

# **INVITATION TO TENDER (ITT)**

## **Implementation Audit of Transport Model Development & Analysis**

**Ref : HS2/644**

### **Appendix F: Schedule of Requirements**

**V1.00**

## 1 Background and General Transport Model Audit Requirements

- 1.1 High Speed Two Limited (HS2 Ltd) uses a number of analytical tools to inform its work. A key tool in forecasting future demand for rail services and the demand for high-speed rail is the PLANET Framework Model (PFM). It provides forecasts of demand and generalised costs to drive HS2 Ltd's analytical requirements, such as the HS2 Economic Case, Commercial Analysis, internal decision making, and Transport Assessments, amongst others.
- 1.2 PFM is subject to regular updates of inputs and development of methodology to support internal and published demand and economic analysis. Recent model development requirements have included updated base matrices, the latest train service specifications, and a number of enhancements to the methodologies and processes involved in creating and maintaining the model.
- 1.3 Model development and day to day model use introduces risks from human error or corruption of calculations. Incorrect or weak modelling could undermine both HS2 Ltd's reputation and support for the project. HS2 Ltd has therefore established a multi-layered quality assurance (QA) regime to ensure models and analysis are evidence based, transparent, results are understood and there are no material errors. Model audit is carried out to verify that the implementation of model development and analysis is in line with the documented method and inputs and this process is a key part of HS2 Ltd's quality assurance (QA) regime.
- 1.4 We have recently awarded new long term contracts to continue the development and use of our transport models, therefore, we now require a supplier of transport model audit services until March 2020.
- 1.5 We require a supplier who can continue to deliver iterative audit assurance consistent with previous work and at the same time advise and implement new audit process improvements. The supplier will be encouraged to challenge the status quo and make recommendations where they believe quality improvements could be made.
- 1.6 Quality assurance of the audit of implementation is an essential part of the deliverable. The audit supplier will have an internal quality assurance process that is proportionate to the requirement and builds confidence in the conclusions of the audit.
- 1.7 The supplier will need to work closely with the model development and analysis supplier(s) who will be working under different contracts. HS2 Ltd's Economic and Commercial Analysis (E&CA) team, the analysis supplier, the model development supplier and the audit supplier will all need to work closely together when programming work to ensure that realistic deadlines are in place. As the audit supplier will be working to a shared supplier programme it is important they have the capacity to reliably deliver improvements to schedule and are able to react to unexpected challenges.

## 2 The PLANET Framework Model (PFM)

- 2.1 PFM is the main modelling tool HS2 Ltd have developed and used for economic analysis over the past five years. Data from PFM is being extracted for a growing variety of high-impact purposes including the Transport Assessment, HS2 Commercial Analysis, Land Use Transport Impacts (LUTI) modelling, sub-national impact estimation work and carbon modelling.
- 2.2 PFM is a transport model designed to forecast the impact on demand, revenue and benefits of rail schemes such as HS2. PFM was originally based on PLANET Strategic developed by the Strategic Rail Authority to support their high speed line study in 2001 but since then the model has been extensively developed, re-estimated and updated by HS2 Ltd.
- 2.3 PFM was developed from a number of separate models, including components for multimodal all day long distance demand, peak period rail travel in the Southern, Midland and Northern regions, and a model looking at Heathrow airport access demand. In order to support the Economic Case for HS2 the model and the appraisal spreadsheet were extensively updated and developed. PFM contains several thousand files, 12 separate EMME databanks, is 25 gigabytes large and one run on a dedicated machine takes 12+ hours.
- 2.4 The size and complexity of the model, its differing formats and computing languages and its many interfaces present some of the potential sources of quality assurance risk. HS2 Ltd has addressed these risks through the experience of using the model, by expert review leading to re-estimation and development of the model, increasing automation to reduce manual interventions, improved documentation, and thorough independent audit.

### **Model development**

- 2.5 The types of model development that may take place during the contract and may require implementation audit include:
  - production of new base demand matrices for long distance travel by rail, highway and air;
  - re-estimation of the long distance assignment and station choice models;
  - re-estimation of the long distance demand model;
  - updated growth forecasts, WebTAG parameters, and network assumptions (updating all parts of the model in a consistent manner and in line with source material has presented a number of quality assurance challenges);
  - improvements to the benefits appraisal process;
  - improvements to the operating costs appraisal process;
  - implementation of new EMME functionality and general re-coding to improve model quality;
  - commercial, financial, LUTI and other model development (depending on the skills set of the supplier).

- 2.6 The types of analysis that require audit are typically the central scenario/reference case of key pieces of work. Known examples of transport model analysis contract which may be subject to audit includes:
- producing the HS2 Economic Case for both phase 1 and phase 2 (a and b);
  - informing the Strategic Case for HS2 by undertaking economic analysis of strategic alternatives and informing how classic line services might be re-specified with HS2;
  - HS2 Ltd route refinement work for phase 1 and phase 2 by assessing the economic impact of different services, stations or routes; and
  - input into the Commercial and Financial Cases for HS2, Northern Powerhouse Rail and improving analysis of impacts in Scotland.
- 2.7 A detailed description of the model, model input assumptions and model audit reports can be found on HS2's website: <https://www.gov.uk/government/collections/hs2-economics>.

### 3 Requirements

#### Audit objective

- 3.1 HS2 Ltd wishes to appoint a supplier to be the independent auditor of HS2 Ltd transport models and analysis.
- 3.2 The objective of the independent model audit is to provide HS2 Ltd and HS2 stakeholders with evidence and assurance, or "audit sign-off", confirming that the implementation and use of transport models is accurate and consistent with the documented modelling and appraisal methodology. Much of the audit will concern new development and the use of PFM for HS2 analysis.
- 3.3 Conflicts of interest that might prevent an independent audit must be avoided. Tenderers must detail any work undertaken by their organisation or team members for which there could be a possible conflict of interest or a perception of this. HS2 Ltd retains the right to take its own view.
- 3.4 Measures of a successful audit project will include:
- effective communications, proactive and collaborative working with HS2 Ltd, the model developer contractor and the model analysis contractor in time to allow for corrections to be implemented in advance of key project milestones;
  - robustness of audit advice over time and identification of "hidden" issues, e.g., an aspect of model development that has been overlooked;
  - the auditor will "sign-off" that the model's agreed method has been accurately implemented and confirm that the model documentation is in line with agreed standards for transport modelling, appraisal and decision making.

#### Scope

3.5 The scope of the audit will include:

- the implementation of developments to the PFM from the commencement of the contract;
- the extraction of data or model inputs from third-party data sources and their implementation within PFM. Auditing the data sources themselves is out of scope;
- changes to the computer code linking all models within the PLANET framework developed by HS2 Ltd;
- the use of PFM to produce analysis; and,
- other HS2 Ltd transport models and analysis, e.g., for commercial analysis.

3.6 Parts of PFM are out of scope if they have already been independently audited. This would generally include all model development up to and including PFM version 6 (PFMv6).

3.7 The audit supplier will not be asked to peer review the documented method underlying any model or analysis. However, the auditor will have to beware that while the documented method is implemented but there may yet be an error in the documentation.

#### **Audit tasks**

3.8 The audit may include, but is not limited to, the following tasks.

- Verifying the implementation of the model and input data are consistent with the documented method.
- Confirming that the model and analysis is consistent with the Department for Transport Analysis Guidance ('**WebTAG**'), or other relevant guidance and/or best assurance practice, and that any divergence is documented and communicated with HS2 Ltd.
- Systematic, bottom-up review of spreadsheets, programs and software code at a micro level to confirm that the model processes and results are correct and error free.
- Confirming that the transport models' base and future year matrices, transport networks and growth forecasts are consistent with the stated methodology and original sources and are implemented correctly and consistently.
- Confirming that model outputs are consistent with the model methodology and model inputs.
- Confirming that results can be relied upon for policy decisions.
- Replication of the results of full model runs and comparison or investigatory procedures for material fluctuations.
- Investigation into/discovery of unintended omissions within a sub-model or inconsistent application of a change in different parts of the framework.

3.9 Currently specific tasks and deliverables required are not fully defined. They will be defined during the course of the contract in accordance with the project management process detailed in the 'Approach to Working' section of this document.

- 3.10 Some indicative substantial model enhancements that would be the subject of implementation audit are listed below. The list is not exhaustive and there may be other substantive work required.
- Optimise the structure of the model – move to an integrated model approach fully combining all of the component models instead of the combination of long distance and regional models that exists at present.
  - Greater use of automation and use of databases in the model to reduce manual errors in model specification and appraisal calculations.
  - Use innovative or alternative sources of data provided by the Client (eg. mobile phone data) to enhance/validate base demand matrices.
- 3.11 In order to audit these developments, we would expect the supplier to have expertise relevant skills including:
- experience of developing transport modelling code using established software (eg EMME);
  - experience of applying best practice Business Intelligence techniques using databases (eg SQL) for the management and assurance of large datasets;
  - statistical expertise, with experience of assessing data sources in terms of statistical quality criteria; and
  - experience of developing systematic audit processes.

## 4 Approach to Working

- 4.1 HS2 Ltd's E&CA team use 'AGILE' project management in order to ensure the delivery of the most important development, analysis and audit work is prioritised and delivered first. This way of working requires the delivery of outputs incrementally and often, as such we will usually require work packages to be split into tasks that take between one and two weeks to deliver.
- 4.2 HS2 Ltd requires the complete audit of new model development and more targeted audit of analysis.
- 4.3 E&CA team will formally commission model development work at a model development Sprint planning meeting that will be held on a fortnightly basis. This will set out why the work is needed, what it is required to deliver, and what audit is required. The "embedded auditor" will attend every model development Sprint planning meeting to maintain an understanding of the model development programme.
- 4.4 Audit Sprint planning meetings will take place every two weeks involving HS2 Ltd, the "embedded auditor" and the wider audit team. Based on the audit requirement for model development, the Supplier shall propose an audit task breakdown together with a resource plan to deliver audit of each model development work package. Once HS2 Ltd has agreed to the audit task breakdown and the level of resource required the supplier can commence work.

- 4.5 On a day-to-day basis HS2 Ltd will track audit progress using a shared online model development task board (Trello Board). This task board is accessible by HS2 Ltd, the audit Supplier, and the model development supplier. In addition, there will be a short daily conference call covering the audit and model development work undertaken over the previous day, the plans for the following day, and whether there are any blockages. There will also be regular conference calls, typically twice a week, between the audit supplier and HS2 Ltd to allow discussion of audit progress, budget and other issues.
- 4.6 The E&CA team work in a highly communicative environment with our suppliers and we require personnel, however senior or junior, to join the daily conference calls to update on all work they have been undertaking.
- 4.7 There will be a fortnightly review meeting, in which HS2 Ltd and the suppliers assess progress of work against the work commissioned. This meeting need only be attended by the supplier's contract managers and key personnel. It provides an opportunity for more detailed consideration of progress and the signing off of completed tasks. Once tasks have been approved as complete they can be invoiced for. The meeting will also serve as the main opportunity for HS2 Ltd to update the supplier on the forward work programme, although updates will also be given as and when required.
- 4.8 For suppliers that are not familiar with AGILE ways of working HS2 Ltd will provide an introduction upon award of contract.

## 5 Enterprise Bridge (eB)

- 5.1 HS2 Ltd uses the cloud storage facility eB. We manage information transfer with our suppliers through this system including the issue of a Project Change Form. In response the supplier will submit the resource plan and task breakdown via eB and HS2 Ltd can then formally accept the submissions through eB and an audit trail of the commission is electronically captured.
- 5.2 In the same way results will be uploaded onto eB by the supplier and the process of HS2 Ltd accepting outputs will be formalised through electronic acceptance. This mitigates any ambiguity about the acceptance and submission of information and gives both HS2 Ltd and the supplier confidence and clarity throughout the process.
- 5.3 Training in the use of eB will be required and this will be provided by HS2 Ltd. The supplier will need to specify at least two designated document controllers. They will have the access required to formally 'transmit' documents. However further personnel can have the ability to upload and view documents if required.

## 6 Quality Assurance

- 6.1 As PFM is one of HS2 Ltd's officially recognised Business Critical Models. All model development undertaken by HS2 Ltd must conform to the Government's best practice procedures. These are displayed in the Macpherson Review of quality assurance of government models<sup>1</sup>, the Aqua book

---

<sup>1</sup> <https://www.gov.uk/government/publications/review-of-quality-assurance-of-government-models>

guidance on producing quality analysis for government<sup>2</sup> and also the Department for Transport's published Strength in Numbers<sup>3</sup> analytical assurance framework.

6.2 Our suppliers play a major part in helping HS2 Ltd comply with these principles and recommendations, and HS2 Ltd expects a proportionate level of quality assurance to take place on all development activities.

## 7 Supplier requirements

7.1 In deciding whether to accept audit work delivered by the Supplier, HS2 Ltd will require information about the quality assurance process undertaken. During the delivery of the contract, HS2 Ltd would expect as a minimum:

- A quality assurance plan. Within six weeks of appointment the supplier will draft a detailed and agreed quality plan as a standalone document that sets out the steps that the Supplier shall take to ensure that all audit deliverables meet the agreed specifications, that must be agreed with HS2 Ltd;
- Definition of a standardised set of checks to be undertaken on model audit processes and findings proportionate to the level of audit risk, prior to acceptance;
- Specification of who will undertake primary QA checks of audit and any further independent checks within the audit supplier;
- How effective communications will be managed;
- How auditor errors will be reported, rectified and charged for (the supplier would not be reimbursed for any element of the audit that fails to identify an error in the model implementation, compared with the documented model methodology as communicated to the supplier); and
- Evidence that the quality management and assurance processes and environment in place are in line with best practice. This should include details of secure data management and data transfer within and between organisations that reflects the size and sensitivity of some data files.

---

<sup>2</sup> <https://www.gov.uk/government/publications/the-aqua-book-guidance-on-producing-quality-analysis-for-government>

<sup>3</sup> <https://www.gov.uk/government/publications/dft-analytical-assurance-framework-strength-in-numbers>