22 April 2019

Tiascope

WebTAG Reference

1. Overview

1.1. Transport Analysis Guidance (TAG) explains why we use forecasting, modelling and data collection for transport appraisal and why certain methods are used.

1.2. This document sets out guidance components within TAG unit M1-1 principles of modelling and forecasting, and refers to how these components are relevant to the Tiascope modelling approach.

1.3. Within this reference there are four levels of comparison. Out of 98 points made within the guidance, the four levels met occur the following times:

- N/A - 35
- Question - 8
- Not met - 4
- Met - 51

1.4. Meeting the criteria does not either signify that Tiascope is or is not 'WebTAG compliant'. These comparisons are present to help understand the position, use and certainty of Tiascope in relation to recommended modelling practice.

1.5. It should be noted that Tiascope is not an all-encompassing variable demand assignment model: it is an automated demand, distribution and site-specific assignment model.

1.6. This document currently provides reference only to TAG unit M1-1 principles of modelling and forecasting. It is expected to be developed to additionally provide reference to the following WebTAG units (as the model itself is developed):

- M1-2 data sources and surveys
- M3-1 highway assignment modelling
- M4 forecasting and uncertainty

Section	Code	Main point	Sub point (if applicable)	Tiascope criteria	Tiascope comments
Data collection	3.13	Five types of data can be collected and used to inform most models:	data on the transport network, including the physical layout, number of lanes, signal timings, public transport frequencies and capacities	Met	The data is fit for purpose in that there is an accurate representation of the existing road network and level of service. The forthcoming ability to make changes by the user will allow additional detail where necessary.
			counts of vehicles or persons on transport services, links or at junctions	Not met	Base counts are not used to determine forecast trip generation and distribution.
			journey times	Met	Speed data for different periods has been taken and processed to determine journey times.
			queue lengths at busy junctions	Not met	Impacts of queues on trip distribution is accounted for within link speed characteristics.
			interview surveys	Met	NTS surveys are used to determine NTEM trip generation by mode and journey purpose. Census travel to work data informs distribution of workplace trips.
	3.15	There are many risks with collecting and interpreting data samples. These should be mitigated by:	ensuring that samples are of adequate quality and sufficiently large	Met	Trip generation is suitably determined from NTEM. Data used to determine the trip generation exceeds traditional alternative methodologies.
			recognising the statistical limitations of the sample (for example the scale of sample error)	Met	Trip generation is suitably determined from NTEM. Data used to determine the trip generation exceeds traditional alternative methodologies. Additional changes can be made as determined by the user to supplement the model.
			collecting data under typical conditions (e.g. not during holiday periods or at times of extreme weather). Sometimes data collection needs to be repeated	Met	Speed data is based on a typical neutral day.
	3.16	Data collection is usually the most resource-intensive aspect of transport modelling. It is therefore highly advisable to minimise the amount of data that needs to be collected, by:	taking into account data requirements in the design of the model	Met	No additional data is necessary to determine a suitable Trip distribution.
			using data that has already been collected, where this is of adequate quality	Met	All data collection and processing is automated.
The Standard Model Structure	4.2.1	Figure 1, on the next page, shows the standard model structure in a flow chart format.		Met	The correspondance of the Tiascope model structure is shown in Figure 2 of the Tiascope Development Document.
	4.2.3	These (trips) need to be segmented by origin, destination, time period and mode. This is handled by storing both demand and supply in multi-dimensional arrays, known as the trip matrix and the cost matrix respectively.		Met	Trips are determined from NTEM data by origin, destination, time period and mode. The cost matrix interacts with trips by journey purpose to determine a distribution.
	4.2.4	The various costs of travel are often combined into a generalised cost, usually a linear combination of each cost component, which reflects overall perception of difficulty of travel.		Met	Generalised cost for each road link are the result of WebTAG values of Vehicle Operating Costs and Values of Time multiplied by distance and journey time respectively.
	4.2.5	spatial areas are usually aggregated to zones, and the trip matrix and the cost matrix are usually segmented by pairs of zones.		Met	Correct. All pairs are to and from the site specific zone.
	4.2.6	The demand model (see section 4.3) is used to forecast the trip matrix, based on:	the most up-to-date estimate of the cost matrices	Met	Cost matrices used to determine distribution of journey purpose.
			a measure of travel demand based on the demographic data assumptions (population and employment). The measure most commonly used is known as trip ends, and these are calculated using a trip end model	Met	NTEM trip end model used to determine trip rates by segmented by journey purpose.
	4.2.7	For appraising major transport schemes, the Department strongly prefers the use of incremental demand models in preference to absolute models. Incremental models update a trip matrix heavily based on observed data for the base year, whereas absolute models calculate the trip matrix for each forecast year directly based on trip ends and costs. Incremental models rely more on observed data less on the mathematical specification of the model than absolute models.		N/A	Tiascope is an absolute model. An incremental model is not considered suitable for demand modelling of new sites.
	4.2.8	When using a fixed demand approach, as discussed in section 4.3, it will not be necessary to have a cost-dependent demand model, but trip ends will still be used to implement the effects of changes in demographic data between forecast years.		Met	NTEM forecasts include demographic forecasts.
	4.2.9	The cost matrix is calculated using the assignment model (section 4.4) which is based on:	the most up-to-date estimate of the trip matrix	Met	Cost matrices used to determine distribution of journey purpose.
			a network model (a mathematical representation of the transport network), which is used to calculate the cost of travel between each pair of zones	Met	This bespoke Tiascope network is used to determine cost matrices to and form the site.
	4.2.10	Assignment models have a dual role – as well as calculating the cost matrix, they also allocate the trips by route and calculate demand for each link in the network. This supports analysis of the impacts of transport infrastructure, which is particularly important for highways.		Met	The assignment model in Tiascope is used to both determine network costs and also to determine the demand on links associated with the site in question.
	4.2.11	In general, the demand model and assignment model depend on each other. In order to provide a systematic basis to compare forecasts, they should be run alternately until they have converged to equilibrium within specified tolerances (discussed further in Appendix A). This creates the need for a loop structure, which requires much greater run times than would otherwise be the case.		Met	There is automatic convergence in that Tiascope is only used to determine site specific demand on top of existing background demand.
	4.2.12	A further demand-supply loop is required within the assignment model itself. The assignment model calculates both the demand and cost for individual links and junctions in the network. The demand and cost depend on each other as follows:	the demand for each link depends on the number of trips between each pair of zones (from the trip matrix) and the routes they choose (which are dependent on the cost of choosing each route)	Met	Assignment is determined by minimum cost route for each OD pair.
			the cost (in particular, the travel time) of travelling along each link or junction depends on its demand and the mathematical relationship between demand, capacity and cost. These mathematical relationships are defined in the network model	Met	The minimum cost route is determined using the transport network for each OD pair.

Section	Code	Main point	Sub point (if applicable)	Tiascope criteria	Tiascope comments
The Demand Model	4.3.3	Travel behaviour often varies also by trip purpose and person type characteristics including age, the extent to which the person is working, household structure, and household car ownership. In general, separate demand models will need to be developed for the following three trip purposes (Employers' business, Commuting (to work), Other), as they have different parameters.		Met	NTEM determines trips by journey purpose. Tiascope uses differeing gravity functions to distribute trips within these journey purposes.
	4.3.4	Increasing the number of trip purposes, or using a large number of person types, can improve the capability of the model but will increase its complexity and cost; the cost of data collection may also be increased. Consideration might be given to using greater segmentation for those parts of the calculation that are least data-hungry (particularly person type segmentation in trip end models).		Met	Data collection and processing is automated.
	4.3.5	Demographic data (e.g. population and employment data) is specific to a single zone. This means it does not form a good indicator of the quantity of travel between a pair of zones, but it can inform total demand to and from each zone, or trip ends.		Met	NTEM data is used to determine trips by journey purpose. If a preferred source of trip ends is used these proportions are then applied to the new total trip rates.
	4.3.6	Trip ends are the format in which the Department provides its standard forecasts of growth in demand. They can be calculated quite simply by multiplying demographic data by trip rates, which can be estimated from survey data. Most models will have a trip end model to handle planned local changes in housing and employment data. When forecasting, however, growth in trip ends should be controlled to growth factors from the NTEM dataset at a suitably aggregate spatial level.		Met	NTEM data is used to determine trips by journey purpose.
	4.3.7	Although individual trips are used as the unit of travel demand, transport users do not make a single trip in isolation, but instead undertake a series of trips in order to carry out one or more activities. A series of trips undertaken between leaving home and returning home is commonly called a tour.		N/A	Residential trips within Tiascope use Home Based trips from NTEM. Non Home Based or linked trips are not felt to be in the vicinity of the site.
	4.3.8	In most models, it is convenient to split trips according to their position in the tour – whether outbound from home, return to home, or non-home-based trips – and to define the trip ends by production (the location where the decision to travel is made) and attraction (the reason for travel). The production / attraction (P/A) can differ from the origin / destination (O/D) definition, in which the trip ends are characterised by the beginning (origin) and end (destination) of the trip.		Met	NTEM P/A and O/D are used together to calculate expected Entry/Exits associated with the site by time of day.
	4.3.9	There are three broad approaches to representing travellers' response to cost:	a fixed demand approach, in which demand is independent of cost, and the trip matrix is adjusted using trip ends and no behavioural model is required	Met	This approach is undertaken, albeit with variable demand amongst the same journey purpose determined by gravity functions.
			an own cost elasticity approach where demand in each cell of the trip matrix can vary, but the source of any variation is limited to the corresponding cell of the cost matrix only	N/A	
			a full variable demand approach where demand in each cell of the matrix can vary according to demand in other cells of the trip matrix and costs in all cells of the cost matrix. This is usually implemented using discrete choice models	N/A	
	4.3.10	Fixed demand approaches have the quickest run times as they do not require the demand and assignment models to be run alternately. However, their use is only valid where it can be demonstrated that changes in cost will not generate a noticeable change in demand (commonly called induced traffic). As such, fixed demand models are inadequate for most transport schemes which are aimed at resolving congestion or relieving overcrowding on public transport.		Met	Tiascope is used to determine the demand for new developments; the fixed demand approach is appropriate.
	4.3.11	Own-cost elasticity models do not constrain total demand according to the size of the population. This means they are not adequate for representing either the transport market as a whole, or modes with a high share of overall travel, such as car. However, they have advantages over choice models when analysing rail schemes.		N/A	
	4.3.12	Variable demand models assume that (travel costs notwithstanding) the trip rate for any given demographic segment is constant through time. The National Travel Survey (NTS) supports the validity of this assumption in terms of total trip rates, which are strongly dominated by car and walkbased trips. However, recent growth in rail trips within each household type has been much higher than would be explained by this assumption.		N/A	
	4.3.13	Variable demand models are most often used to model personal travel for highway and local transport schemes. This includes bus schemes, the performance of which is sometimes dependent on the level of car traffic on the network. Since car forms a large proportion of total travel demand, its growth will largely be constrained by population changes, with some variation according to changes in transport cost. The variable demand model approach, which splits total demand into smaller segments through a series of choice models, is the best way of representing this.		Not met	No variable demand modelling undertaken within Tiascope.
	4.3.14	For some trip movements it is more difficult to use choice models. Freight movements, in particular, are often part of a complex logistic chain, which means that it is often not appropriate to assume that TAG Unit M1.1 Principles of Modelling and Forecasting Page 10 each trip can be modelled individually Simple factoring methods are therefore often used for freight movements. Similar approaches are often used for trip movements from external areas (outside the main geographical study area defined for the model), as for these trips it is often more difficult to represent the full range of destination choices available.		N/A	
	4.3.15	In the earlier stages of modelling a major transport scheme (e.g. for option testing), it may not be proportionate to use full variable demand choice models. Guidance in the TPM (Technical Project Manager) unit should be followed.		N/A	
	4.3.16	Analysts using discrete choice models will need to decide whether the demand model should calculate the trip matrix "from scratch", using the trip ends and costs only, or update an existing matrix. Three approaches are commonly used in different contexts:	absolute models, in which the trip matrix is constructed by splitting trip ends into smaller and smaller segments based on the cost of each segment	Met	This approach is undertaken.
			absolute models applied incrementally, in which an absolute model is used to update a trip matrix for a historic year, i.e. the model base year	N/A	
			incremental or pivot-point models, in which changes in cost (rather than absolute cost) are used to update the trip matrix	N/A	
	4.3.17	Both incremental models and absolute models applied incrementally require a starting matrix, which needs to be split by mode. For incremental models the matrix also needs to be split by trip purpose. These approaches require a base year trip matrix which should, as far as possible, be based on a sample of observed data. However, it is unlikely that sufficient data will be available to calculate every cell of the matrix, and in practice a variety of synthetic methods may be used alongside the observed data itself. In using these synthetic methods, however, every effort should be made not to distort the observed trip patterns.		N/A	
	4.3.18	Absolute models rely more heavily on the mathematical formulation of the model, whereas incremental models rely more heavily on observed data; absolute models applied incrementally fall between these two extremes. The Department prefers the use of incremental models, as the risks in relying on the mathematical formulation of the model (imperfect representation of reality) are usually greater than the risks of relying on the observed data (sampling error and statistical error). However, there can be exceptions to this where it is not possible to collect adequate data, such as new modes or developments.		Met	Tiascope works with new developments.
	4.3.19	Discrete choice models are described in many of the references and are not discussed at length here. Briefly, they segment a number of trips between a set of options using a mathematical formula based on the relative cost and benefit of each option. Most variable demand models use hierarchical choice models with a separate choice model for each of a series of choices.		N/A	
	4.3.20	TAG Unit M2 – Variable Demand Modelling gives more guidance on how these models are constructed. As with all models, it is important to use them consistently with the underlying theory behind them.		N/A	
	4.3.21	In the most common demand model structure (hierarchical logit), the order in which the choices appear is important. Usually the order given below is best unless there is strong evidence to the contrary, although for some study areas the order of the mode choice, time period choice and distribution models may be different:	Trip frequency (particularly when one of the major modes – car, public transport, walking / cycling are not modelled)	Met	Uses NTEM to determine trip rates.
			Mode Choice	Met	Uses NTEM to segment by mode.
			Time period choice	Met	Uses NTEM to segment by time of day.
			Distribution (the matching between productions and attractions)	Met	Determines distribution using cost matrices within the bespoke model.
	4.3.22	Each sub-model depends on parameters which will affect the modelling response for each choice. These parameters need to be estimated by trip purpose, either by calibrating the choice model against observed data or importing sensible parameters from another model.		Met	Gravity function parameters are adjusted to validate against National Travel Survey (NTS) data by journey purpose.

Section	Code	Main point	Sub point (if applicable)	Tiascope criteria	Tiascope comments
The Assignment Model	4.4.1	The assignment model splits the trips according to the route they take through the network, and then calculates the cost of travelling via each route. These cost calculations are needed not only for the assignment model itself, but also (assembled in matrix form) for the demand model. Vehicle flows on links from highway assignment models inform the analysis of some social and environmental impacts.		Met	The demand distribution is linked with the assignment within Tiascope to determine link-by-link demands associated with the proposed development. Outputs could be used to assist in environmental analysis.
	4.4.2	Route choice has a complex set of options which cannot usually be represented using matrices. When comparing two forecasts (as is necessary in appraisal), the network (and hence the choice of routes available) will vary between the two forecasts. Commercially-available software packages are usually used for the assignment model – these use a mathematical representation of the transport network which, in virtually all cases, can also be viewed graphically.		Not met	Assignment is all or nothing determined by minimum cost. There is no scope to compare assignments between models at the same site.
	4.4.3	In general, the demand and cost for each route depend on each other, so the assignment model is an equilibrium model. In highway assignment, in which cost varies according to congestion on the network, the notion of equilibrium is consistent with Wardrop's principle:	Traffic arranges itself on networks such that the cost of travel on all routes used between each origin-destination pair is equal to the minimum cost of travel and all unused routes have equal or greater cost.	Question	Although the minimum cost is used to determine distribution and assignment, it should be noted that there is currently no reassignment of background traffic associated with the site.
	4.4.4	Under Wardrop's principle, no user will benefit by changing route. However, Wardrop equilibria are not always unique, which creates a risk that the difference in traffic flow between two forecasts will be as a result of reaching different equilibria, rather than because of the input assumptions to the forecasts themselves.		N/A	
	4.4.5	The simplest form of Wardrop assignment assumes all travellers have the same perception of cost. However, more complex forms of assignment exist in which it may be assumed that different users perceive cost in different ways, such as Stochastic User Equilibrium (SUE). Further details are given in TAG Unit M3.1 – Highway Assignment.		Question	Within Tiascope there is only one type of user and thus one type of assignment.
	4.4.10	In practice, perfect convergence will not usually be achieved in assignment models. TAG Units M3.1 – Highway Assignment Modelling and M3.2 – Public Transport Assignment Modelling provide guidelines on the tolerance standards expected.		Met	Convergence of site specific demand is met as an overlay to any background demand that exists without the site.
	4.4.11	Intra-zonal trips (with origin and destination in the same zone) present a challenge to all assignment models because they are modelled as starting and ending at the same point. This has the following implications:	their cost is calculated, incorrectly, as zero	N/A	Zones local to the site are at a census OA level. Trips between this zone are likely to be low, especially by car.
			their contribution to congestion and/or crowding is not taken into account when calculating the cost of other, inter-zonal trips	N/A	See above.
	4.4.12	These problems can be reduced by minimising the zone size, although this increases model complexity and run times. TAG Units M3.1 – Highway Assignment Modelling and M3.2 – Public Transport Assignment Modelling provides some further guidance on representing intra-zonal trips.		Met	See above.
Interfaces between Demand and Assignment models	4.5.1	In order to automate the alternate running of demand and assignment models necessary to achieve equilibrium, appropriate interfaces between the two models are required.		Met	Demand and assignment models are integrated.
	4.5.2	The trip matrix is output from the demand model and input to the assignment model. It needs to be converted from Production / Attraction (P/A) format to Origin / Destination (O/D) format for the purpose of assignment.		Met	NTEM P/A and O/D are used together to calculate expected Entry/Exits associated with the site by time of day.
	4.5.3	The cost matrix is based on outputs from the assignment model and is used to inform the demand model. Various measures of cost, such as travel time, distance, and charges such as public transport fares or highway tolls, are extracted for each origin-destination pair in the assignment model – a process known as skimming.		Met	Minimum costs are skimmed for each OD pair to determine preferred route and cost within the demand model.
	4.5.4	The demand model often requires a generalised cost matrix - usually a linear combination of the various components of cost (travel time, fuel costs, and public transport fares for example). This is usually calculated in units of time as opposed to money (as the Monetary costs are converted into time units by dividing the monetary value by the value of time which varies by trip purpose and year. The value of time varies by trip purpose and can also vary by income and distance.		Met	Generalised cost for each road link are the result of WebTAG values of Vehicle Operating Costs and Values of Time multiplied by distance and journey time respectively.
Alternative Model Structures	4.6.1	Models as described in sections 4.2 to 4.5 will generally assume that demand is aggregated into the total number of trips in each matrix cell, which may not be an integer. Microsimulation differs from this by simulating the behaviour of individuals, with individual's choices being based on the probability of each choice being made and determined using random numbers.		N/A	
	4.6.3	The standard model structure does not account for the potential impact of transport on land use patterns, such as the location of housing or employment. By contrast, LUTI models use economic principles to relate changes in transport provision to the spatial locations of employment and housing. Further details are given in Supplementary Guidance on Land Use/Transport Interaction Models.		N/A	
	4.6.7	The standard model structure calculates the demand for transport based on the historic relationship between the population and the number of trips made per person. Activity-based models, by contrast, use an alternative demand model which estimates the number of activities that transport users make, and the time profile and location of each activity, and then calculate the number of trips required to carry out these activities. This necessitates an understanding of tours and the way in which individuals schedule tours within a day.		N/A	
	4.6.10	Many transport schemes will be appraised using static assignment models which assume a constant rate of demand for each link during a period of time. Dynamic assignment models differ from this by: allowing varying rates of demand on each link at different times during the assignment period.		N/A	
	4.6.11	Dynamic assignment models may be disproportionate for some transport schemes, but may be important for understanding how the state of the network (e.g. queue formation) varies during a time period. Further guidance on this is given in TAG Unit M3.1 – Highway Assignment Modelling.		N/A	
Mitigating Modelling Risks	4.7.1	The main risks from constructing a model are as follows:	there are errors in the inputs (for the transport network or the demand data)	Met	Inputs are automated to limit error.
			the model is not being used in accordance with its underlying theory	Question	Users should understand the limits of the modelling approach within Tiascope.
			the model's representation of human behaviour is unrealistic	Met	By disaggregating demands human behaviour can be represented discretely.
			a disproportionate level of effort and resources are invested into building the model	Met	Automation ensures limited effort on the user side.
	4.7.3	Inputs to transport models should be transparent and straightforward to audit. In particular, network model inputs should be checked carefully by a practitioner independent of the original coding.		Met	Model inputs can be downloaded or viewed for inspection.
	4.7.4	Any model is a simplification of reality. Although it is often sensible to use existing models to save unnecessary costs, a model designed for one purpose may not be suitable for a different situation. For example, a model designed for the appraisal of a scheme in one spatial area may not be sufficiently detailed or may not be supported by sufficient data to appraise a second scheme in an adjacent area, even if the model covers the area of the second scheme spatially.		N/A	
	4.7.5	There may also be circumstances where it is technically possible to obtain results for appraisal whilst using a model in a way inconsistent with its underlying principles. This can lead to misleading appraisal results. An example of this is failure to run an equilibrium model to convergence.		N/A	
	4.7.6	The quality of the model response should be tested by running the model for a designated base year (usually the current year or a recent historic year) and carrying out the following tests:	validation: comparing model outputs with observed data, such as that discussed in section 3 in this unit	Met	Gravity function parameters are adjusted to validate against National Travel Survey (NTS) data by journey purpose.
			realism testing: rerunning the model with some standard changes to inputs, such as fuel prices, public transport fares and car journey time, to check that the model responses (elasticities) are realistic	Question	A lot of the demand response is reliant on the NTEM model outputs.
			sensitivity testing: rerunning the model with changes to model parameters, to check the model results are robust to changes in these parameters (or otherwise indicate areas of risk if the model inputs are changed)	Question	See above.
	4.7.7	Even when a model performs well against these tests, there is no guarantee that it will not produce misleading forecasts, but the risk of this happening is considerably reduced. Conversely, a model which does not perform particularly well against these tests may still be useful for some purposes (e.g. relatively minor schemes or early stage option sifting), providing the risks are understood and managed. However, even at these early stages, models should only be used if their response is plausible.		N/A	
	4.7.8	Detailed guidance on the tests required and standards expected for model validation, realism testing and sensitivity testing can be found in TAG Unit M2 – Variable Demand Modelling, whilst guidance TAG Unit M1.1 Principles of Modelling and Forecasting Page 15 on tolerance levels for assignment validation is given in TAG Units M3.1 – Highway Assignment Modelling and M3.2 – Public Transport Assignment Modelling.		N/A	
	4.7.9	The risks of using disproportionate time and resources can be minimised by specifying the model scope correctly from the outset. Models should be sufficiently sophisticated to represent travel movements for the scheme effectively, whilst avoiding unnecessary complexity. Consideration should be given to the appropriate level of detail in demand responses, zone sizes and networks.		Met	Tiascope is clearly to be used to determine demands and distribution of demands for proposed developments.
	4.7.10	Even with the best attempts to specify modelling work prior to commencement, there may be circumstances where practitioners may need to simplify the approach during the project and document any simplifications made.		N/A	

Section	Code	Main point	Sub point (if applicable)	Tiascope criteria	Tiascope comments
Forecast Design	5.2.1	The Appraisal TAG Units set out the analysis work that usually needs to be undertaken to appraise a scheme. For most schemes, forecasts of economic benefits will be calculated for:	the scheme opening year	Question	Up to model practitioner to ensure correct year is chosen of demand. Care should be made to ensure new road infrastructure is included.
			at least one other forecast year, called the final forecast year	Question	See above.
	5.2.2	Additional forecast years between the scheme opening year and the final forecast year should be modelled where appropriate (for example, just before and after major step changes in demand or supply that will significantly affect the profile of benefits). For economic appraisal it is best if the final forecast year is as far into the future as forecasting datasets (including NTEM, items on the uncertainty log, and data used to calculate economic impacts and environmental impacts that may be monetised) will allow.		Question	See above.
	5.2.3	The forecasting model needs to be run twice for each modelled year. This means that appraisal of a scheme under a single set of assumptions requires a minimum of four model runs. As will be seen in section 5.3, the scheme will need to be appraised under multiple sets of assumptions, to test the robustness of the benefits to uncertainty.		N/A	
Mitigating Forecasting Risks	5.3.1	Systematic over-forecasting or under-forecasting of travel demand or costs will bias transport appraisal results. Such bias needs to be avoided so that:	decision-makers have a realistic view of the impacts of transport interventions (both positive and negative) under central assumptions based on current evidence	N/A	
			transport schemes can be compared on a fair and consistent basis	N/A	
	5.3.2	Transport schemes often have both positive and negative impacts, both of which are usually augmented as demand for the transport schemes increase. It is therefore not possible to create a universal "worst-case" scenario that takes into account all risks. Instead, the primary basis of evidence should be the core scenario, which should be developed using unbiased and realistic assumptions.		Met	Outputs from Tiascope are produced at an expected demand, not a worst case scenario. However, conservative assumptions are applied throughout to ensure robustness.
	5.3.3	The Department provides standard national assumptions to enable different transport schemes to be compared fairly. TAG Unit M4 – Forecasting and Uncertainty describes these standard assumptions and how they should be used.		N/A	
	5.3.4	The core scenario should also be unbiased with regard to local sources of uncertainty. Such sources of uncertainty therefore need to be identified, through construction of an uncertainty log, as part of the definition of the core scenario.		Met	Uncertainty within the model is described within the Development Document.
	5.3.5	The model itself can also be a source of bias, although this will be kept to a minimum if the guidance on mitigating modelling risks in section 4.7 is followed.		Met	Risks are understood and mitigated against.
	5.3.6	Forecasts are, by nature, uncertain. Even though the assumptions in the core scenario should be unbiased, there is no guarantee that outturn real-world result will be the same as the forecasts in the core scenario. This creates risks that:	the benefits of the transport scheme will not be as high as the forecast suggests, leading to an intervention that is either unnecessary or represents poor value for money	N/A	
			the benefits of the transport scheme are higher than the forecast suggests, leading to failure to intervene where necessary	N/A	
			the problems created by the transport scheme will be greater than the forecast suggests	N/A	
			a cheaper investment than the one actually implemented would have been sufficient	N/A	
	5.3.7	Decision-makers need to understand these risks, so it is important for analysts to communicate them well and quantify them if proportionate. Given the complexity of interactions between demand and supply in transport systems, the best way to quantify these risks is to define alternative scenarios using different assumptions to the core scenario, and then re-run the model using these different assumptions.		N/A	