7	August 2017	Buckinghamshire Countywide Local Plan Modelling (Jacobs, August 2017) – Appendix B Vol 3
CD/TRA/003a8	August 2017	Buckinghamshire Countywide Local Plan Modelling (Jacobs, August 2017) – Appendix B Vol 4
CD/TRA/004	Jan 2017	Aylesbury Transport Strategy (AECOM, January 2017)
CD/TRA/004a	Jan 2017	Aylesbury Transport Strategy (AECOM, January 2017) - Summary
CD/TRA/005	Jan 2017	Buckingham Transport Strategy (AECOM, January 2017)
CD/TRA/005a	Jan 2017	Buckingham Transport Strategy (AECOM, January 2017) – Summary

Proposed Modification Stage

REFERENCE	DATE	TITLE
ED214A	July 2019	Transport Modelling: Buckingham Town Centre Modelling Report (May 2019)
ED214B	July 2019	Transport Modelling: Revised Countywide Modelling for Buckingham (April 2019)
ED214C	July 2019	Transport Modelling: North East Bucks Local Plan Tests – Technical Report (May 2019) Pages 1-50 Pages 51-100 Pages 101-125
ED215A	July 2019	Transport Note: BCC Advice note to AVDC (May 2019)
ED215B	July 2019	Transport Note: AVDC Note on Buckingham VALP Allocations (May 2019)

APPENDIX 2

Summary of impacts outside Buckinghamshire

URBAN AREA /CORRIDOR	COMMENTS DS WITHOUT MITIGATION	COMMENTS 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	Moderate demand flow increases on the A4421 to the north of Bicester and on the A41 west of Bicester, particularly in the PM peak. There is also a reduction in demand flow on the B4100 to the northwest.	There are less significant increases in demand flow on the A41 and A4421 with the mitigation schemes in place.
Thame	Increases in demand flow observed on approaches to the Thame Roundabout from the A41, B4011 and B4012, and on Aylesbury Rd in and out of the town centre.	Less significant increases in demand on the approaches to the Thame Roundabout, and on Aylesbury Rd in and out of the town centre. Smaller increases in demand also observed on the A4129 and B4012 to the southeast in the AM peak.
Hemel Hempstead	Minor increases in demand flow on the approaches to the Hemel Hempstead gyratory off the A41.	The impact of this is less significant with the mitigation in place.
Dunstable	Minor increases in demand flow on the A505 in both directions.	With the mitigation schemes in place there are further minor increases in demand flow in this road.
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.
M40	Significant increases in demand flow, particularly north-westbound in the PM peak, between Stokenchurch and Wheatley.	This impact is greatly reduced with the mitigation in place, with only minor increases on the M40 compared to DM levels of traffic.
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.	In the same location with the mitigations in Aylesbury in place, the demand flows toward Aylesbury further increase, however the increase is less significant in the opposite direction.
A43	There is a minor increase in demand flow north-eastbound, and a minor reduction in demand flow south-westbound, between Brackley and Silverstone, on the A43.	With the mitigation schemes in place the changes observed are smaller, and traffic levels are similar to the DM.