National Highways Regional Traffic Models 2nd Generation

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RTM1 - Overview

- Highways England (as we were previously called) tasked with delivering over 100 major schemes within Roads Period 1 (2015 –2020).
- Historically building individual scheme models, either from scratch or from older/nearby schemes, is time consuming.
- The regional modelling approach was devised to speed up the modelling and appraisal process.

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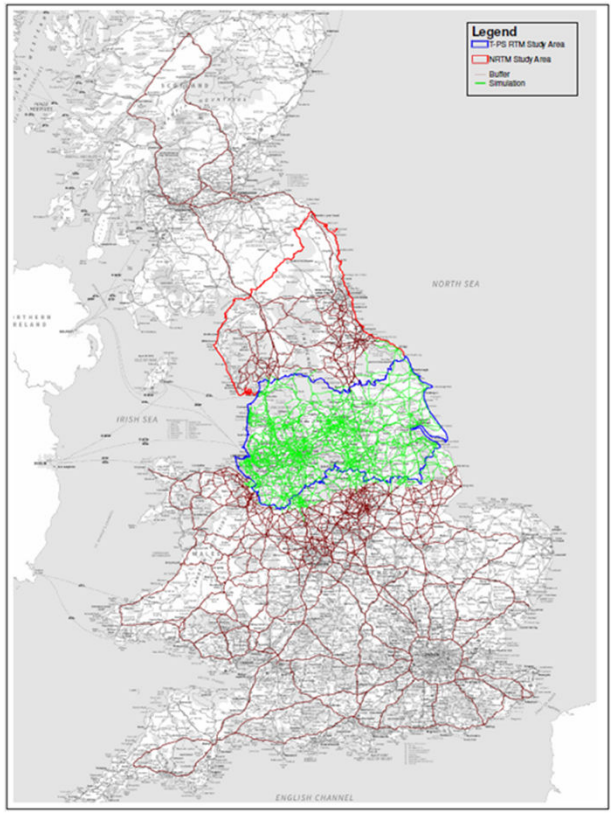
RTM1 - Overview

- Decision made to separate the country into 5 regions which has its own area in simulation.
- Each RTM also includes major A-roads and motorways for the rest of GB to maintain full trip data needed for VDM.
- The 1st gen RTMs enabled:
  - Projects to have a significant start point for modelling work.
  - Improved opportunities for corridor-based studies.
  - Greater consistency between studies.
  - High level sifting without the need for major new model build.
  - E.g. RIS1 schemes, LTC, M25 SW Quadrant using RTM data.



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RTM1 - Outcomes

- The 1st gen RTMs were available from 2017 to 2022 and adopted on over 50 RIS1 schemes.
- A study in 2020 estimated that this generated £25mil - £30mil of savings within NH alone.
- The RTMs were also widely used as the basis for many LA / STB schemes and Local Plan models and therefore generated significant additional savings to the public purse.

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RTM2 - Objectives

- The updated, second-generation models have a clear set of high-level objectives, namely:
  - To provide the basis for the development and appraisal of RIS2 and subsequent RIS pipeline schemes.
  - To ensure that a common approach is employed, using common data sources and software for consistent outcomes between regional models; and
  - To support wider policy work and decision-making across National Highways, including such areas as air quality and wider economy modelling.

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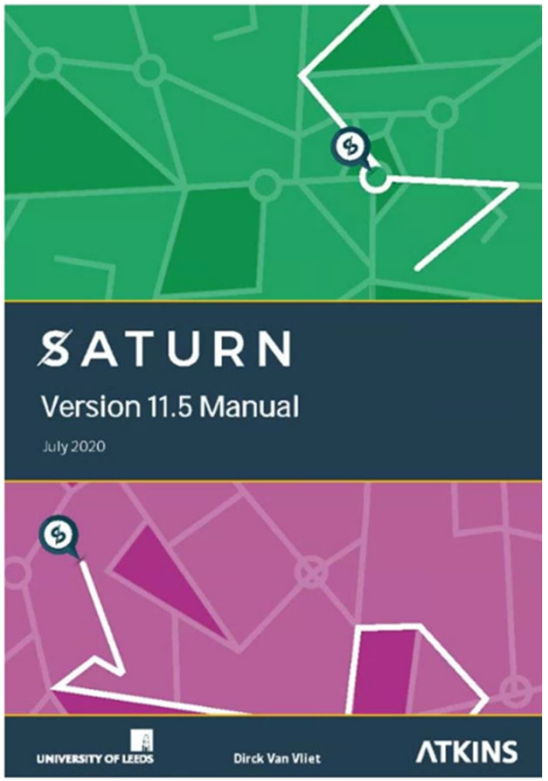
RTM2 – Model Structure

- There are five models covering the same geographic areas.
- The models have variable demand modelling capability and have been developed as far as is practicable in accordance with the guidance contained in TAG.
- Each regional model has been built with a model base year of 2019, representing March 2019 conditions, for weekdays (Monday to Friday). The models have common modelled time periods representing the following average hours:
  - AM peak period 07:00-10:00;
  - Inter-peak (IP) period 10:00-16:00; and
  - PM peak period 16:00-19:00.



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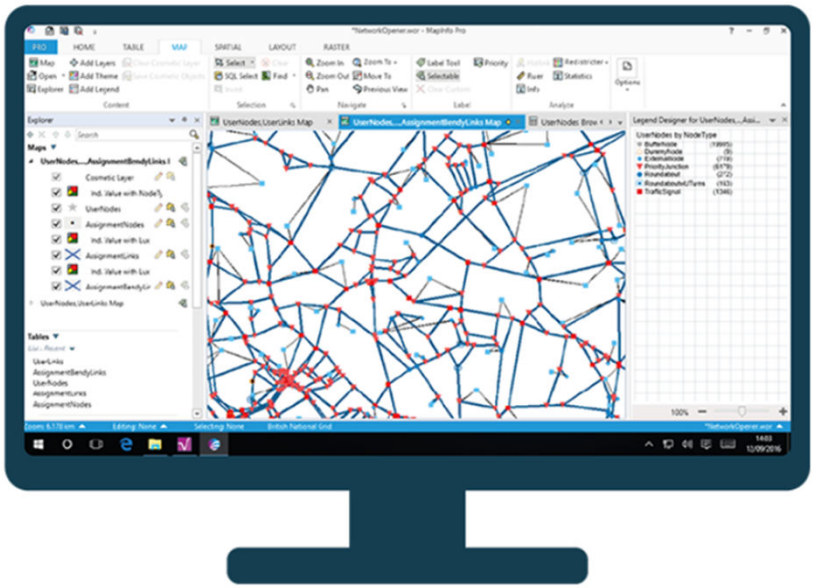
RTM2 – Why SATURN?

- Making the most of previous expenditure at RTM1 was key.
- For example, using SATURN for RTM2 gives a longer life-span to bespoke tools like HEIDI that had been developed for RTM1.
- Awareness that many LA's and STBs developed their models using RTM1 so a change would have impacts far beyond NH
- Upskilled the supply chain (and wider traffic modelling industry) in use of the RTMs and ancillary software over the course of RTM1.



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RTM2 – Model Structure

- The RTM2s are a suite of models with several constituent components.
- The highway assignment model has been developed using SATURN version 11.4.07H.
- The Variable Demand Modelling (VDM) capability is provided via DIADEM version 7.0 using the HEIDI interface tool (version 7.5c).
- HEIDI is an interface with DIADEM to help with the setting up of runs and providing a consistent process across the RTM2s, in addition to providing diagnostic tools using SQL.
- Public transport costs (time and fare) come from a Rail Cost Skim Tool built using CIF rail timetable data, Cube Voyager (rail station to station times, distances, fares and route choice) and TRACC (access/egress times to/from stations.

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RTM2 – Timeline

- Planning for RTM2 started in 2018/19, with a ‘Data Gap Analysis’ study being undertaken to ascertain the need for primary data collection.
- The ‘Model Build’ project officially kicked off in September 2020.
- To maintain consistency between the models, NH set up the following Technical Consistency Groups comprising of 1 NH staff member and a representative from each model team:
  - Data
  - Network
  - Matrix
  - Cal Val
  - Forecasting and VDM
  - End User
- As well as the Technical Consistency Groups, Project Boards were also held monthly to decide on matters which affected multiple TCG’s.

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Overview of data used in the model build

Network	Model Network - RTM1 Networks, NH Roadworks Database and RTM1 Uncertainty Log Road geometry / details / connectivity – OS MasterMap Highways Network Layer and satellite / aerial imagery Signal Data - Existing Local Traffic Models (signal data) Speed Data - Teletrac Navman & INRIX speed data Parameters – TAG Databook (v1.15, May 2021)
Matrices	NH owned- TIS (National Highways Trip Information System), DfT Data - Census 2011, National Travel Survey, ONS Population updates, LGV user survey, NTEM (v7.2), RTF18 External - CAA Data (Aviation) ,MOIRA / PLANET rail models, MDST HGV data, Teletrac Navman OD dataset, OpenRouteService
Cal / Val	Traffic count data – As per next slides JT data – Teletrac Navman

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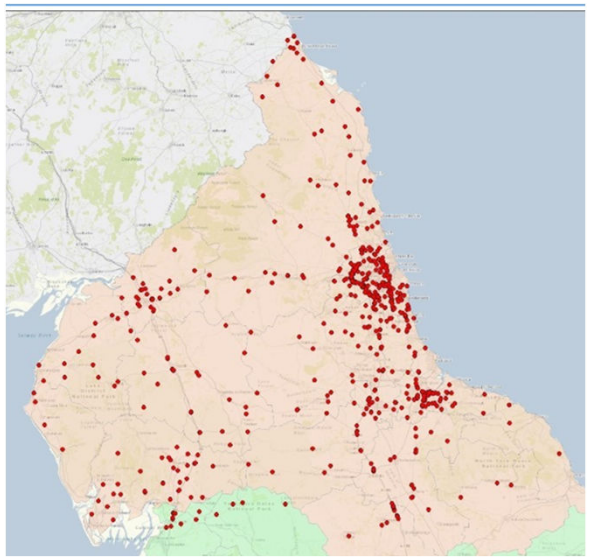
RTM2 - Overview

- National Highways commissioned two contracts to cover the collation, collection and processing of traffic count data to be used to inform RTM2.
- The first commission identified available traffic count data for non-SRN roads collected between January 2016 and December 2019. This helped establish the extent of new data collection that would be needed during 2020.
- The second commission involved the specification and execution of traffic count surveys on roads using automatic traffic counters (ATCs) at specified locations in March 2020.
- The March 2020 surveys were cancelled on 16th March due to the Covid-19 pandemic. Data from the first 2 weeks in March has been used subject to a series of checks.



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RTM2 - Overview

- This resulted in the use of the ‘data hierarchy’ used to indicate relative count data quality in the RTM traffic count database.

1. WebTRIS data
2. DfT ATC data
3. March 2020 surveys (that pass all statistical reliability tests)
4. LA / HS2 data (that pass all statistical reliability tests)
5. March 2020 surveys (pass some statistical reliability tests and ascertained as suitable for use)
6. LA / HS2 data (pass some statistical reliability tests and ascertained as suitable for use)
7. DfT MCC data
8. TfL data
9. Teletrac Navman data

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RTM2 – Network Overview

- Software capabilities and model run times drive the level of network coding and zoning .
- Detailed simulation coding focused on SRN with graduated zoning system applying away from SRN. The simulation network includes:
  - All the motorways and A roads managed by National Highways;
  - Other “A” roads and “B” roads with material role in allowing traffic to access the SRN
  - Any local roads or “C” roads that are necessarily included to capture local traffic routing realistically .
  - All junctions on SRN are coded in simulation allowing for blocking back / flow metering.
- Network outside the region of focus mainly modelled as simplified simulation network. Dummy nodes with max turning saturation flow to avoid unrealistic junction delay.
- Common buffer network from ITN layer.
- Updated NH coding manual.

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RTM2 – Key Network Updates for RTM2

- Greater focus on the Major Road Network and NH Diversion Routes – all MRN links modelled to the same level of detail as the SRN.
- Extent of urban areas of fixed speed reduced.
- Reduced the frequency of nodes / links with convergence errors.
- Contraction of zone loading points.
- Common pool of speed-flow curves across all RTMs.
- Links have been geo-rectified to the OSHighways layer. SRN links have a high match rate in each model. This should speed up onward environmental analysis.

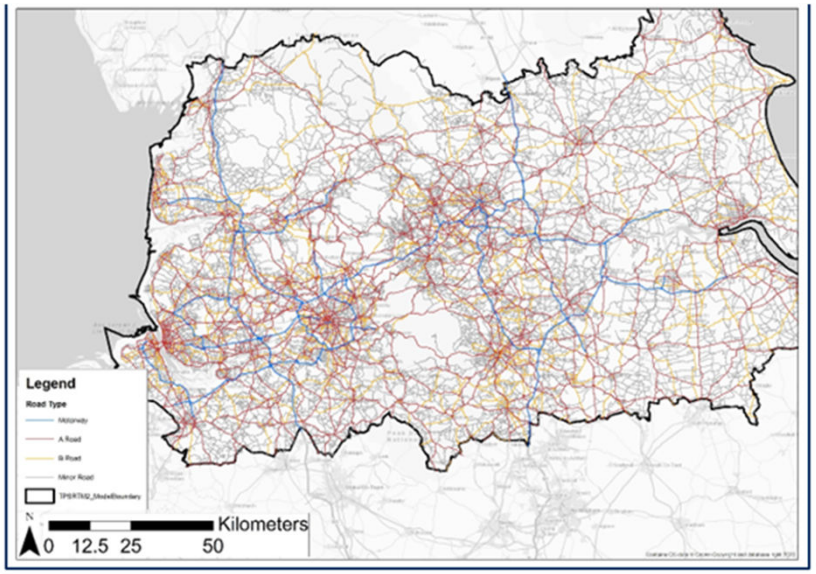

Figure 3-1: Ordnance Survey MasterMap Network Layer coverage in TPSRTM2

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RTM2 – Key Matrix Updates for RTM2

By Vehicle Type

- Source of data for car matrices is TIS 2019 compared with 2015 Provisional data in RTM1.
- LGV matrix development methodology has changed, using MOT/DVLA data to expand and other data sources to adjust. This approach won an award at ETC 2022 for the 'Most Innovative Use of Data'.
- Source of HGV data is MDST for RTM2 - it was BYFM (DfT) for RTM1.

Prior Matrices

- Undertake hybrid gravity modelling to build synthetic matrices.
- Various updates to methodology / matrix build process drawing on lessons learned and TAG Unit M2.2.
- Better method for applying time period sector adjustments (sectorised).
- Greater focus on screenline performance of prior matrices.
- Enhancing the approach to review consistency across boundary movements for both the prior and post matrices.

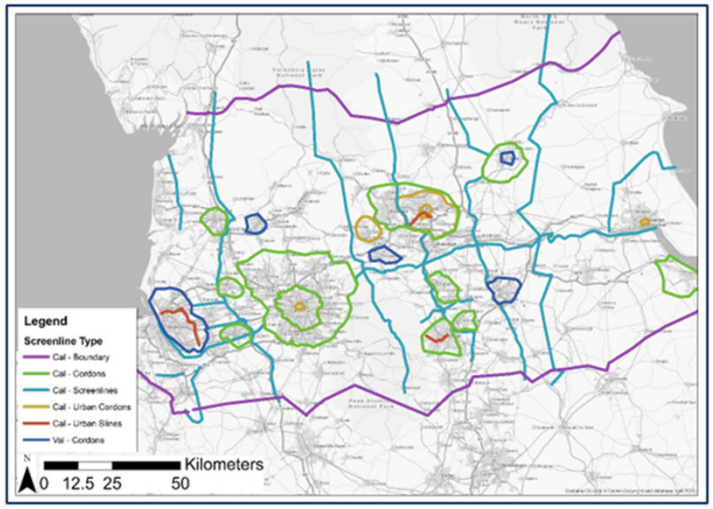

Figure 3-4: Model Screenlines and Cordons

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RTM2 – Cal/Val Overview

Question – "When is a RTM good enough?"

TAG Unit M3.1 §3.2 provides a detailed set of criteria and acceptability guidelines against which it is recommended model performance should be assessed.

- National Highways produced a defined set of measures and criteria against which the performance of the RTM2s should be assessed – this is known as the "When is an RTM good enough?" guidance.
- This is based on TAG, albeit there are relaxations allowed given that:
  - The RTMs are much larger than a 'normal' model to which the TAG guidance refers.
  - The RTMs have specific requirements for consistency between the five models forming the RTM2 suite.
  - The 'standard' RTM2 models will not be used for individual scheme assessment (beyond PCF Stage 0).
- In addition to the specified criteria, there is also a general aim that the RTM2s should either equal or improve upon the performance of RTM1.

Table 3.2 – Acceptability criteria (strategic road network)

Element	Criteria	Time Period	Vehicle Type
SRN Links with flows >2,700	Flows within ±400 of observed flows in 85% of cases	All time periods	Cars and total flow
SRN Links between 2,700 and 700	Flows within ±15% of observed flows in 85% of cases	All time periods	Cars and total flow
SRN Links less than 700	Flows within ±100 of observed flows in 85% of cases	All time periods	Cars and total flow
All SRN Links	GEH<5 of observed flows in 85% of cases	All time periods	Cars and total flow

Table 3.3 – Acceptability criteria (non-SRN)

Element	Criteria	Time Period	Vehicle Type
Non-SRN Links with flows >2,700	Flows within ±400 of observed flows in 85% of cases	All time periods	Cars and total flow
Non-SRN Links between 2,700 and 2,000	Flows within ±15% of observed flows in 85% of cases	All time periods	Cars and total flow
Non-SRN Links less than 2,000	Flows within ±300 of observed flows in 85% of cases	All time periods	Cars and total flow
All Non-SRN Links	Report sliding proportion of GEH values	All time periods	Cars and total flow

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RTM2 – Cal/Val – Key changes since RTM1

Calibration

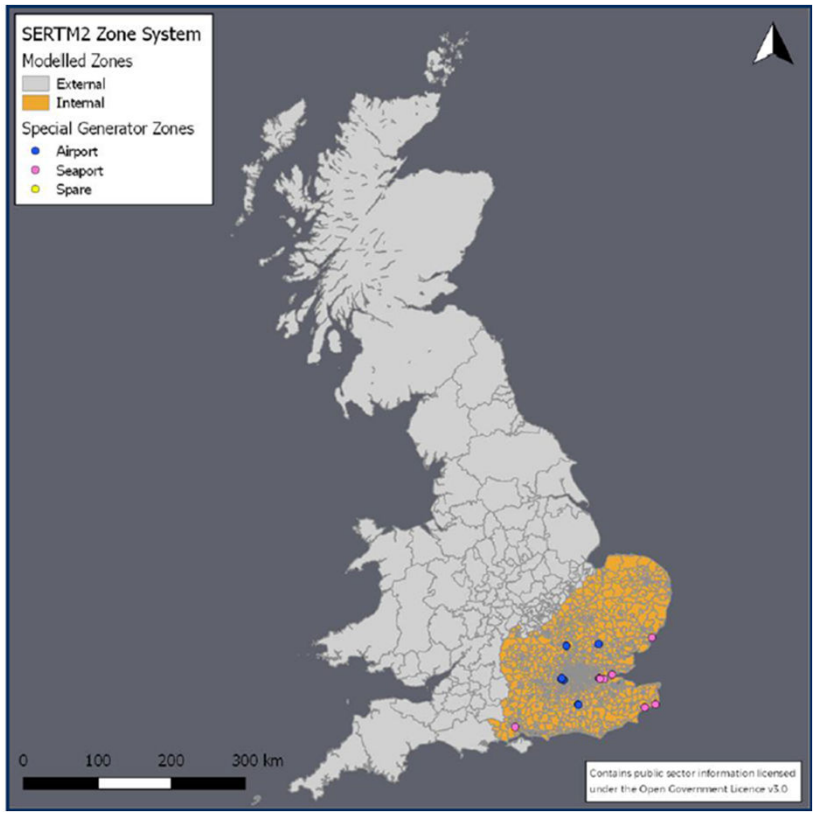
- Application of a matrix estimation capping process to limit sector-sector changes to prior matrices made by ME in line with latest TAG guidance.
- Consistent use of matrix estimation parameters (e.g. XAMAX factors) between models.
- Wholly external-to-external movements that would not reasonably be considered to pass through the RTM's Region of Focus have been frozen during ME2 to prevent unnecessary changes to the matrix.

Validation

- RTM2 now additionally considers links on the MRN to be 'core' and thus subject to tighter validation criteria.
- Additional journey time validation route coverage to include the majority of all MRN routes in a region and a selection of National Highways 'Diversion Routes'.
- Additional screenline/cordons to cover areas of the model where enhanced network detail has been included in urban areas.

Assignment

- Cal/Val SATURN version upgraded from 11.3.12W (RTM1) to 11.4.07H (RTM2).
- Consistency in SATURN parameter files across RTMs.



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RTM2 – Cal/Val Results

Cal / Val Results

- Overall, the validation of SRN links for flows and journey times has improved since RTM1.
- The performance of the non-SRN links in relation to observed journey times has improved since RTM1.
- There is a more mixed picture on the non-SRN routes with some models showing an improvement. This is reflective of the poor count quality on many of the non-SRN roads especially in SERTM which had the largest number of validation sites.

RTM	Validation Links Only - IP		
	SRN Counts	Non-SRN Counts	JTR
NRTM-2	85%	96%	100%
TPSRTM-2	89%	80%	100%
MRTM-2	81%	90%	95%
SWRTM-2	85%	98%	92%
SERTM-2	79%	81%	97%

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RTM2 – Forecasting Overview

- The main build project produced traffic forecasts for 2025, 2031, 2041 and 2051.
- The forecasts were developed using since superseded TAG datasets including:

NTEM 7.2 <> NTEM 8 (predicts less car growth)

RTF18 <> NRTP22 (predicts greater LGV and HGV growth)

TAG Databook v1.19 <>TAG Databook 1.20.2 (revises value of travel costs)

- The forecasts were developed for the core scenario only.

Department for Transport

National Road Traffic Projections 2022

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VDM characteristics

- TAG compliant VDM method which captures:
  - Time Period Choice.
  - Mode Choice (car versus rail only).
  - Trip Distribution (also referred to as Destination or Attraction Choice).
- The VDM for RTM2 is implemented in DIADEM software.
- DIADEM is compliant with TAG guidance with respect to model form, most notably model hierarchy and the incremental nature of the model. The demand model form is incremental (pivot-point) rather than absolute.
- There are other changes in terms of exogenous forecasts (e.g. versions of RTF and TAG Databook) but the general approach is fundamentally the same. The most notable changes are:
  - Calibrated the VDM so that each RTM2 achieved TAG realism testing targets (rather than just aiming to meet them ‘on average' over all RTMs as we did in RTM1).
  - Use of MDST forecasts, rather than RTF, for forecasting HGV growth (albeit constrained to RTF18 growth at the regional level).
- Run times very much depend on the user's hardware and the RTM in use!

ATKINS
Member of the SNC-Lavalin Group

Dynamic Integrated Assignment and Demand Modelling (DIADEM)
User Manual v7.0
Department for Transport
02 November 2022

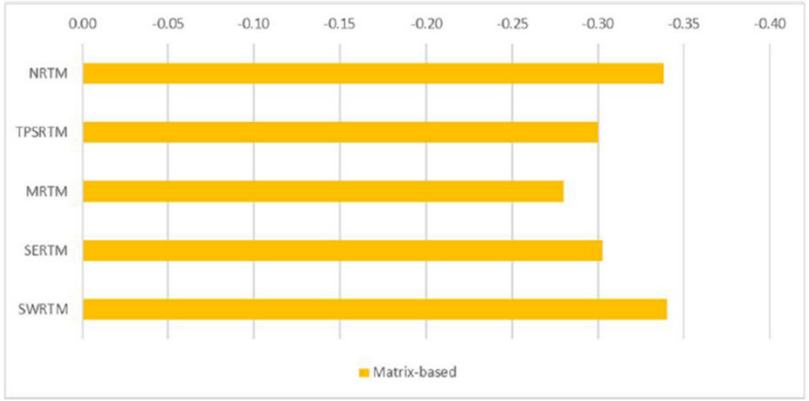

Figure 7-3: 24-hour car fuel cost elasticity by RTM, all purposes combined (matrix-based, Internal to All)

RTM2 – Upcoming tasks and rules on access

- We are currently updating the forecasts to align with TAG guidance including:
  - Change in TAG Databook.
  - Change in NTEM dataset.
  - Change in NRTP22 LGV HGV forecasts.
- Rules on accessing the RTMs outside of NH:
  - We are happy to hand the base year models to LA's / STB's as a starting point for model development.
  - We recommend that LA's / STB's produce their own forecasts using their base year model.
- Future Proofing the models
  - Maintenance contract – looking to increase lifespan of the models beyond '6' years.

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Thanks and Q&A

- Thanks for listening, are there any questions? In particular along the themes of….
  - Do you have any ideas for tasks that we could progress during the maintenance programme? Either routine matters that you feel could be improved, or research tasks?
  - If you are from or working with a LA / STB and have used an RTM, it would be great to hear from you.
  - RTM2query@nationalhighways.co.uk
    Your request will need to be validated by a TPG Business Partner, so please contact one of the team before submission.
    Paul.melia@nationalhighways.co.uk
    Glen.mcadam@nationalhighways.co.uk

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RTM2 – Car Matrix Overview

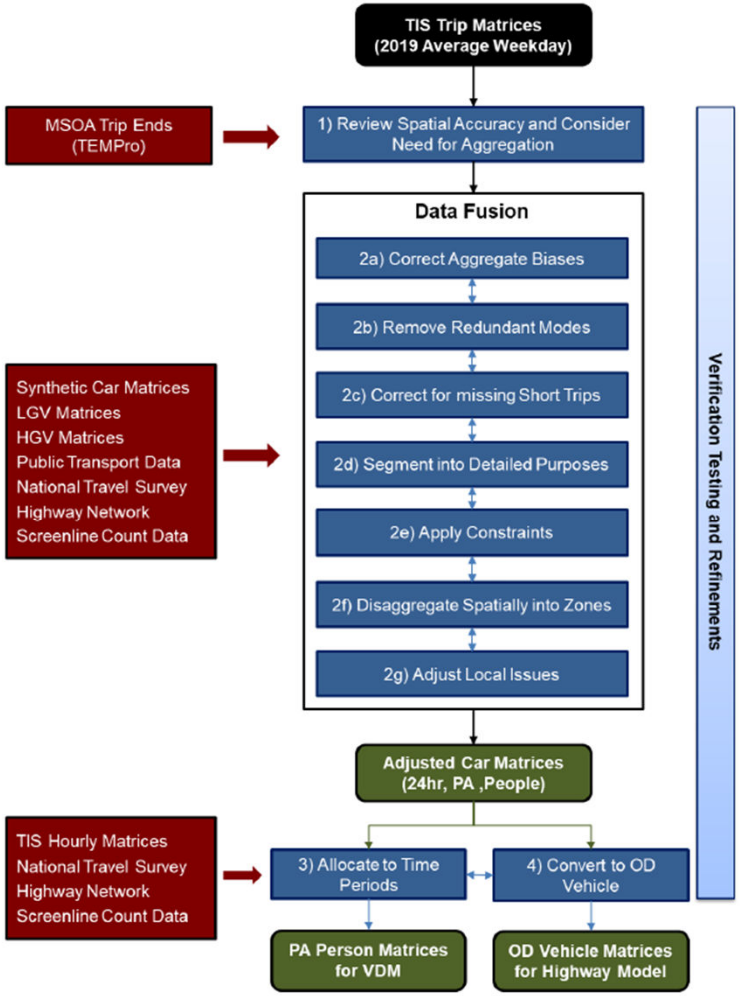

Figure 2.1: Car Matrix Development Approach

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RTM2 – LGV Matrix Overview

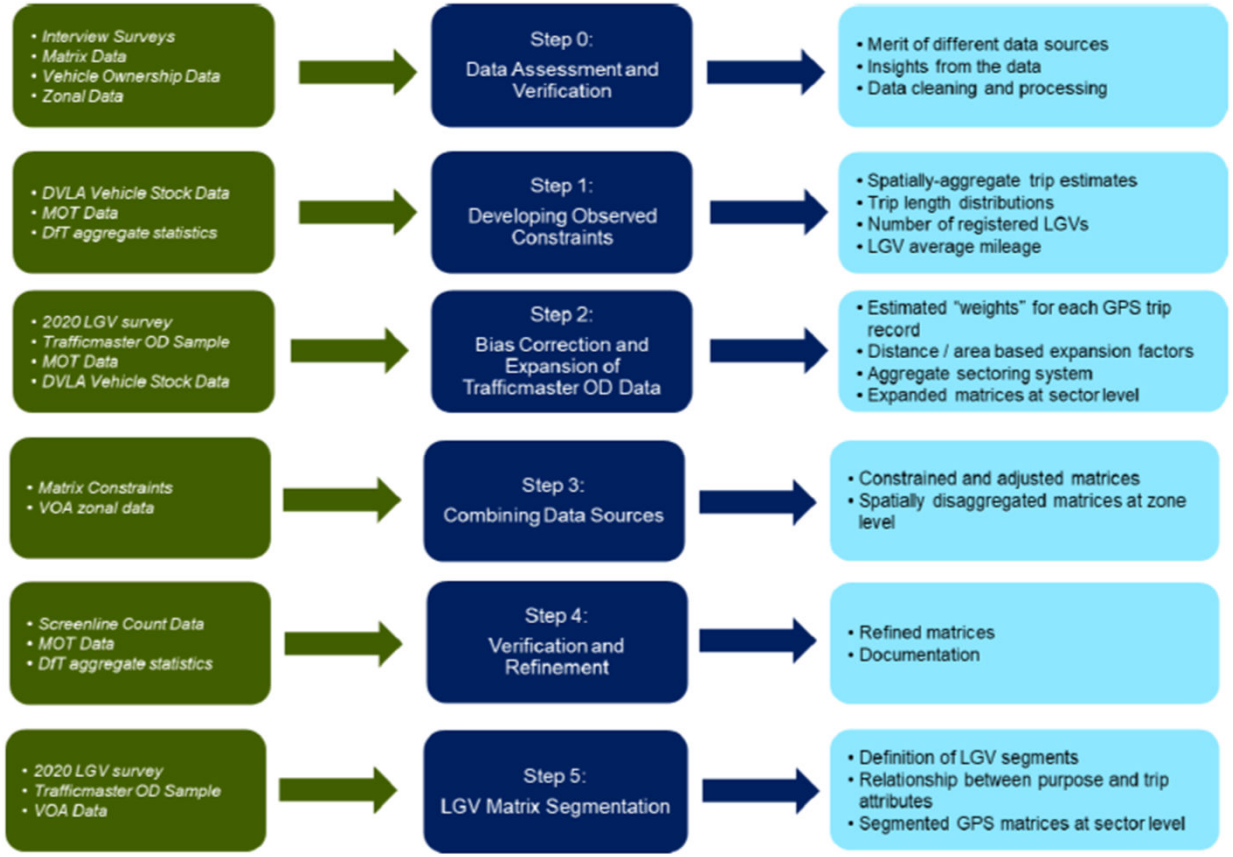

Figure 5.1: Base Year LGV Matrix Development Process

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