Order Schedule 20 (Order Specification)

This Schedule sets out the characteristics of the Deliverables that the Supplier will be required to make to the Buyers under this Order Contract

CONTENTS

1. PURPOSE

1.1 The National Trip End Model (NTEM) is a trip generation model of Great Britain (England, Scotland and Wales). The most recently published results, NTEM version 8, cover the period 2021 to 2061. These forecasts inform most of the Department for Transport's investment decisions.[1]

1.2 We wish to replace the components 'Scenario Generator', 'NATCOP' and 'Licence Cohort Model' with new forecasting software that generates a 'synthetic population' that can be published as well as continuing to provide the inputs to the existing CTripEnd modelling software.

1.3 This project aims to solve three problems:

1.3.1 the existing software is old and increasingly difficult to maintain;

1.3.2 the existing software does not support the most modern transport modelling techniques (activity modelling) well; and

1.3.3 we would like all our modelling to be more transparent than at present, so that our users can more easily monitor our assumptions and understand our reasoning. We currently publish detailed reports as well as the final model results. However, we do encounter ethical/privacy constraints on how we can share our model's inputs and its implementation.

2. BACKGROUND TO THE CONTRACTING AUTHORITY

2.1 The Department for Transport is responsible for government investment in transport in England. It is answerable to His Majesty's Treasury (HMT) and to Parliament to demonstrate that all such investments are a wise, proper, and proportionate use of taxpayers' funds. This goal is implemented in accordance with HMT's five-part business case process.

2.2 DfT publishes guidance[2] on preparing the required analyses for transport scheme promoters. It also publishes various software and data sets, including the NTEM results and TEMPro. These publications aim to ensure:

[1] The published NTEM 8.0 Results can be downloaded from https://www.data.gov.uk/dataset/11bc7aaf-ddf6-4133-a91d-84e6f20a663e/national-trip-end-model-ntem. The interface program TEMPro can be downloaded from https://www.gov.uk/government/publications/tempro-downloads. The TEMPro download includes the NTEM 8.0 documentation (which describes the existing model and it's data sources) as well as the TEMPro software installer.

[2] The relevant guidance is called Transport Analysis Guidance (TAG). It can be found online at https://www.gov.uk/guidance/transport-analysis-guidance-tag. The TAG units most concerned with NTEM and TEMPro are ***Unit M4***, https://www.gov.uk/government/publications/tag-unit-m4-forecasting-and-uncertainty, ***The Uncertainty Toolkit***, https://www.gov.uk/government/publications/tag-uncertainty-toolkit, and ***Sub-models of NTEM***, https://www.gov.uk/government/publications/webtag-si-ntem-sub-models-july-2016. However, there are references in other units also.

2.2.1 that assumptions relating to the whole nation[3] (especially those relating to places distant from the policy intervention) are consistent between business cases (enabling fair comparisons between funding applications from different promoters);

2.2.2 that our uncertainty about the future is appropriately represented in the business cases (again, in a way that enables fair comparisons between schemes); and

2.2.3 to mitigate the cost of proportionate appraisal of transport schemes thereby supporting scheme promoters to provide high quality analyses to decision makers.

2.3 In addition, NTEM results are direct inputs into the National Transport Model, which is used for strategic policy analysis and to produce National Road Traffic Projections.

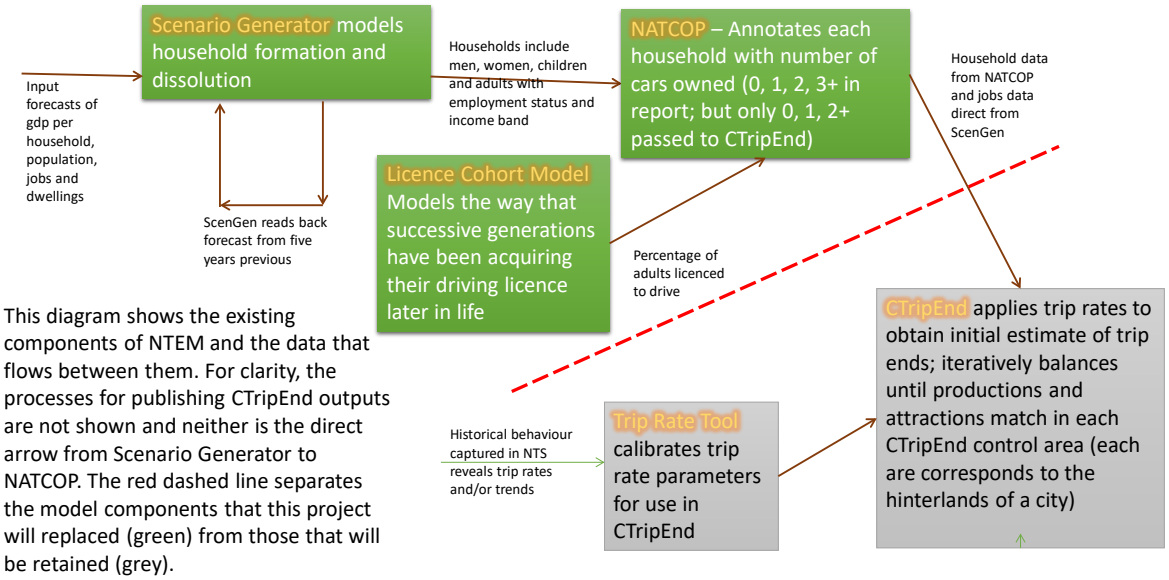
2.4 As a result, NTEM directly influences many billion pounds of government investment annually.

2.5 While the preceding paragraphs describe DfT's motivation for publishing TEMPro and the NTEM results, they are known to play a wider role in promoting the application of analysis in the planning system in Great Britain. This is because of its ubiquity as a readily available data source in the offices of local government and their consultants. We discovered these additional uses/users in our user-research, https://www.gov.uk/government/publications/national-trip-end-model-discovery-report.

3. BACKGROUND TO REQUIREMENT/OVERVIEW OF REQUIREMENT

3.1 NTEM is intended to forecast potential personal travel demand unconstrained by costs or limitations from the transportation itself. When TEMPro is used in conjunction with a strategic variable demand model, we would expect that model to reduce demand to reflect congestion and/or crowding. NTEM/TEMPro is primarily a representation of the exogenous drivers and constraints on the transport system.

[3] The use of TAG, including NTEM/TEMPro assumptions is mandated by DfT in England. The Welsh government's 'WelTAG' publication https://www.gov.wales/welsh-transport-appraisal-guidance-weltag, does likewise. The Scottish Government mandate different background assumptions for use in Scotland.



This diagram shows the existing components of NTEM and the data that flows between them. For clarity, the processes for publishing CTripEnd outputs are not shown and neither is the direct arrow from Scenario Generator to NATCOP. The red dashed line separates the model components that this project will replaced (green) from those that will be retained (grey).

3.2

3.3 The model components that are being replaced are demographic in nature. Scenario Generator is concerned with how the household structures in an area evolve in response to changes in population, employment opportunities and the availability of housing. NATCOP is concerned with households' decision about how many motor vehicles to operate.

3.4 Before the CTripEnd component of NTEM is run, NTEM has an internal, but aggregate description of a population where each model individual has an age, a gender, an employment status, a household role, a household income band (low, medium or high) and a car availability (none/shared/exclusive).

3.5 Many users of NTEM, including DfT itself, will be bound by the Public Sector Equality Duty. This requires that transport models represent the differing needs and behaviours of protected subgroups of the population. We can see that NTEM already considers age, gender and income, but not disability nor ethnicity. It may also be desirable to model unpaid caring roles explicitly.

3.6 NTEM has been a lynch pin of transport appraisal and analysis in England[4] for many years. However, it has to be updated in order to meet user needs:

3.6.1 NTEM was built over many years and was most recently updated around 2017. It was built using languages and software that were appropriate at the time. However, it is becoming increasingly challenging to operate and maintain the old software in the modern computing environment. It is difficult and expensive to source the relevant skills and tools. In addition, the user interfaces could be modernised so that they are familiar and easy to learn for new users.

[4] DfT is only directly responsible for transport policy appraisal in England. The Welsh Government has also mandated the use of NTEM/TEMPro in schemes in Wales. The Scottish Government appraisal process does not involve direct use of NTEM/TEMPro by the scheme promoters, but the Scottish Government uses NTEM/TEMPro in calibrating their process.

3.6.2 The types of transport modelling required for policy analyses is also advancing. NTEM is designed to support aggregate modelling styles, such as those derived from the 'four-step transport model'. These were formulated to appraise value for money policies like new infrastructure provision to relieve congestion. They are less well suited to appraise investments around information infrastructure (eg bus open data, variable message signs)

3.6.3 There is an increased appetite to understand the needs of users and the impact of changes on different groups of people. The current modelling doesn't include as much data on travellers as is available and does not retain all the data in the model outputs.

3.7 A synthetic population is a database describing a collection of artificial individuals. While the individuals in the artificial population cannot be matched to individuals in the actual population, their aggregate statistics do match. Synthetic populations are a better basis than observations of the actual population for many modelling purposes because:

3.7.1 Observations of the actual population raise ethical and legal concerns that don't arise for the synthetic population.

3.7.2 Observations of the actual population are incomplete and there are inconsistencies between different data sources; a synthetic population effectively infills the data gaps.

3.7.3 Our models and observations are statistical in nature – they do not forecast people's individual fate; a forecast synthetic population is like a 'representative' pick from a probability distribution.

3.8 The technology required to create synthetic populations is maturing rapidly. Prior art includes:

3.8.1 SPENSER, an open source synthetic population generation model of England at LSOA resolution developed at the Institute for Transport Studies (Leeds) and the Turing Institute (London) https://lida.leeds.ac.uk/research-projects/spenser-synthetic-population-estimation-and-scenario-projection-model/

3.8.2 PopulationSim, an open source synthetic generation modelling tool, originally developed by the US state of Oregon. The popular transport modelling platform, PTV VISUM, provides support for using PopulationSim in VISUM models. https://activitysim.github.io/populationsim/software.html

3.8.3 NORMITS – an open source synthetic population generation model of Great Britain focussing on the North of England that imports land use and planning data from Transport for the North's planning data

base systems and feeds their multimodal transport modelllng systems https://github.com/Transport-for-the-North/Land-Use.

3.9 DfT needs a model and modelling platform that it can curate and control because of the role of the NTEM/TEMPro system in standardising the national assumptions used in business cases from a wide variety of organisations. It is also important that users can trust the forecasts to be plausible and unbiased. Traditionally we publish reports and forecasts, but sometimes we come under pressure to publish the model's software and intermediate workings and to allow others to run them on their own behalf. With the present system, such publication is technically and legally challenging. We would like to have the option of opening our source and/or data should we choose to do so in the future.

3.10 One consequence of requiring suitability for publication is the requirement for a user interface and/or Application Programing Interface (API) that is as intuitive, guiding novice users towards best practice while offering maximum flexibility for scenario construction to advanced users. We expect the suppliers to engage with existing practitioners and/or academics to seek feedback on their designs. The supplier may suggest who they wish to talk to, but an option that DfT could provide is an opportunity to present to our 'Joint Academic Panel (JADP)' of external transport experts.

3.11 The social and behavioural research team at DfT maintains a set of 'personas' that stratify the population according to their travel requirements and behaviours[5]. In principle, the personas create opportunities to improve modelling of the way different segments of the population will respond differently to a transport intervention and to analyse how the benefits will be distributed. Currently modellers still find these analyses unnecessarily challenging because the relevant data is concealed by aggregation during trip generation. DfT would like the option to publish the disaggregate data.

3.12 There are plans to introduce the DfT personas into the National Travel Survey, commencing in 2024.

3.13 It is also essential that DfT can maintain a 'standard' set of model runs, with inputs derived from national statistics, but modified by applying the scenario-specific assumptions from the Common Analytical Scenarios (described in the TAG Uncertainty Toolkit https://www.gov.uk/government/publications/tag-uncertainty-toolkit). We need a flexible, easy to use process for supplying the statistics and assumptions to the model; we do not want the existing CAS assumptions 'hard-coded' into the model. This is partly because we may wish to consider additional scenarios and partly because the CAS themselves are expected to change over time.

[5] https://www.gov.uk/guidance/transport-user-personas-understanding-different-users-and-their-needs

3.14 This invitation to tender was preceded by an 'Expression of Interest' and the Expression of Interest document is attached for reference.

4. DEFINITIONS

Expression or Acronym	Definition
API	Application Programming Interface
CAS	Common Analytical Scenarios
DfT	Department for Transport
IPR	Intellectual Property Rights
JADP	Joint Academic Panel
LSOA	Lower Layer Super Output Area
MSOA	Middle Layer Super Output Area
NATCOP	National Car Ownership Model
NTEM	National Trip End Model
PTV	A German transport modelling software company
TAG	Transport Analysis Guidance
TASM	Transport Appraisal and Strategic Modelling
SPENSER	Synthetic Population Estimation and Projection Model

5. SCOPE OF REQUIREMENT

5.1 The supplier shall supply software to the Department to forecast synthetic populations. The supply should include program source code, full input test data and test results, and complete documentation for the end user, the software developer, and for quality assurance purposes.

5.2 The supplier's product design should be mindful of the Department's needs described in section 3, especially paragraphs 3.5, 3.10, 3.11 and 3.13.

5.3 The supplier shall demonstrate that the outputs from the software are sufficient to enable CTripEnd to run. This must be within a reasonable processing time (≤ 1 hour per year/scenario combination), and in an analytically transparent[6] and robust way. This includes ensuring that the processes for importing data from input sources and transferring the output

[6] The test for whether the model is transparent and robust will be "Can specialist DfT staff understand the model well enough to confidently present and defend it to an audience including transport planners, transport modellers and scheme promoters with confidence. Inevitably such an audience will ask probing, and sometimes hostile questions (There can be quite a lot at stake for the audience because, inevitably, new forecasts will improve the prospects for some schemes at the expense of others)

data to CTripEnd are convenient[7] and well documented. However, the supplier will not be required to produce a complete, publication ready set of forecasts, across all Common Analytical Scenarios, and including CTripEnd output and TEMPro input files.

5.4 The required products shall include knowledge transfer such that DfT can operate and maintain the software after delivery has been completed. It is important that this information is captured in documents and files that are managed alongside the software itself. This will ensure that the information can be retained as staff turnover in DfT and elsewhere.

5.5 Supply shall include transferal of all IPR associated with the software and documentation.

5.6 While the supplied software and documentation should be organised so as not to present any impediment to DfT releasing the software as open source in the future, no such publication is within the scope of this contract.

5.7 Similarly, all documentation should be fully accessible, in accordance with the attached “external-authors-gov-uk.pdf”.

6. THE REQUIREMENT

6.1 This requirement is for the design and implementation of a synthetic population forecasting model of Great Britain. The model will output descriptions of individual people, households, and vehicles. The data output from the new model will provide all the forecast variables currently available in the NATCOP and Scenario generator programs. It is expected that additional output variables will be agreed between the DfT and Supplier during project implementation.

6.2 The software will also provide files suitable for input into CTripEnd, so that the conventional trip end forecast corresponding to the synthetic population forecast can be obtained.

6.3 The software will be written in a common, open source, programming language such as R or Python, which will be agreed with DfT prior to the development commencing. It will be accompanied by a suite of test harnesses and documentation, so that, after project completion, DfT staff can install, maintain, enhance, and operate the software without assistance from the supplier.

6.4 The software will be delivered both as source on Github and as an executable resource on agreed (physical or virtual) hardware. It will conform to relevant programming standards and style guides. These will include a project specific

[7] The test for whether the model is convenient and well documented is whether newly recruited DfT analysts operate the model and produce forecasts using the documentation without requiring to be taught how to do so by senior staff. In applying this test, we will assume that these staff are already competent in a civil service profession (eg economist, statistician, data scientist, operational researcher, etc) but that they may be new to transport. It is important that the transfer of the data to CTripEnd is straightforward and not unnecessarily convoluted, but the documentation for synthetic population model is not required to duplicate information from the CTripEnd manual.

style guide that will be developed and maintained by the supplier as part of the software development process but must be agreed with DfT.

6.5 The software will be suitable for publication as open source. This means that all intellectual property rights for the delivered software, must be transferrable to DfT. Furthermore, any libraries or other software components that the delivered software references must either already be open source or must be delivered with IPR and source so that it can form part of any future open-source release. (To reiterate, DfT have not decided when/if they will publish the source).

6.6 The geographic resolution of the model will be Census Middle Layer Super Output Areas (MSOA). Although we anticipate that many of the available input data will have lower resolution the model will be required to infill detail with synthetic data.

6.7 The software will be able to forecast the synthetic population at five-year intervals going into the future. The existing NTEM software is only ever run at five-year intervals, even though it can produce more frequent forecasts. Note that it is not a requirement that the fate of individual people, households or vehicles should be traceable from year to year through the forecasts.

6.8 Wherever possible, the input data will come from official statistical publications. Ideally**,** we would like to use open and freely available data sources. While DfT will help the supplier to locate suitable input data, we will also listen to suggestions from the supplier. All data sources must be agreed between DfT and the supplier.

6.9 It will be possible to manipulate the input data to describe different future scenarios, particularly those specified as Common Analytical Scenarios in https://www.gov.uk/government/publications/tag-uncertainty-toolkit and https://www.gov.uk/government/publications/common-analytical-scenarios-databook. It must be possible to manipulate the input variables with as much flexibility as possible, not constrained to those currently listed in the Common Analytical Scenarios. The supplier will document how to perform the data manipulations for each scenario, and additional variables.

6.10 The Model outputs will include separate tables for People and Households; other output tables may also be agreed. For example, a table relating to vehicles (cars) might be helpful. The output tables will include variables corresponding to each of the data fields in the existing CTripEnd input tables, so that the inputs from CTripEnd can be prepared by a simple aggregation. DfT and the supplier will agree additional variables to be included in the CTripEnd data sets. These will include variables currently modelled but not used by CTripEnd (eg household income). Consideration should be given to modelling completely new variables such as mobility impairment and to classifying people using the DfT personas.

6.11 Additional data will be required for model calibration and validation. Ideally, the model validation data set will include data that is not part of the calibration data set. The model validation and analysis will be automated as part of the

model test harness so that the impacts on the validation of any future model changes are easily available.

6.12 The data dictionary will document what data will be used for input, output, and testing and how they are formatted into files and/or tables. It will record the agreements about data between DfT and the supplier. It will also be used as a reference by future model users and developers after this project has ended, so it is important that it continues to be maintained after initial delivery, so that it always represents the current agreed design.

6.13 The initial version of the data dictionary will be a useful tool to facilitate engagement with external experts (eg JADP) so that we can get independent comments on our proposals.

6.14 The software will be accompanied by test harnesses and test schedules (or alternative forms of test documentation) that automate and expedite the verification of the correct functioning of the software. It is intended that these testing systems should be enhanced and maintained alongside the software itself after project completion. It is important, therefore, that their design and use is documented alongside the software that they test.

6.15 All the products of this project should be subject to a discipline of version and quality control that starts when their development starts and continues through project delivery to be continued by the DfT staff taking ownership.

7. KEY MILESTONES AND DELIVERABLES

7.1 The following Contract milestones/deliverables shall apply:

Milestone/Deliverable	Description	Timeframe or Delivery Date
1.1	**Inception Report** Sets out the suppliers understanding of their brief. Resolves any ambiguity or impracticality in the scope or specification. Sets the baseline for monitoring project progress	Draft for review within two weeks of contract award. Final agreed document within one month of contract award
1.2	**Notes From Progress Meetings** Frequency to be agreed between DfT and supplier. The frequency may vary over the lifetime of the project (eg more frequently during design at the project start, and handover/acceptance at the project end; less frequently during coding).	At least monthly; at most weekly - throughout project execution

Milestone/Deliverable	Description	Timeframe or Delivery Date
	The notes should include progress reports and agreed actions from the meetings at which the progress was presented	
1.3	**Data Architecture Report/Data Dictionary** This document is the metadata for the model. It specifies the input and output data from the model, including all the variables and how they are organised into tables. Includes details such as units of measurement and data type. It must also include the proposed source of data, and any caveats or notes that are pertinent from the data providers. For input data, specifies provenance including whether/how they might be varied for scenario modelling. This report will need to be of publication quality. It needs to be accessible and subject to version and quality control.	Initial delivery four months after contract award. This document will be maintained as a 'living document' for the remaining duration of the project and transferred to DfT in an editable form at the end of the project
1.4	**Model Methodology Proposal** A note setting out how the model will work. Describes the algorithms used for combining data from disparate sources. Describes the maths used to generate model outputs. Presents evidence (from the literature or observations) in favour of the proposed method. While there are no publication requirements for this report, the supplier will need to reproduce much of this information in publishable reports.	Six months after contract award.

Milestone/Deliverable	Description	Timeframe or Delivery Date
2.1	**Github repository** where source code and other documents can be stored. Initially this would be empty but the supplier would fill it as the contract progressed. The Github repository will also act as a medium of transfer for several of the other project deliverables The contractor and DfT will agree security settings for the Github repository and this agreement may include agreeing not to exclude some kinds of information from the repository (eg password information, security tokens for APIs, personal information about survey respondents etc)	The empty repository will be delivered at the end of first month of project (ie shortly after inception report) The repository will be re-delivered after having been populated with code, documents, etc at the project completion, within two years of contract award.
2.2	**Modelling Software** This includes executable software to run the model, software source so that the model can be maintained and amended, software test harnesses so that the correct operation of the software can be verified.	Within two years of contract award
2.3	**QA report(s)** Describes the quality checks that were applied during the project. Demonstrates how the checks verify the correct handling of the data Demonstrates how the checks verify the correct operation of the software Demonstrates that the software produces plausible and justifiable forecasts	Within two years of contract award
2.4	**Model documentation** Documentation for four distinct audiences	Within two years of contract award

Milestone/Deliverable	Description	Timeframe or Delivery Date
	- Explains to transport modellers and analysts what the model outputs mean, how they were derived and how to apply them. - Explains to transport modellers and operational researchers how to operate the software, how to vary the inputs to represent scenarios, and how to extract the outputs - Explains to transport modellers and software engineers how to maintain and develop the model, including using and maintaining the automated test system. Includes any relevant coding and documentation standards and style guides. - Explains to local planners and policy makers (with little analytical experience) what the synthetic population is intended for, the limitations and the risks around the data.	
2.5	**Backlog** A prioritized list of bugs, issues and suggestions for enhancement. Note that at time of handover there should be no serious or critical defects[8] requiring attention in the backlog; this is a mechanism for smooth handover of the maintenance and development of the model from the supplier to DfT	Within two years of contract award

[8] A defect is critical if it prevents the application from executing or if it results in a violation of any law or statutory obligation. A defect is serious if it results in outputs that are wrong (as not in accordance with specification)

Milestone/Deliverable	Description	Timeframe or Delivery Date
	and, at project completion it should only contain cosmetic issues and suggestions for further enhancements.	

8. MANAGEMENT INFORMATION/REPORTING

8.1 The supplier and DfT shall hold progress meetings throughout the execution of the contract. The frequency of these meetings will vary between weekly and monthly over the lifetime of the project. We envisage they will be most frequent during project inception at the beginning and project delivery at the end. The meetings will be less frequent during coding and software implementation. These meetings will be held virtually, eg using Microsoft Teams. After each meeting, the supplier will circulate a note confirming any actions agreed.

8.2 In addition to the regular progress meeting there will be at least three major meetings at which the supplier will review progress and decide the strategic way forward. All of these meetings will be virtual. They will be:

8.2.1 The project inception meeting, within two weeks of project start, and accompanied by a project inception report. During project inception the DfT and supplier will jointly review the project scope and execution plan

8.2.2 A presentation of the data dictionary that specifies the model inputs and outputs, their metadata and provenance. The supplier will suggest proposals to DfT along with evidence from user engagement supporting their design choices. The supplier may also make representations about the practicality (or otherwise) of including or excluding variables.

8.2.3 One or more presentations at the end of the project at which the supplier presents the project results to DfT staff and trains them in its operation. If further meetings to deliver thorough training are needed, the supplier will provide these.

8.3 At the end of the project the DfT will identify opportunities to present papers about the new system at conferences and (eg ‘European Transport Conference, Modelling World, Transport Modeller’s Forum, …). DfT will offer the supplier the opportunity to co-author and/or co-present these papers. The DfT does not require that the supplier for contributes to writing or delivering these presentations and will not pay them for doing so.

9. VOLUMES

9.1 This is a research and development contract: all outputs and deliverables are essentially unique.

10. CONTINUOUS IMPROVEMENT

10.1 DfT intend to be an 'active' client (and the supplier should budget for client engagement accordingly).

10.2 At each progress meeting the supplier and DfT project teams will review whether any risks to project delivery or opportunities for improvement have arisen since the previous meeting or whether any are anticipated to arise before the next one. Mitigations (for risks) and improvements (for opportunities) will be agreed by the supplier and DfT together.

10.3 Changes to the way in which the Services are to be delivered must be brought to the Authority's attention and agreed prior to any changes being implemented.

11. SUSTAINABILITY

11.1 The products of this project are all virtual; they only exist as electronically. All parties to this contract should avoid unnecessary 'hard copy'.

11.2 Furthermore, while it isn't the only reason for wanting the software's execution to be efficient, we should note that more efficient software consumes less carbon when executing.

11.3 However, the most important sustainability impact comes from using the synthetic population forecasts in transport analysis. The greater granularity for distributional analyses should result in better and more sustainable transport investment decisions.

12. QUALITY

12.1 All analysis has to be fully compliant with the AQUA book[9] on Quality Assurance, and the DfT guidance 'Strength in Numbers[10]'. These will be provided. They cover Validation, Verification and Communication of results. In addition, proof of the checks and compliance must be provided. Mechanisms for DfT repeating the checks to the same standard need to be built in, to allow for future development and maintenance to be possible to the same standard.

12.2 All data sets, documents and source code should be subject to document and version control. And evidence for the provenance of all files and tables delivered will be traceable.

12.3 All documents and user interfaces comply with the international WCAG 2.1 AA accessibility standard.[11]

12.4 All code will adhere to relevant software standards (eg PEP 8[12] for Python).

[9] https://www.gov.uk/government/publications/the-aqua-book-guidance-on-producing-quality-analysis-for-government

[10] https://www.gov.uk/government/publications/dft-analytical-assurance-framework-strength-in-numbers

[11] https://www.w3.org/TR/WCAG21/

[12] https://peps.python.org/pep-0008/

12.5 The work must also comply with the Public Sector Equality Duty.

13. PRICE

13.1 Prices are to be submitted via the e-Sourcing Suite [Attachment 4 – Price Schedule excluding VAT and including all other expenses relating to Contract delivery.

14. STAFF AND CUSTOMER SERVICE

14.1 The Supplier shall provide a sufficient level of resource throughout the duration of the Contract in order to consistently deliver a quality service.

14.2 The Supplier's staff assigned to the Contract shall have the relevant qualifications and experience to deliver the Contract to the required standard.

14.3 The Supplier shall ensure that staff understand the Authority's vision and objectives and will provide excellent customer service to the Authority throughout the duration of the Contract.

15. SERVICE LEVELS AND PERFORMANCE

15.1 The Authority will measure the quality of the Supplier's delivery by:

KPI/SLA	Service Area	KPI/SLA description	Target
2	Quality Assurance	All code is verified through rigorous, documented and repeated testing methods	100%
3	Model run time	Model can run to generate a synthetic population that meets the agreed requirements on a typical laptop (operated by an analyst in the DfT team)	(⩽ 1 hour per year/scenario combination),
4	Model understanding	Model can be used by an analyst who is otherwise considered technologically literate, through an intuitive interface and accessable documentation	Highly likely
5	Model adaption	Model and data is editable and changeable by an analyst who has over 3 months of transport analytical background, has a previous understanding of coding, and can dedicate time to learn and understand the model, through appropriate use of	Likely

		version control, training and documentation	

15.2 The DfT will review the supplier's progress on the contract and planned approach after receipt of Deliverable 4 (the Model Methodology Proposal). At this point, the DfT retains the option to terminate the contract, at its sole discretion, by providing the supplier with not less than 30 days written notice.

15.3 The supplier should not undertake subsequent work on the project until the DfT has undertaken this review and indicated its intention to continue with the project.

16. SECURITY AND CONFIDENTIALITY REQUIREMENTS

16.1 The Supplier will comply with all Data Protection requirements outlined in Order Schedule 9 (Security) and in section 14 of the Core terms for RM6126 (Research and Insights)

17. PAYMENT AND INVOICING

17.1 Insert details of required invoicing schedule.

17.2 Payments for each of the two milestones will be treated separately. 80% of the total cost of the milestone will be divided into equal portions to be paid monthly during project execution subject to the Department's satisfaction with the Supplier's performance on the contract, as evidenced in regular progress review meetings. The Department will indicate its intention to approve payment within such meetings, as well as indicating any concerns with the Supplier's progress, giving the Supplier reasonable opportunity to rectify them.

17.3 Should the Department wish to withhold payment on the basis of dissatisfaction with the Supplier's progress, it will first invite the Supplier to produce a rectification plan for agreement (giving a minimum of 10 days' notice for such a plan to be provided). Future payment will be conditional on the Department's acceptance of such a plan (such acceptance not to be withheld unreasonably) and the Supplier's adherence to its commitments under the plan.

17.4 The remaining 20% of the cost associated with the milestone will only be paid once the associated deliverables have been accepted as being of sufficient quality by the Department.

17.5 Before payment can be considered, each invoice must include a detailed elemental breakdown of work completed and the associated costs (on the basis of time spent on the contract against agreed rates).

17.6 You will be issued with a Purchase Order number for this contract and will need to quote this number on all invoices, which should be submitted directly to:

Via email: **ssa.invoice@sharedservicesarvato.co.uk**

Or post:

Accounts Payable,
Shared Services Arvato,
5 Sandringham Park,
Swansea Vale,
Swansea
SA7 0EA.

17.7 Invoices received without the correct Purchase Order Number are likely to be returned to you and will delay receipt of payment.

18. CONTRACT MANAGEMENT

18.1 Contract Review Meetings will be held ‘virtually’ on Microsoft Teams. No expenses will be admissible for remote meetings, such as the contract review meetings.

19. LOCATION

19.1 This work will be carried out at a location to be provided by the supplier. Most, if not all, meetings between the DfT and the supplier will be held remotely on Microsoft Teams. Transfer of code and data between the supplier and DfT will be via Microsoft Teams and/or GitHub.

19.2 DfT may offer the supplier opportunities to ‘co-present’ or ‘co-author’ papers about the project at conferences (such as ‘Modelling World’ or ‘European Transport Conference’. These opportunities are not obligations on the supplier, and the supplier will be responsible for any expenses they incur in taking them (should they choose to do so).