Hampden Fields, Aylesbury

High level review of Aylesbury Transport Model Local Model Validation Report (January 2019)

1. Transport Planning Practice (TPP) were commissioned by Hampden Fields Action Group (HFAG) to provide advice in relation to the Transport Assessment (TA) for the Hampden Fields development proposals near Aylesbury.

Purpose of this note

2. The purpose of this note is to inform HFAG about the new Aylesbury Transport Model (ATM) using information from two sources:

- South East Aylesbury Link Road, Local Model Validation Report, TN01, Final Draft dated January 16, 2018 and prepared for BCC by consultants Jacobs. TPP note that the date of the report should probably be January 2019 and the report appears to have been discussed with DfT.
- Simon Craine/Joan Hancox Buckinghamshire County Council (BCC) Report to Head of Service.

Context

3. At the time of the most recent planning application, the traffic impacts of the Hampden Fields development were assessed using the Aylesbury Transport Model (ATM). The local traffic model was developed by consultants Jacobs working on behalf of BCC. The software package used is called VISUM. It includes junction delay modelling and speed-flow curves on some links. It is similar to the widely used SATURN traffic model. The model Base Year was 2014.

4. TPP undertook a review of the strategic modelling work to establish whether the model represented a sound basis for the further assessment of the impact of the Hampden Fields proposals on the surrounding highway network.

5. TPP reviewed the Combined Stocklake and Eastern Link Roads Business Case LMVR and Forecasting Report dated May 2015. These were appendices to the Hampden Fields Transport Assessment (TA). These reports were prepared to support the Business Case for the Stocklake and Eastern Link Roads, but they were also used as the basis of traffic forecasting carried out for Hampden Fields.

6. In the TA the name of the VISUM model was re-stated as the "Aylesbury Town Strategic Model", although this is, in fact, the same model which was designed to be used for the Business Case for the ELR. The model forecasts were developed for 2019 and 2034.

7. In general, the traffic model validation followed the guidelines set out in the Department for Transport's (DfT) transport appraisal guidance, known as WebTAG. However, TPP had some reservations about the method used to develop the trip matrices for the VISUM model. The level of data collection undertaken would be adequate to support the transport

Transport Planning Practice| 70 Cowcross Street | London | EC1M 6EL| Tel: 020 7608 0008 | email@tppweb.co.uk

modelling and appraisal for the ELR, but was not sufficient to support traffic forecasting over the entirety of Aylesbury.

8. TPP found no confirmation from Jacobs or BCC that the model was deemed suitable for the purpose of looking at wider traffic issues in Aylesbury. Therefore, its 'fitness for purpose' to forecast the impacts of the Hampden Fields development and the operation of the Walton Street Gyratory was questionable.

Walton Street Gyratory

9. At the 2013 Public Inquiry which considered an earlier planning application for Hampden Fields, the impacts of the development on the Walton Street Gyratory were a major consideration for the Inspector who eventually ruled that the developer's appeal against a non-determination by AVDC should be rejected. This Inspector's decision was upheld by the Secretary of State in 2015.

10. Consequently, the ability of the transport models used by BCC to reliably estimate the impact of the Hampden Fields development on this part of the road system is very important. Equally the ability of such models to estimate traffic relief as a result of construction of various proposed transport interventions including various orbital road schemes is critical.

HFAG concerns

11. HFAG have expressed interest in the following specific questions regarding the LMVR and the new model:

a) Has the extensive use of Telefonica (O2) mobile phone data in creating the new demand matrices been handled appropriately and using industry standard techniques ?

b) Is the model calibration and validation suitable for the intended purposes of the new model ?

c) Is the new model adequate to examine the full orbital road strategy for Aylesbury as outlined in the Aylesbury Transport Strategy prepared by AECOM and the Draft Vale of Aylesbury Local Plan (VALP) ?

d) Where does the new model, and BCC proposals for its application, leave the VALP proposals and the Buckinghamshire Countywide Model (BCM) ?

e) Where does the new models, and BCC proposals for its application, leave the Hampden Fields and Woodlands planning applications ? AVDC and BCC have already asked for more modelling from both developers using the updated Aylesbury Transport Model.

High Level Review of Local Model Validation Report

12. This review was undertaken at a high level. It gives an overview of:

- the way in which the model has been developed;
- in particular, the methods used to build the trip matrices which differs significantly from the previous model;
- the standards of calibration and validation achieved; and

- the applicability of the new model in testing the impacts of the Hampden Fields development, the proposed traffic mitigation measures and associated development proposals and road schemes.

13. No direction communication has taken place between TPP and AVDC, BCC or Jacobs at this stage. Reliance is placed on the report(s) provided.

Name of model and model purpose

14. In the LMVR the new model is named the South East Aylesbury Link Road (SEALR) transport model. Elsewhere in this document the model is called the Aylesbury Transport Model (ATM). ATM will sit within a hierarchy of transport models operated on behalf of BCC. The Buckinghamshire County Model (BCM) covers the whole of the county. The new ATM model covers only a portion of the county. Using BCM a cordon model has been developed as a starting point for ATM. This was, apparently agreed with the DfT. The need for a variable demand model (VDM) has been assessed using a separate scoping exercise which confirmed the need for VDM. VDM is designed to test the impacts of both suppressed traffic and scheme induced traffic on the benefits of the bypass scheme.

15. VDM is relevant because the SEALR scheme is intended to reduce travel costs for highway users compared to the pre-scheme situation, which may create additional "induced" traffic. However, interestingly Jacobs comment that a public transport model is "not considered necessary". Jacobs comment that the nature of the SEALR scheme means there is no competition between public transport and car use and acknowledge that there is a relatively low public transport share in the area. This comment, whilst perhaps accurately reflect the existing situation, seems rather negative given that Aylesbury is going to be planned as a Garden Town. Presumably "carrot and stick" measures will be introduced over time to encourage car users to adopt other modes such as walking, cycling and bus travel.

Model coverage

16. The extent of the ATM transport network was assessed by examining the likely impact of SEALR in terms of long-distance re-routeing. The local impacts of SEALR, as determined from running the BCM, are shown below. It appears that the "without SEALR network" used here includes the Eastern Link Road (ELR) North and South, plus the Southern Link Road through Hampden Fields and the Stoke Mandeville Bypass. It would be useful to clarify this point with BCC.

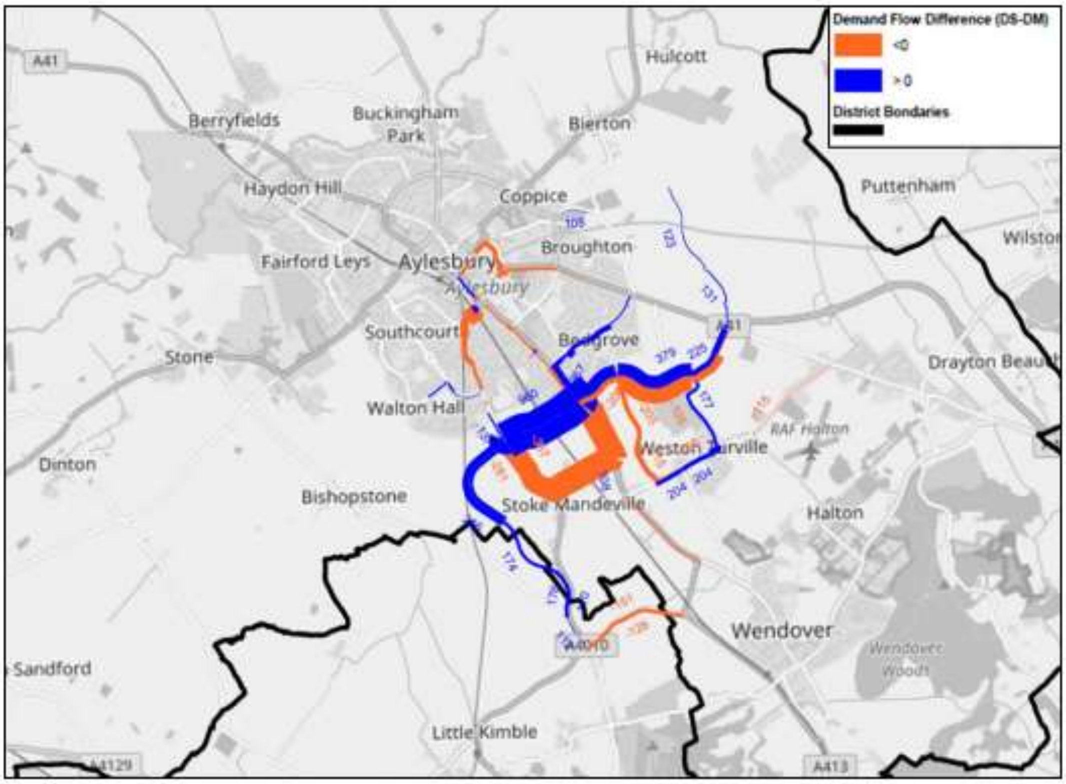


Figure 4-1: Demand Flow Difference plot showing the effect of introducing just the SEALR in the countywide model

17. It interesting to note that this test appears to show a very modest reduction in traffic on the A41 and A413 radial routes south of Aylesbury as a result of opening the SEALR. It also shows an increase in traffic on Bedgrove/Camborne Avenue which would not be desirable. Hence, the supposed benefits of SEALR for the Walton Street gyratory are not very clear. This once again confirms that through traffic volumes from north to south east across Aylesbury are not very significant.

18. It can be seen from this diagram that the old ATM model was not very well suited to modelling the SEALR due to the limited network to the south of Aylesbury.

19. This test was used to define the area of road network to be taken as the basis for the new model, which is shown below. To the south the network extends to Wendover. To the north the model extends to Wing. It is noted that RAF Halton is on the edge of the model which could cause problems in the future if major development occurs in this area.

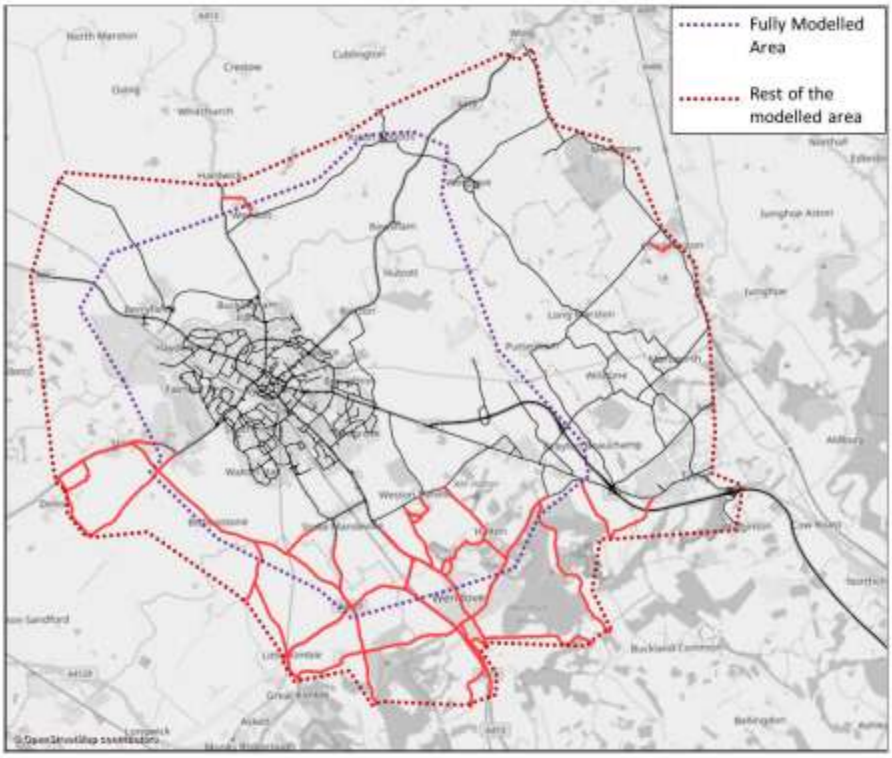


Figure 4-3: Extent of the modelled area

<u>*Model Base Year and time periods*</u>

20. The ATM model Base Year for calibration and validation is 2017. The model time periods on a weekday are as follows:

- AM peak 07:00-08:00
- Inter peak average hour 10:00-16:00
- PM peak 17:00-18:00.

21. It should be noted that the AM peak period has changed from the previous version of the model. There is no discussion of this change in the LMVR.

<u>*Data sources*</u>

22. A separate Data Collection Report is referred to in the LMVR. This was not made available at the time of preparing this note. However, the main travel data sources used by Jacobs appear to be those summarised below.

Data Type	Source	Details
Mobile phone data (MPD)	Telefonica (O2)	Matrix building
Traffic volumes	2013, 2014 and 2017 traffic counts	78 calibration counts 50 validation counts
Automatic number plate recognition (ANPR) survey in A413/Stoke Mandeville corridor		Calibration of model assignment and journey times
Journey time data (seven routes)	Trafficmaster and other sources	Journey time validation

Trip matrices

23. The method for forming the trip matrices (estimates of vehicular trips between one part of the study area and another) was as follows:

- Step 1 – use mobile phone data (MPD) to estimate longer distance movements (mainly >5km).
- Step 2 – estimate shorter distance trips (mainly <5km) using a synthetic gravity model.
- Step 3 – merge MPD and synthetic matrices.
- Step 4 – create cordon matrices for the area shown above.
- Step 5 – apply matrix estimation to “smooth” the matrices.

24. Steps 1, 2, 3 and 4 are technically complex processes and are described in Appendices A, B and C to this note respectively.

25. The purpose of matrix estimation is to refine estimates of trip movements which have been synthesised (rather than derived from surveys). This means that counts are required on screenlines which intercept intra-sector movements. The calibration screenlines should be designed so that the majority of intra-sector movements are subject to the adjustment process.

26. Matrix estimation should be applied to individual vehicle type matrices because the routes used in the matrix estimation will vary by user class. This means that manual classified counts (MCC) are required at the sites where constraints are to be applied. The use of average vehicle proportions to obtain vehicle splits by type in the absence of MCCs should be avoided where possible.

27. To enable matrix estimation to adjust the prior matrices to approximately the correct overall levels, automatic traffic counts (ATC) are also required at the constraint sites. Thus, the ATCs should be used to give the total vehicles, and the MCCs to provide the split by vehicle type.

28. Hence, matrix estimation is part of the matrix calibration process, but independent traffic counts should be used for validation.

29. The matrix building process appears to have broadly followed WebTAG guidelines. It is noted that the MPD data is changed considerably during the process and it might be

instructive to see the level of change at various stages in the process. Only the changes due to matrix estimation are presented.

30. TPP note that, at the end of the calibration process, no comparison has been made between the MPD-based matrices and the roadside interview surveys (RIS) carried out on the A418 and A41 in 2014. This would have been a good check on the matrix building process. A select link comparison of the new matrices and the RIS data could be requested from BCC.

Networks

31. The model was developed using the VISUM software. There have been no significant changes here since the previous version of the model, although the software may have been applied slightly differently in some respects.

32. It is beyond the scope and resources of this review to comment in detail on the VISUM model networks, but is assumed that Jacobs have carried out reasonable checks on the junction coding, link lengths etc as would be required by good practice.

Calibration and validation

33. The diagram below shows the screenlines where modelled and observed traffic flows were compared. Those screenlines designated with a C were used for calibration and those with a V were used for validation.

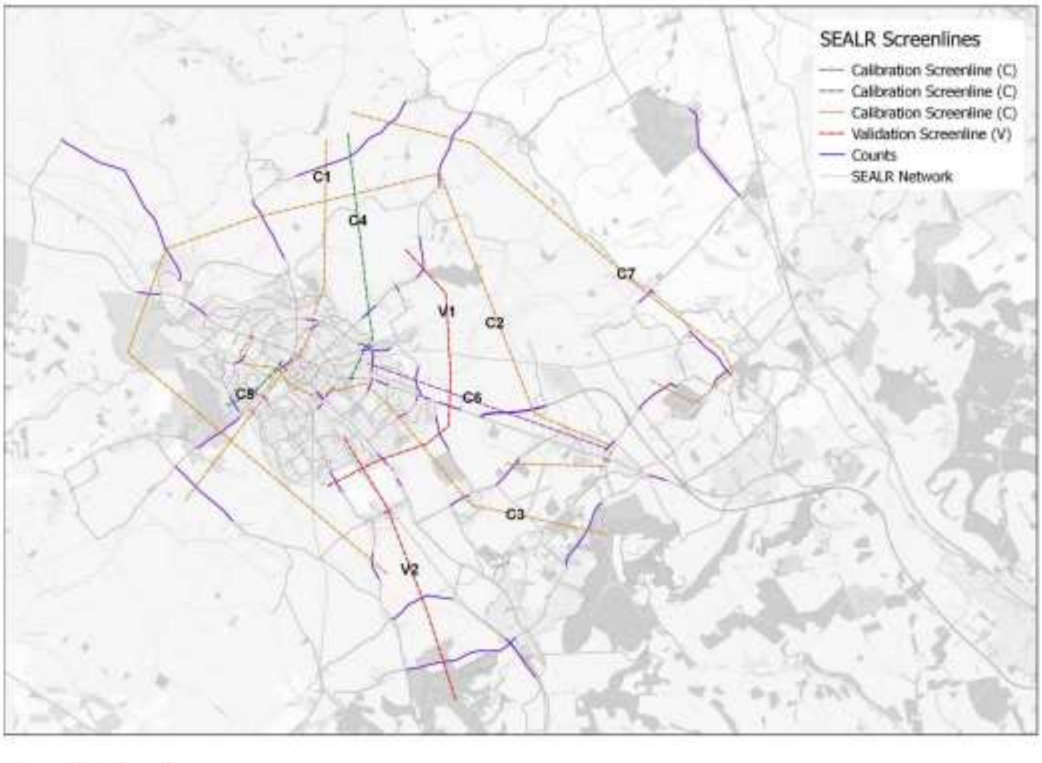


Figure 10-2: Screenlines

34. In calibration the match between modelled and observed flows is expected to be very good because the model is being constrained using the counts. The validation is supposed to

use independent data and, therefore, will usually not match quite so well with observed flows. Jacobs created seven calibration screenlines with a total of 44 individual road links. Modelled flows on the vast majority of screenlines should be within ±5% of the observed.

35. In this case, all of the WebTAG criteria appear to have been satisfied. The one reservation here is that there only eight links on the validation screenlines, so the number of comparisons is rather limited.

36. There were some additional validation links which were not included in the screenlines. Hence there are 25 validation locations in all (giving 50 links with the two directions) where modelled and observed flows have been compared.

37. It should be noted that Jacobs have compared modelled junction turning movements with observed data at two locations – A41/Aylesbury Road and A41/Bedgrove/Broughton Lane. Whilst these junctions are important to the assessment of the Hampden Fields and Woodlands junctions, it is very surprising that no comparison was carried out for the Walton Street Gyratory and the A413/Camborne Avenue roundabout. Also, it is notable that at the A41/Bedgrove the junction the model significantly underestimates traffic passing straight through on the A41 in both directions, but particularly traffic travelling into Aylesbury.

38. There were seven journey time routes across the town where modelled and observed journey times were compared. Taking the two directions of slow, this gives 14 comparisons in each model period. The new model matches the observed journey times to within ±15% in all but on case.

39. Overall, the calibration and validation of the new model looks satisfactory. Importantly the scope of the exercise has covered a much wider area than with the previous version of the model.

<u>Fitness for purpose</u>

40. Regarding "Fitness for purpose" Jacobs comment as follows:

"As evidenced by the overall calibration/validation statistics, it is considered that the model provides a good overall representation of current travel conditions for those areas included within the modelled network and is therefore appropriate for the purposes of assessing smaller scale schemes and developments. For larger scale schemes, (i.e. those of a similar size to SEALR and the other orbital link road schemes) an initial assessment of the extent of the scheme's impact in terms of reassignment (potentially through the use of the existing Countywide model) and a detailed assessment of the model's validation in the vicinity of the scheme should be undertaken before the model can be said to be fit for purpose for use as an evidence base for a major scheme appraisal of the given scheme."

41. On the last point that is made here, TPP assume that Jacobs are concerned that a full Aylesbury orbital route strategy could have the potential to attract longer distance traffic towards Aylesbury from quite a wide area. Therefore, the extent of the ATM model network would need to be checked for adequacy by using the BCM. This comment ignores the fact that, as far as TPP and HFAG are aware the BCM model has not been updated using the MPD.

Updated Aylesbury Transport Model – Note seeking authorisation from Head of Services

42. This note was dated 03 March 2020 and is attributed to Joan Hancox (BCC Head of Transport Strategy Manager) and Simon Craine (BCC Senior Transport Strategy Officer).

Purpose of the report

43. The stated purpose of this report is to seek authorisation, from the Head of Service, to use the ATM (2020) for the purposes of assessing the impacts of major schemes and development proposals on the county's highway network. The paper recommends that ATM (2020) is formally authorised for application by BCC. This will include using the model to assess planning applications around Aylesbury, including undertaking charged model runs for developers. It will also include supporting the development of a Full Business Case for SEALR, and informing the business cases for additional major schemes within the Aylesbury orbital strategy.

44. As HFAG are aware, for several years BCC has made some of its transport models available to developers for their transport assessments for a nominal charge.

45. The note reminds officers that, in January 2014, BCC commissioned a model to cover the Aylesbury area for the purpose of supporting a business case for Stocklake Link Road and Eastern Link Road (South). The paper points out that, whilst the existing Aylesbury model is fully compliant with the WebTAG standards for the purposes of a business case for those schemes, it required updating in order to attain the TAG compliance appropriate for a Full Business Case for the SEALR scheme. This 2020 model now includes a Variable Demand element and will replace the 2014 Aylesbury model. BCC do not acknowledge that the previous model had limitations in its ability to demonstrate the impact of developments such as Hampden Fields because of the way in which it was developed and in particular the focus on the A418 and A41 corridors.

46. BCC also state that they intend that the ATM (2020) will be used for the assessment of the impacts of development sites in the Aylesbury area. It has therefore been developed with consideration for these purposes as well.

Fitness for purpose

47. BCC state that ATM was constructed in a manner consistent with WebTAG and exceeds DfT criteria for calibration and validation of models in a number of areas. They consider that it is suitable for the purposes of assessing planning applications and business case appraisals in the study area. A secondary purpose intended for the model is that it can be used for other more general assessments of impacts of various transport and development schemes around Aylesbury, and it is considered that the model is fit for this secondary purpose as well.

48. TPP concur with these comments as regards the appraisal of road investment, although any schemes which need to consider public transport or walking and cycling interventions will be outside the scope of the model as configured.

Other considerations

49. BCC rightly acknowledge that it is possible that the new ATM might generate forecasts of highways impacts which are inconsistent with Council policy. Model outputs could be contentious, especially if considered against previous assessments. As the officers correctly *state "The outputs for instance, might show that a development cannot go*

forward (e.g. some site allocations in local plans are not viable), or that an already consented site might have unacceptable impacts on the transport network."

50. They then suggest that modelling alone should not be the key determinant of decision making. It should form part of an assessment process that considers the wider context. These relationships would primarily be managed by the Highways Development Management team in liaison with Transport Strategy and Jacobs.

51. It is assumed that the Service Director has now authorised the approach suggested. This is evidenced by the recent letters sent to the Hampden Fields and Woodlands developers.

Footnote

52. A footnote to the paper the following is stated:

"For larger scale schemes, (i.e. those of a similar size to SEALR and the other orbital link road schemes) it is recommended that an initial assessment of the extent of the scheme's impact in terms of reassignment (through the use of the existing Countywide model) and a detailed assessment of the model's validation in the vicinity of the scheme should be undertaken before the model can be said to be fit for purpose for use as an evidence base for a major scheme appraisal."

53. This wording is taken from the LMVR. As stated elsewhere, it raises the issue that the BCM model now has very different trip matrices from the ATM due to the use of MPD in ATM. Because, to the knowledge of HFAG and TPP, the BCM has not been updated, there is a major inconsistency here. This also has implications for the Local Plan since the BCM was the main tool used as an Evidence Base.

Summary and conclusions

54. The key characteristics of the old and new ATM models which are of relevance to the Hampden Fields planning application and Transport Assessment are summarised in the table below.

Model Feature	2014 ATM Model	2019 ATM Model	Comment
Software	VISUM	VISUM	
Link with Countywide Model	ATM prior matrices derived from Countywide model	No direct link although zone systems should be consistent.	
Base Year	2014	2017	
Model Time Periods	Weekdays 08:00-09:00 10:00-16:00 17:00-18:00	Weekdays 07:00-08:00 10:00-16:00 17:00-18:00	Note change of AM peak period.
Data Collection and Collation	Two origin destination surveys, traffic counts and journey time surveys	Mobile phone data, extensive traffic counts, journey time survey data and automatic number plate recognition surveys (ANPR).	More extensive data collection geographically. High reliance on mobile phone data.
Model Network	Designed to focus on Stocklake Link Road and Eastern Link road proposals	Model road network extended to enable full orbital roads strategy to be assessed.	Extension of network to south and east is helpful to understand wider impacts of orbital strategy. However, RAF Halton (with major

Model Feature	2014 ATM Model	2019 ATM Model	Comment
			development potential) is on edge of model.
Trip Matrix Development	Matrices created using cordon from the Countywide Model. Augmented with data from roadside interview on A418 at Bierton and A41 Aston Clinton Road	Car matrices created from mobile phone data. Short distance trips augmented using synthetic estimates.	High reliance on accuracy of mobile phone data for orbital movements.
Matrix adjustments		Merging of synthetic and mobile phone data. Subsequent matrix factoring.	
Matrix estimation	Extensive use of matrix estimation	Extensive use of matrix estimation	
Area of Calibration and Validation	Mainly focussed on A418 north and A41 east corridor	More comprehensive geographically covering all of Aylesbury	The new model has been calibrated and validated against count data covering the whole of the urban area and some surrounding villages.
Standard of Validation	Meets WebTAG guidelines for link flow and journey time comparisons	Meets WebTAG guidelines for link flow and journey time comparisons	
Forecast Years	2019 and 2034	2021 and 2036	
Induced and Suppressed Traffic	Fixed matrix model	Variable demand model	The new model has the capability to show whether proposed new road infrastructure will cause induced traffic (commonly called "generated traffic"). However, it contains no detailed representation of bus supply or demand in Aylesbury, which is surprising, and no consideration of walking and cycling as alternative modes.

55. Returning to HFAG particular concerns regarding the new model, these are addressed in turn below.

56. a) Has the extensive use of Telefonica (O2) mobile phone data in creating the new demand matrices been handled appropriately and using industry standard techniques ?

In comparison with other methods for sampling travel movements (e.g. roadside interviews or household interview surveys) the use of MPD significantly increases the sample size. However, MPD requires verification and adjustment using existing third party data sources. This should add the level of confidence in the data that is needed, whilst highlighting potential required refinements. To our knowledge, there is currently no WebTAG guidance or established practice around the issues of using MPD to develop trip matrices. The methods used by Jacobs appear to accord with techniques used on recent Highways England projects such as the Regional Traffic Models (RTM) in which the trip matrices are heavily based on MPD information.

57. b) Is the model calibration and validation suitable for the intended purposes of the new model ?

The latest version of ATM marks a major improvement on the previous model. The matrices have been developed using a mixture of synthetic matrices (based on gravity models) for short distance trips, and mobile phone data (MPD) for longer distance trips. TPP can confirm that the approach used appears to be consistent with good practice following widely accepted methods for checking, adjusting and verifying the MPD. However, no comparison has been made between the MPD-based matrices and the roadside interview surveys carried out on the A418 and A41 in 2014 which would have been a good model check. Leaving this point aside, the level of calibration and validation appears to be consistent with WebTAG guidance.

58. c) Is the new model adequate to examine the full orbital road strategy for Aylesbury as outlined in the Aylesbury Transport Strategy prepared by AECOM and the Draft Vale of Aylesbury Local Plan (VALP) ?

In general, the level of calibration and validation for ATM appears to be consistent with WebTAG guidance and importantly the model has been calibrated across the whole of Aylesbury. It was developed to be capable of assessing traffic impacts from the full Aylesbury orbital road strategy. **There are some localised concerns about the calibration and validation. For example, Jacobs have compared modelled junction turning movements with observed data at two locations – A41/Aylesbury Road and A41/Bedgrove/Broughton Lane. Whilst these junctions are important to the assessment of the Hampden Fields and Woodlands junctions, it is very surprising that no comparison was carried out for the Walton Street Gyratory and the A413/Camborne Avenue roundabout. Also, it is notable that at the A41/Bedgrove the junction the model significantly underestimates traffic passing straight through on the A41 in both directions, but particularly traffic travelling into Aylesbury.**

TPP are of the view that the use of variable demand modelling (VDM) for forecasting with the new ATM model is to be welcomed. However, it is perhaps somewhat surprising that, in a Garden Town, only highway trips and rail trips will be considered in the VDM process. It is understood that walk and cycle initiatives, bus priority, park and ride will be high on the agenda in the Garden Town proposals. This model, as currently formulated, is largely unable to reflect the choices that travellers will face between these modes. One other major concern here is whether RAF Halton should have been given more careful consideration in the model design.

59. d) Where does the new model, and BCC proposals for its application, leave the VALP proposals and the Buckinghamshire Countywide Model (BCM) ?

The Jacobs report does not mention any update of the BCM. The last version of the BCM model, as used for the Draft VALP had a Base Year of 2013. It is strange that the BCM model was not updated when the MPD data was processed. This creates a major inconsistency between the local and strategic models. It also brings into question the suggestion that the BCM model should be used to examine the wider impacts of further larger road schemes in Aylesbury. There is now a major inconsistency between the ATM and BCM, due to the adoption of MPD in creating the ATM trip matrices. The limitations of the old ATM model and the old BCM model in examining the impacts of the Draft VALP and the orbital road strategy have been illuminated by the SEALR work.

60. e) Where does the new model, and BCC proposals for its application, leave the Hampden Fields and Woodlands planning applications ? AVDC and BCC have already asked for more modelling from both developers using the updated Aylesbury Transport Model.

On 26 October 2017, at an AVDC planning committee, TPP understand that the decision on the Outline Planning Permissions for Hampden Fields and Woodlands was deferred and delegated to officers for approval. No such approval has so far been forthcoming, although some subsequent work on Section 106 agreements was undertaken. AVDC and BCC have recently asked the Hampden Fields and Woodlands developers to re-examine the Environmental Impact of their proposals using the new ATM model. No doubt HFAG will welcome a reassessment of the traffic impacts of these developments using the new modelling tool. In the Joan Hancox/Simon Craine note discussed above, BCC concede that the new model could show new, or more extreme, adverse traffic and environmental impacts from the proposed developments. This could bring the advice presented to the AVDC councillors in October 2017 into question. The impacts of a number of land-use developments and associated transport mitigation measures are likely to be different if reassessed using the new ATM. At the very least, the new modelling could be used to justify additional mitigation measures. Therefore, HFAG's active involvement in the ongoing technical work is advisable.

61. It will be interesting to see whether the COVID19 situation results in a more radical longer-term change in travel patterns (e.g. more business meetings taking place via Zoom). Working from home could become more popular and younger generations may place a higher value on the work-life-balance. The local authorities and developers will need to take these factors into account in making forecasts. However, it will take months and years before the evidence of these changes is available. This suggests that a flexible approach is needed in managing development impacts. Travel Plans will become increasingly important, and continuous monitoring of development impacts will be required.

62. On a couple of additional points, TPP are unclear why the modelled AM peak hour has been changed in the ATM. Perhaps this relates to activity at Stoke Mandeville Hospital. But a clear explanation regarding this change would be helpful, remembering that the model should be representing the busiest weekday AM hour across the town.

63. It would be useful for HFAG to be provided with copies of the new trip matrices in sectored form (11 sectors as presented in the LMVR).

64. In general, subject to the reservation expressed above, TPP can confirm that the new ATM model provides an improved basis for forecasting the impact of the Hamden Fields development and the associated various road schemes and mitigation measures (including SEALR). It would require further work to develop a model suitable to examine the transport impacts of the Garden Town initiative and the Aylesbury Transport Strategy in full.

Appendix A

Mobile Phone Data (MPD)

Overview

Jacobs have sourced mobile phone data (MPD) to estimate vehicular movements between ATM zones. Trip information in the Highways England (HE) database Trip Information System (TIS) was mainly derived from data extracted by Telefonica (also known as O2 in the UK). The TIS database has been used extensively by Highway England and is considered a reputable starting point for matrix building to cover longer distance movements (>5km).

Mobile phones generate "events" as they communicate with the national cell network. Events are collected on an anonymised basis. The TIS database contains trip records (based on these events) covering the UK mainland for the whole of 2016. The event types which have been collected are the following:

• **Active Events** from the 2G and 3G networks which are triggered by the sending and receiving of calls and texts. 4G is included as the wireless internet access at a much higher speed. It also includes switching the mobile on or off.
• **Passive Events** from the 2G, 3G and 4G networks. This includes movement-related random location updates comprising location area updates, routing area updates, tracking area updates and cell to cell handover events within these types of area. It also includes events arising from changes in the type of network a mobile station is connected to i.e. switching between 2G/3G for voice and 3G/4G for data. These may or may not be movement related. Finally, it includes periodic location updates every few hours.

TIS utilises event data for all O2 mobile phone subscriber's resident in mainland UK. The data used for the SEALR model covers a ten weeks period including September, October and part of November 2016, excluding bank holidays/half terms. The data includes customers from piggybacking firms that utilise the O2 network, including, Giffgaff, Tesco Mobile, Sky Mobile, Lycamobile and TalkTalk Mobile.

TIS outputs can be produced in the form of trip matrices which relate to the average number of trips, aggregated over a period of at least 20 days. For ATM an aggregation of approximately 50 weekdays and 20 weekend days was used. Trips in TIS are recorded with a start and end time. O2 users generating seven or more events per day on ten different days in each calendar month have their trip details included in TIS. There must also be sixteen days between the date of the first and last qualifying days. Users not meeting these criteria were deemed invalid users and their data was excluded.

The main way of identifying a trip origin or destination (OD) in TIS is via a "dwell threshold". A threshold was calculated for every cell and for every day/time segment available within the journey time data. The threshold was equal to the travel time across that cell using the slowest possible mode, plus a ten-minute minimum dwell. Where a phone within a cell exceeded the threshold time, it was assumed that this was because the phone was at an origin or destination at the start or end point of a trip.

Advantages of MPD
Jacobs and Telefonica point out that MPD-based OD trip matrices have certain strengths when compared to conventional sources of OD information, such as:

- wider geographical coverage.
- bigger sample size.
- capture of day-to-day variability of trips.
- time and cost savings in the collection and processing of data.

Limitations of MPD
MPD is a relatively new type of travel data. It is not exclusively processed and designed for transport planning purposes. Consequently, there are weaknesses with the data which must be appropriately investigated and addressed. Jacobs acknowledge a number of issues which are summarised below.

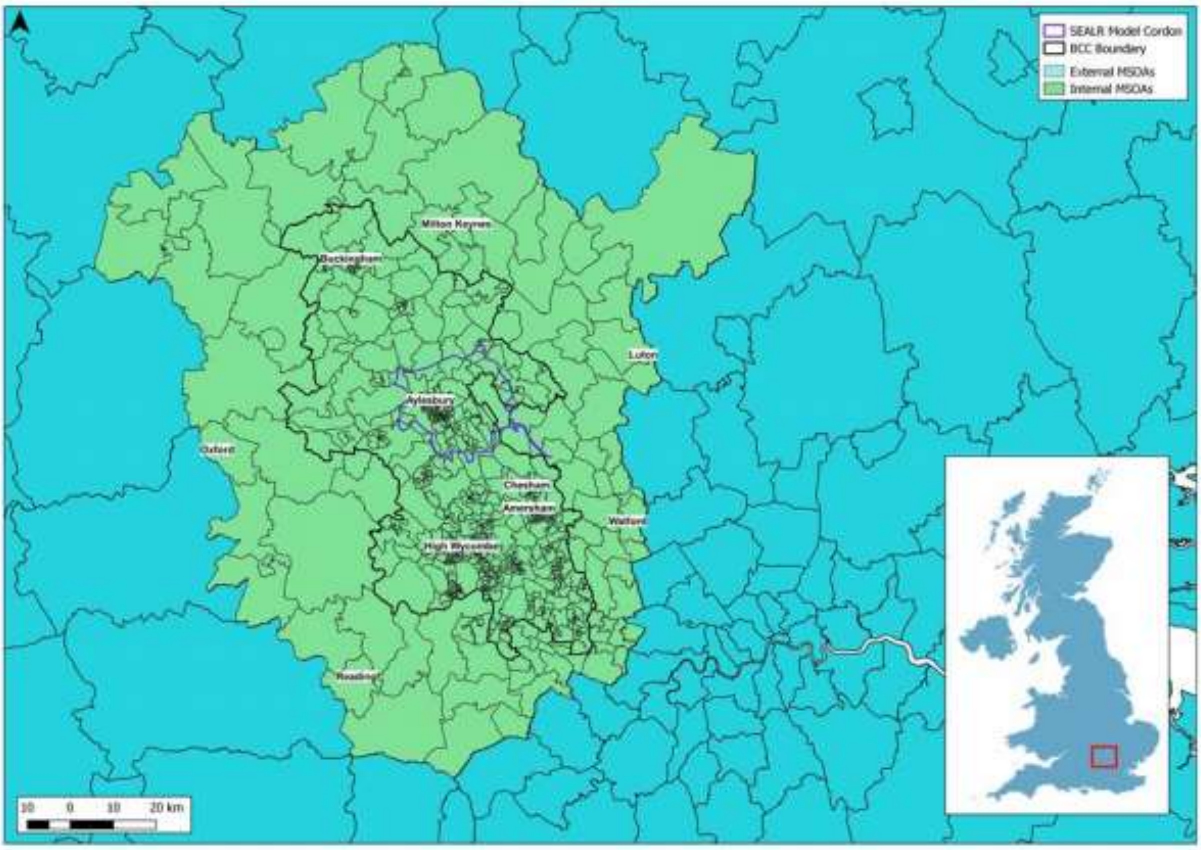
MPD issue	Discussion
Underestimation of short distance trips	Short distance trips are less likely to generate active or passive events. The original data will be biased towards longer distance journeys.
Misidentification of modes, trip purpose, vehicle types and occupancies	Because MPD are generated at phone level instead of vehicle level, there are limitations and difficulties in differentiating between modes and in identifying all people travelling in the same vehicle.
Differentiation of trips and tours	Rules must be set to define when a trip begins or when it reaches a destination. This is typically done based on the amount of time during which a user remains stationary at a single and constant location. Telefonica employ a dwell time threshold to set the end of a trip and the beginning of the next one.
Spatial resolution	The number and spatial resolution of mobile events influences the spatial accuracy of trip ODs. The total number of events created also depend on the type of network. For example, 4G users generate more events than 3G and 2G users. In cases where MSOAs are smaller than mobile phone cells, trip ODs may not be located accurately.
Expansion of MPD data sample	Expansion factors are calculated by comparing the number of users identified as having a home location and the total adult population in the area of interest. To account for different market shares within the area of interest, as well as sociodemographic aspects, this expansion must be checked at a disaggregated spatial level, defined to minimise potential errors at identifying home ends.

MPD Processing

The MPD was available in the form of trips by census Middle Super Output Areas (MSOA). For the SEALR modelling, a specific zone system comprised of MSOA or combinations of MSOA, was defined. Telefonica provided MPD trip matrices based on that zone system.

Trips were extracted for each hourly time period, with longer trips which cross the boundary of the study area being allocated to a time period based on the time they crossed the boundary. The cordon of SEALR is illustrated in Figure 1 -1 from the Jacobs report (shown below). Zones in green, within the blue outline, represent the area within the cordon. To ensure wider traffic patterns were captured in and around Buckinghamshire, data was obtained from a wider area than just the model cordon.

Figure 1-1 below details the MSOA aggregation used for the SEALR modelling.



Trips were segmented by motorised road (including bus and HGV), walk, cycle, and rail. The modes relevant for the SEALR were motorised road and rail only. Rail trips and car trips can be difficult to distinguish and a number of "rules" were used to distinguish between the two modes.

TIS provides trip data in terms of home-based work (HBW), home-based others (HBO) and non-home based (NHB) trips. The home location of a phone user was identified as the cell with the greatest number of observed ODs exceeding six hours' duration over a rolling six-week period. It was assumed that everyone will sleep once per day, requiring them to be stationary in one place or another for at least six hours per day on seven days per week. Other activities such as work will also generate ODs exceeding six hours, but these should very rarely be greater in number over a six-week period.

To avoid holiday accommodation being mistaken for home, it was assumed that holidays within the UK were unlikely to last more than three weeks. Holidays outside of the UK were irrelevant.

Only UK locations can be a “home” for UK based subscribers who were valid users. Valid users were those who generate seven or more events per day on ten different days in any calendar month. There must also be sixteen days between the date of the first and last qualifying day.

For work locations the assumption was that anyone spending more than three hours in a single location (other than home) on three or more days per week over the six-week window, was likely to be working at that location (or in full-time education). To avoid educational locations being mistaken for work locations, the work locations of all users identified in the month of May were compared with that identified in October and August (of the same year). If these locations were the same, but the work location for August was different or non-existent, then the most likely reason was the summer break at educational establishments. It was then assumed that the work location previously identified was, in fact, an educational location. In these cases, the “work” designation was changed to “education”.

The work location was designated by identifying all non-home locations with a dwell of 3+ hours on any day during the six-week window. This was a ‘qualifying day’. The non-home location with the most ‘qualifying days’ was the work location, provided that the number of qualifying days was equal to or greater than three out of seven of all valid days in the six-week window (a valid day being one where there were seven or more events), and there were at least sixteen days between the first and last qualifying day. This deals with the situation where a user stays in an alternative location to home (for non-work purposes) for more than three out of seven of their valid days during the six-week window. This could result in the alternative location being mistaken as a work location if the remaining number of valid days was less than three out of seven of the total, or the number of work qualifying days amongst the remaining days was less than that at the alternative location.

Data expansion

O2 users represent only a sample of all UK residents (approximately 10-40% across different areas) and the trips made by those residents. The sample required expansion to represent all trips. Expansion was undertaken at a user level rather than a trip level. This requires the calculation of an expansion factor for each user, which was calculated on a daily basis. In order to avoid underestimating trip totals, expansion was based on only those users for whom there was full trip information available on the day in question. This means that all ODs must be identified for the user, including any inferred ODs for motorised road trips (a cell location has been identified for any intermediate ODs inferred as being located between the observed ODs). It will also be necessary for the user to have a defined “home” and for the mode of all trips between ODs to have been successfully identified as motorised road or rail.

Users meeting these criteria were given a grading or rating of ‘1’ meaning that they could be included and given an expansion weighting. User’s not meeting these criteria were graded 2. A user may be graded as 1 on one day and 2 on another day. Each user also required an expansion weight on each day. The expansion factors were equal to the ratio of resident population (from census data) in a geographic area (MSOA) to the number of other users resident in that MSOA (provided that the other users were graded 1 on the day in question). Some users might not make any trips on a given day and will therefore have remained stationary. These users were identified and included in the TIS database as making zero trips.

Mobile phone ownership differs between those in the age 75+ category and those aged between 10-74. Users over 75 would have different travel patterns and would ideally be subject to a separate expansion factor, However, Jacobs report that it was only possible to identify users over 65 years and these then were expanded separately. Where age cannot be identified, the user was assumed to be under 65. There were a small percentage of children under 10 who own a mobile phone, the data specifies the age of those under 16 by 'age unknown'. It was not possible to categorise those under 10 through occupancy factors for cars and LGVs as these include all persons. Therefore, the travel patterns of those under 10 were reflected in the 10-65 category.

Jacobs and Telefonica state that there is only a slight difference in mobile ownership between higher and lower socio-economic groups. Smart phone ownership differences are more marked and there may be some impact as smartphones will generate more cell ID events than a non-smartphone. However, it was concluded that effort in correction of this issue was not warranted.

Jacobs used a number of data sources within the development of TIS. Some data was used directly in the TIS identification process such as data from the following sources:

- National Travel Survey (NTS) to support mode allocation.
- Census population and employment data to support trip end allocation to zones.
- Census population in the trip expansion process.

Some data was used indirectly to assess the accuracy of TIS outputs, and allowed the refinement of the trip identification process including the NTS 2015, Census 2015 Mid-Year Population Estimates, Census 2011 Workplace Population Estimates, the DfT National Trip End Model (NTEM v 7), Rail WiFi Data, Office of Rail and Road Rail (ORR) Passenger Statistics and DfT and Highways England Traffic Counts.

The various data sources were used to prepare a number of statistics which could be compared with equivalent statistics from TIS. The key areas that these statistics relate to were as follows:

- Person Trip Rates.
- Trip End Totals.
- Accuracy of Home and Work Locations'
- Modal Share.
- Daily Profile.
- Trip Length Distribution.

There is no established practice around the issues of using MPD to develop trip matrices. The methods used by Jacobs appear to accord with techniques used on recent Highways England projects such as the Regional Traffic Models (RTM) in which the trip matrices were heavily based on MPD information.

Verification process

The preliminary processing of MPD was undertaken entirely by Telefonica and O2. Jacobs carried out a series of data checks and adjustments which are described below. A number of sources of third-party data were employed for this purpose including 2011 Census Residential Population and Journey to Work data, National Travel Survey and various traffic count databases within the region.

The output of the verification stage was a series of refined MPD matrices consistent with independent sources and suitable for the subsequent disaggregation. The following key aspects of the provisional data were reviewed and verified:

- removal of rail trips;
- trip ends and trip purpose allocation;
- checks on the symmetry of matrices;
- trip rates; and
- volumetric vehicle flows.

Matrices from Telefonica were compared against 24 hours Census commuting data for all modes, and for just road modes, at different levels of spatial detail. Jacobs state that the comparison with all modes and those representing just road modes was relatively consistent for all MSOAs. MPD trip data was aggregated into matrices that were consistent with the TEMPro Trip-end Database in terms of time periods, modes and purposes. All day trip ODs were compared against NTEM trip ends separately by journey purpose (e.g. commuting) for all zones contained within the model area. These checks were carried out at District level and then by MSOA. In general, Jacobs state that the correlation between the MPD data and the TEMPro estimates was satisfactory both at the 24 hour level and in individual time periods (e.g. AM peak). The exception was the commuting purpose for the AM time period, which fell close to the expected required threshold. It should be noted that TEMPro is a model owned by DfT. Calibrating or validating the MPD data against model data is somewhat questionable, but comparisons can be made.

Synthesised GV trips were removed from non-commuting MPD matrices. This was carried out to look for outliers and identify potential errors with either provisional data and/or synthetic matrices. Similar checks were undertaken with the same aim, but checking against Census commuting data instead.

Since MPD matrices include only trips entering, leaving or staying within the boundaries of the BCC Boundary Cordon, the Census commuting data was filtered for consistency. All day from-home trip origins/destinations and to-home trip destinations/origins were compared against commuting only trips for all zones within the BCC boundaries. This was done first at District level and then at a more detailed level of MSOA. Although the agreement between the data sources was reasonably satisfactory, Jacobs note that the comparisons proved that provisional MPD data, when compared to the Census, underestimates commuting trips.

Similar patterns were found in the remaining capture area – rest of Buckinghamshire and Milton Keynes. Correlations between both data sources remained broadly consistent for the attractions end while proving to be a less accurate match for the home end of the trips. This comparison suggested that home-based trips were being underestimated and that their spatial distribution needed to be addressed as well.

Matrix symmetry (each zone should have roughly the same number of trips departing and arriving over 24 hours) was also checked. Totals were compared for all the different purposes, both at Aylesbury Vale and Buckinghamshire level. In general, symmetry among the matrices was observed to be good.

To prove that errors and inconsistencies on either purpose or spatial allocation remain constant during the different time periods, MPD matrices aggregated at both Aylesbury and around Aylesbury area were compared against 2011 Census Data, as well as general population. Residential population was compared against home-based trip ends from the MPD. Total residential population was matched against HBW and HBO origins for the AM period and destinations for the PM.

The trip rates for home-based trips were compared against TRICS which provides comprehensive data for the entire UK on trip rates per household. These values were factored by the average household size across the UK, UK Census 2011, and compared against the values obtained for the provisional MPD matrices. Jacobs confirmed that the trip rates obtained for HB of around 0.30 to 0.45 trips per person on each 3-hour time period, were slightly smaller when compared against TRICS, whose values tend to range from 0.50 to 0.70 for populations similar to Aylesbury.

To address the issues raised by these comparisons, an iterative process of data adjustment and consecutive checks was applied to convert the initial provisional matrices into final prior matrices. According to Jacobs, overall the Telefonica Data can be described as being accurate enough to be used as the primary source from which to develop prior trip matrices (for input to matrix estimation).

Jacobs report that the final "prior" matrices match reasonably well with third party sources. The MPD data compared reasonably well against TEMPro for the entire county for AM and PM HBW and NHB purposes, before and after the adjustments were implemented. The last verification test included a test-run (model assignment) of the matrices within a previously calibrated version of the model and against up-to-date traffic counts and screenlines. WebTAG Unit M3-1 criteria was applied for checking not only the differences among volumetric counts and modelled flows, but also changes to matrices due to the implementation of the Matrix Estimation processes.

Appendix B

Preparation of Synthetic Trip Matrices

Passenger car trips

The synthetic car trip matrices for Aylesbury Transport Model (ATM) were estimated, by Jacobs, using on an existing methodology developed for the Buckinghamshire Countywide model (BCM) and then refined for the ATM. Trip rates were applied to zonal residential and workplace population to estimate the daily total trip generation of each zone, by trip purpose. The resultant 'trip ends' were then used to distribute trips across all zones in the model using gravity models. The output matrices, by trip purpose, were then converted from people to vehicles (using vehicle occupancy assumptions), from PA to OD, and from a 24-hour period to the specific time periods used in the ATM model.

Population data was gathered using the 2011 National Census. Employment data was taken from Business directory information. These data sources were supplemented with planning completions data from Aylesbury Vale District Council up to 2017 to update the land use to the model base year, 2017.

In BCM for the purposes of generating trip ends, people living within each model zone were split into eleven categories based on age, gender, employment or education status. Also, household types were split into eight categories according to the number of resident adults (1, 2 and 3+) and the level of car ownership (0,1, and 2+). In all, a total of 88 person/household type combinations were defined, and all have trip rates based on NTS data, as used in NTEM (the National Trip End Model). The number of persons in each zone who fall into each person/household type combination was calculated by NATCOP using the updated Census data.

To generate trip ends at the attraction end, data on employment within each zone was required. This included the number of jobs in pre-specified employment categories, as summarised below.

Education	**Employment**
Primary and Secondary Education	Hotels, Campsites etc.
Higher Education	Retail
Adult/Other Education	Health/Medical
	Services (business & other)
	Industry, Construction and Transport
	Restaurants & Bars
	Recreation & Sport
	Agriculture & Fishing
	Business

The data set contains details of over 4 million workplaces (in theory, this includes all workplaces in the UK) and provides the number of employees by business type and location. Trip ends were generated using bespoke software developed by Jacobs, which incorporates the DfT programs CTripEnd and NATCOP into a single process. The software uses NATCOP to calculate car availability, and the number of persons in each person type by household type combination for each model zone. The CTripEnd program was then used to combine household structure information with trip rates (by mode of travel for each car availability category) derived from NTS. This produces production and attraction trip ends, by trip purpose and household car availability, at both 24 hour (daily) level and split by time period. The resulting production-attraction trip ends were constrained to match TEMPRO 7.2 at a 24hr, District-wide level, with planning assumptions adjusted in line with the land use determined previously.

The trip ends were calculated for the following standard trip purposes, for each car availability category;

- Home-Based Work (HBW);
- Home-Based Employer Business (HBEB);
- Home-Based Shopping (HBS);
- Home-Based Education (HBEd);
- Home-Based Other (HBO);
- Non-Home-Based Work (NHBO);
- Non-Home-Based Employer Business (NHBEB); and
- Non-Home-Based Other (NHBO).

Trip Distribution

The trips were distributed using a gravity model.

The gravity model is based on the hypothesis that the amount of travel between two areas can be considered as being proportional to their population, numbers of jobs, schools, factories, offices etc but inversely proportional to the distance (or some measure of the separation or deterrence) between them.

The gravity model used by Jacobs was calibrated to reproduce average trip lengths by journey purpose from NTS. To reflect the diversity of Buckinghamshire zones (in terms of urban/rural characteristics) and the proximity of London, the model zones were categorized using NTS bandings. For each band the mean trip length obtained was calibrated to match NTS values. This gave longer car trips from rural zones. As the NTS data is given for all trips regardless of time period, the synthetic data is similar for all time periods combined. Observed MPD replaced the synthetic data above 5km in length.

The distribution model was applied to 24-hour production and attraction trip ends by trip purpose, to produce a production-attraction (PA) matrix for an average 24-hour weekday period. Productions by time period were used to split the 24-hour matrix into PA matrices by time period, and factors were used to convert the PA matrices into OD matrices. These factors determine for each outbound trip (i.e. from the production end to the attraction end) by time period and trip purpose, what the likely time period and trip purpose of the return trip will be.

Time period splits were based on NTS data. For example, the morning period, home based work trip purpose PA matrix will contain a number of trips between a production (home) and attraction (work). The PA matrix effectively provides the OD matrix for the outbound (from home) trip. The PA matrix once transposed provides details of the return trip (back home from work) and the factors specify in what time period the trip will return, and what the trip purpose would be. The return trip purpose may be different to the outbound trip purpose if for example the individual stopped at the shops on the way home from work (the return trip purpose would therefore by home based shopping). There are a set of factors for morning peak home based work trips, which determine what the return trip purpose and time period. In the specific example the following proportions were applied to the return trips (note due to rounding figures below add to 99%):

• 63% of trips will return as a home based work trip in the evening peak
• 19% will return as home based work in the interpeak
• 8% will return as home based work in the off peak
• 4% will return as home based work in the morning peak
• 2% will return as home based shopping in the evening peak
• 2% will return as home based employers business in the evening peak
• 1% will return as home based shopping in the interpeak

Similar factors were specified for all combinations of outbound trip purpose and time period. The result of applying the factors was OD matrices by time period and trip purpose. A vehicle occupancy factor was then used to convert the matrices from person trips to vehicle trips. The factors initially used are those in the WebTAG data book.

A further factor was applied to convert from the three-hour peak time period to the modelled peak hour. These factors were derived from traffic count data for Aylesbury. The inter-peak period was modelled by use of an average hour matrix, comprising one sixth of the period demand.

Matrix merging and Trip Length Distribution Calibration

In the MPD preliminary matrices there was a shortfall in trips between 0km and 5km in length. Jacobs' solution was to develop synthetic trip matrices and merge these with the MPD matrices to make up the shortfall of short-distance trips. The approach adopted was to infill the observed trip matrices with synthetic trips for zone to zone pairs of less than 5km. A variety of infilling approaches were tested, including linear combinations of MPD and synthetic trips from 0 to 5km (with full synthetic trips at 0km and full observed trips at ≥5km) and step functions (with full synthetic trips at 0 – 5km and full observed trips at ≥5km). These methods were also tested with a range of trip length distributions (TLD). The final method for infilling was selected based on a comparison of the TLD with Census Journey to Work trip length distribution.

The approach used for generating the synthetic matrices for ATM appears to follow good practice although a detailed analysis has not been carried out.

Goods Vehicles (GV) matrices

The method used to generate trip ends for cars could not be applied for LGVs and HGVs. This was because it relied on use of NTEM data, which is concerned only with private, rather than freight or business trips. Therefore, an alternative methodology was employed.

Heavy Goods Vehicles

Although the observed data, based on the TIS data procured through Telefonica contains GV trips, for use in this model they were removed from the MPD, so as to not double count these trips. The HGV matrix was estimated using the DfT Base Year Freight Matrices (BYFM) dataset, which provides 24hr HGV movements between English, Welsh and Scottish Local Authority Districts (LADs). The data is for 2006 and is measured in annual flows.

Jobs data was used with typical daily HGV trip rates per job by type (sourced from TRICS) to break down regional trip ends to the zonal values used in the ATM model. This was used to calculate weights which were used as probabilities of each origin and destination zone within a local authority district. The method was used without any adjustment (or deterrence function) for length of trip. The resulting HGV flows were then increased to give weekday volumes by modelled time period.

This gave an estimate of longer distance HGV movements, which primarily use the main road network. Further movements were estimated to reflect the local HGV movements (e.g. deliveries by HGV which typically operate in multi-drop rather than point-to-point mode, or operate over shorter distances). These trips were estimated using a gravity model with a typical short (inter-stop) mean trip length. The HGV matrix was then divided to give average weekday totals and then (using proportions based on traffic counts) to volumes by modelled time period.

Light goods vehicles

The LGV traffic matrices were synthesised using car and BYFM LGV matrices as inputs. The BYFM LGV matrices represent just that portion of daily LGV traffic which were carrying goods. Those carrying equipment or performing delivery/courier type services were excluded from BYFM, so were estimated to obtain total LGV matrices.

Regressions were undertaken using the Buckinghamshire traffic count data to estimate a simple relationship between LGV flows and the synthetic car employer's business (EB) and BYFM LGV volumes. These were determined first by a regression of LGV counts against HGV and Car counts, with the proportion of car trips considered "business" determined using TEMPRO proportions, and then refined by assigning the resultant matrices onto the network and performing regressions of the resultant flows against observed LGV counts.

Different factors were applied to car EB and BYFM LGV matrices, depending on time period, to give a good representation of LGV counts. LGV matrices were estimated using this relationship with synthetic car EB and BYFM LGV matrices for each modelled period.

Calibration of LGV and HGV matrices

HGV and LGV matrices were used as "initial GV matrices", and further work was undertaken to refine them alongside the "initial prior car matrices". This work included assigning these matrices onto the network together with car matrices derived from merging the synthetic and mobile phone datasets. These "initial matrices" were further adjusted, and then used as "prior matrices" which were subject to matrix estimation. The matrices output from matrix estimation were taken forward as the calibrated LGV and HGV traffic flows and used in assignments.

The standard of data available for estimating HGV and LGV movements is inferior to that for car trips. Because many goods vehicle trips are not home-based it is difficult to calibrate the matrices. MPD data does not help very much in this respect. The general approach adopted by Jacobs is relatively standard for the industry.

Appendix C

Adjustment of merged matrices

Demand matrices adjustments

Before matrix estimation was applied to "smooth" the matrices, a separate adjustment process was undertaken on the merged matrices. Jacobs claim that this was to adjust for large scale discrepancies in movements across the modelled area. This process was undertaken by splitting the zone system into a number of sectors, representing broad areas of the model as shown below.

A map of sectors is shown below in Figure 9-29.

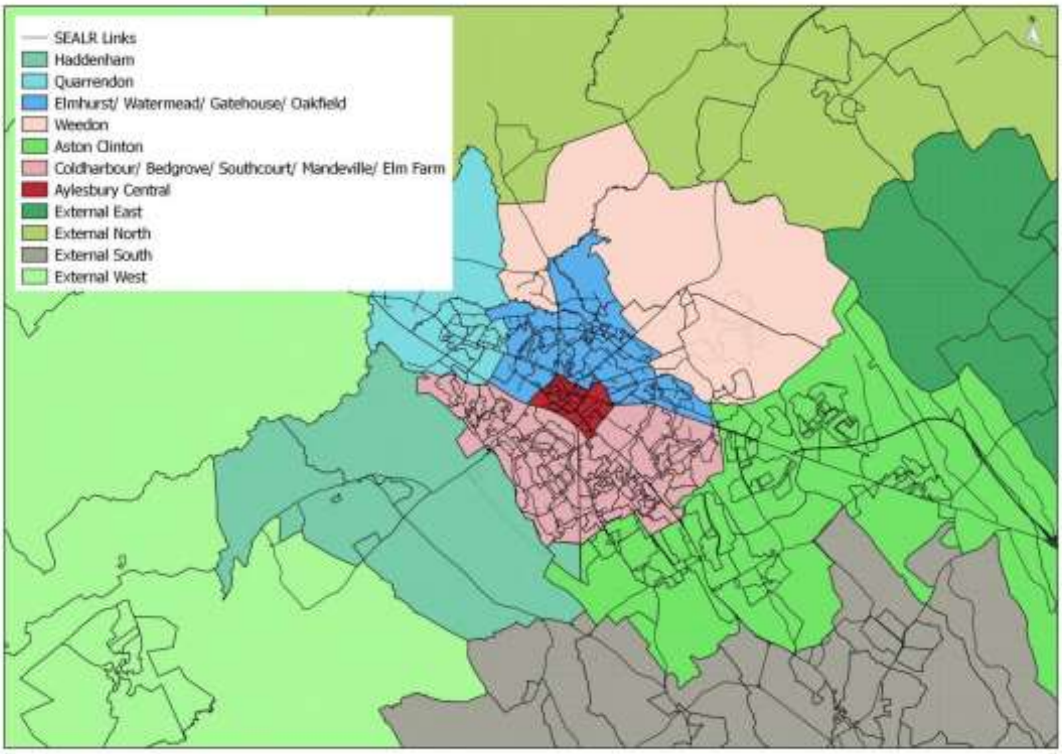


Figure 9-29: Sector Area Map

The merged matrices (part MPD and part synthesised) were assigned to the BCM network. Modelled flows were compared with calibration counts. Then adjustments were made to take into account potential errors in the synthetic demand data and known underestimation of short distance trips by MPD. Checks were carried out to confirm that the adjustments did not significantly change patterns or comparisons against NTEM. Separate adjustments were made for cars, LGVs and HGVs. It was concluded that matrix estimation was required to refine the matrices to traffic volumes.

It is assumed that the process described as "adjustment of merged matrices" was carried out iteratively with the development of synthetic matrices and MPD matrices, although this is not entirely clear from the Jacobs report.

Matrix cordoning

The "merged and adjusted matrices" contained trips for all OD pairs across the country, including those which did not travel through the modelled area. To reduce model run times for the assignment, these were reduced to cordon matrices only. The cordon matrices contain only trips which pass through the modelled area. To achieve this, the "merged and adjusted matrices" were assigned to the BCM network, and the resulting trip routes were cut at the boundary of the modelled area. The model cordon was defined by a series of area of influence tests. Finally trips which entered or exited the cordons were assigned to cordon zones representing each entry and exit point from the cordon. These matrices were taken as "final prior matrices" for matrix estimation.

The process of cordoning is a logical one to reduce model run times for the ATM. However, it is strange that, having built trip matrices for a large area using the MPD, Jacobs have not used the MPD data to update the BCM model.