Department for Transport NTEM discovery report

March 2020

Undertaken by Hive IT on behalf of the DfT Transport Appraisal and Strategic Modelling team

Executive summary

Context

The National Trip End Model (NTEM) datasets are long-term forecasts — they represent the Department for Transport's, (DfT or the Department hereafter) core estimate of the long-term travel response to demographic and economic trends, and as such are viewed as an essential resource in the transport planning and modelling community.

NTEM plays a key role in the appraisal of transport schemes where funding has been sought from the DfT. In accordance with the Department's Transport analysis guidance (TAG), travel demand forecasts in business cases must be consistent with the NTEM central forecast. Furthermore, other bodies supplying funding, such as councils, appraise funding applications in the same way.

The National Trip End Model (NTEM) produces estimates of person travel by all modes (including walk and cycle) for each zone in Great Britain, of which there are 7,700. The model outputs trip productions and trip attractions in each zone (collectively known as trip-ends), which may be separated by mode, journey purpose, household car ownership category and time period.

The model produces a picture of the distribution of trip-ends based on land use and demographic forecasts that users may access freely through use of the TEMPro software.

Trip end outputs from NTEM are used extensively in transport models. These allow the derivation of future year trip matrices, based on the forecast growth in trip-ends at suitable levels of disaggregation. Growth in trip-ends may also be used in scheme appraisals. Where no formal traffic model exists, forecast traffic growth from the National Road Traffic Forecasts can be extracted from TEMPRO.

The current NTEM has been in place for many years and the most recent version, 7.2, dates from 2016. The Department for Transport (DfT) recognises that user needs have changed along with technology and there is an

opportunity to establish what the next generation of NTEM and supporting services need to be.

Hive IT were commissioned by the Department's 'Transport Appraisal and Strategic Modelling' team to carry out a 6-week research project to better understand the needs of users of the NTEM model, and to identify options for the future direction of the service.

The vision and goals

In order to help provide purpose and direction to the project and align all team members around the requirement for this discovery phase, Hive IT worked with the Department to create the following vision:

> *"By completing this discovery we will understand **how** and **why** our users engage with the NTEM model, how we could **better meet** those needs now, and how NTEM can continue to underpin robust analysis, supporting the delivery of **better transport for the public**, in the future."*

At a more detailed level, the aims of the research were to discover:

- who are the users and what are the uses of NTEM;
- what those users need from NTEM;
- what the challenges are of using NTEM;
- where the demands for change are coming from;
- how we can support innovation with NTEM;
- if NTEM needs development and for who;
- what developments might benefit users in the short-term;
- the issues that could influence the future development of NTEM;
- the impacts of any changes to NTEM and who they will impact.

This report outlines the findings of the research, the needs and frustrations of the users, and provides suggestions and recommendations as to what directions the DfT should take.

Project methodology

The discovery phase was run using the GDS (Government Digital Service) agile methodology. As a discovery, the methodology works towards identifying users of a service and their context, their constraints and accessibility requirements, then using that information to make informed decisions about the next stages — should there be an identified need. The discovery also provides the building blocks for further work should this be the case.

Following a discovery phase, the potential next phase is called alpha, where any new service, changes or improvements are prototyped and tested in order to establish feasibility, problems, costs and risks, and understand whether to move the project on to beta, to take a different approach or to end it.

High-level research findings

It has been made clear to us throughout this discovery, by all types of user, that the NTEM model is viewed as essential by the industry.

"An essential part of what we do. There is no alternative."

"If it didn't exist, I'd have to build it"

NTEM is widely used as a valued source of data and predictions, not just where models must be constrained to NTEM predictions but also as source data and a check for many types of model.

There is also a widespread recognition of the complexity — even impossibility — of what NTEM sets out to achieve.

Having said that, there are consistent patterns of frustration with areas of NTEM, TEMPro and CTripEnd (the component that is used by some advanced users to integrate NTEM with their own models). We have identified gaps in

functionality, and suggestions of ways the Department can better engage with the community.

Through our research we identified the following key findings:

- There is a perception that NTEM is a "black box." Users don't understand what data goes in and what happens to it, and therefore struggle to explain discrepancies between NTEM and their own models.

- Related to this, the community wants to understand, be consulted about and contribute to NTEM. They do not currently feel able to do any of these.

- The guidance is complex, lengthy, technical and inaccessible. It is considered extremely challenging to understand exactly what NTEM is for, what to do in certain circumstances, or where an output has come from.

- There is a widespread perception that some or all functionality should be online and accessible from any computer. Alongside this, TEMPro is unusable for many users with access needs, and the guidance documents are less than ideal.

- The entire community is uncertain about the effects of future mobility. While recognising this is currently unavoidable, there is a strong desire for guidance and a common approach to looking at the future.

There are quick changes that can be made to start to address these, and a range of medium and long term suggestions that would fully address the needs and wants of the users.

Headline recommendations

Hive IT recommend that as a result of this discovery the DfT should:

- Create a team for planning and maintaining regular consultation with the modelling community,for engagement and visibility;
- Create a prioritised backlog (a list of tasks in priority order) of updates to TEMPro and work through this using agile methodologies;
- In the short term, update guidance with specific items identified during user research activities;
- A further project phase to explore a full rewrite of the guidance - for online and offline use - by working with content designers, interaction designers and user researchers, testing and validating various approaches;
- Consider an interim NTEM release before the major new version, updating the non-census data;
- Make TEMPro available online, starting with a short discovery phase specifically to identify the core uses of TEMPro. This will inform a defined minimum viable product (MVP) for moving TEMPro online;
- A large project to rewrite NTEM from the ground up to be released as soon as possible after the release of the 2021 census results in 2022/23.

Table of Contents

Department for Transport NTEM discovery report 1
Executive summary 2
Table of Contents 8
Part 1: Research 11
Introduction 11
The users of NTEM 12
The user types 14
Private sector consultants 14
Local / Regional government 18
Department for Transport 22
Other categories 26
Cross-cutting categories 28
The current situation 30
What NTEM does well 30
Areas for improvement 32
Typical uses 35
NTEM 35
TEMPro 36
CTripEnd 36
Part 2: Recommendations 38
Detailed changes 38
Questions for the Department 42
Potential approaches 44
Closing Summary 50
Appendices 52
About the users 52
Use of NTEM 58
User needs breakdown 62
Data flow 63
Glossary and definitions 65

Part 1: Research

A) Introduction

The emphasis of this discovery phase was understanding who the users of the Department for Transport's NTEM model are, what they need, and where the NTEM model is currently meeting, exceeding or failing to meet those needs. There was also a specific consideration towards how NTEM can continue to support the future development of transport planning.

The discovery was broken down into 3 phases and ran from the 12th February – 24th March 2020.

The phases of the project were as follows:

Phase 1 : The DfT, NTEM and its current users
Understanding the current situation, landscape and research to date around the NTEM model.

Phase 2: Engaging with users
Internal and external research with users and other stakeholders through qualitative and quantitative methods.

Phase 3: Analysis and documentation
Evaluate options, form recommendations, create documentation and complete presentations.

Over the course of the project, we engaged with 36 users directly, received 147 survey responses and had a team which included Fred Ewing, consultant industry expert, and 5 Hive IT members engaged at varying times.

The recommendations within this document (as a result of our research) are intentionally user-focused, talking about the needs that should be addressed rather than specific technical solutions that should be developed. We believe that placing the user at the heart of everything we do means that solutions will ultimately shape themselves, through the collaboration of a team working to

meet those needs. If we focus on the solution first, we may never consider whether we are meeting users' needs.

B) The users of NTEM

Participant engagement

A short discovery over 6 weeks meant that whilst we could engage with a number of users, it would inevitably result in some user types not being directly engaged. Those user types who we did not manage to engage are listed as recommendations for further research.

During the discovery, we broke the different users down into 7 broad types, sharing similar needs and behaviours.

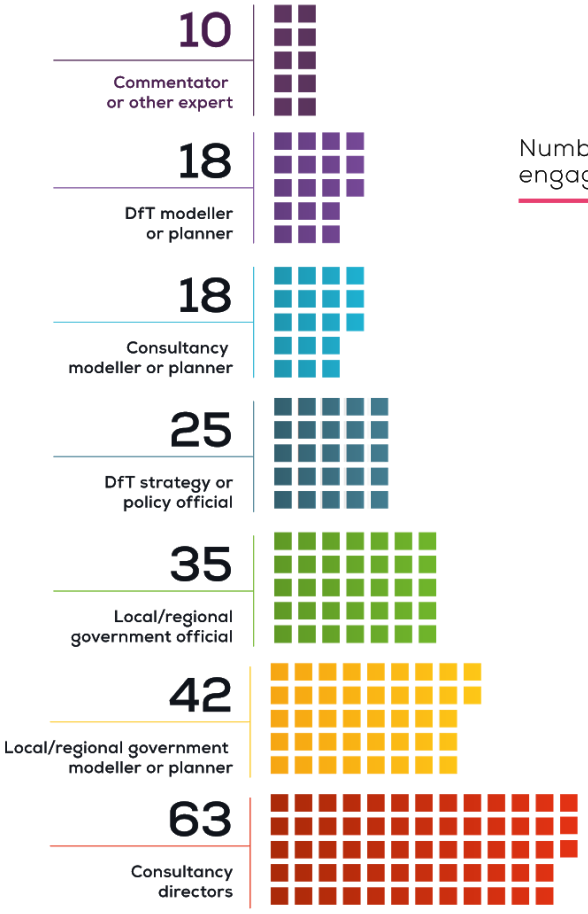
Engagement statistics

36

USERS DIRECTLY ENGAGED

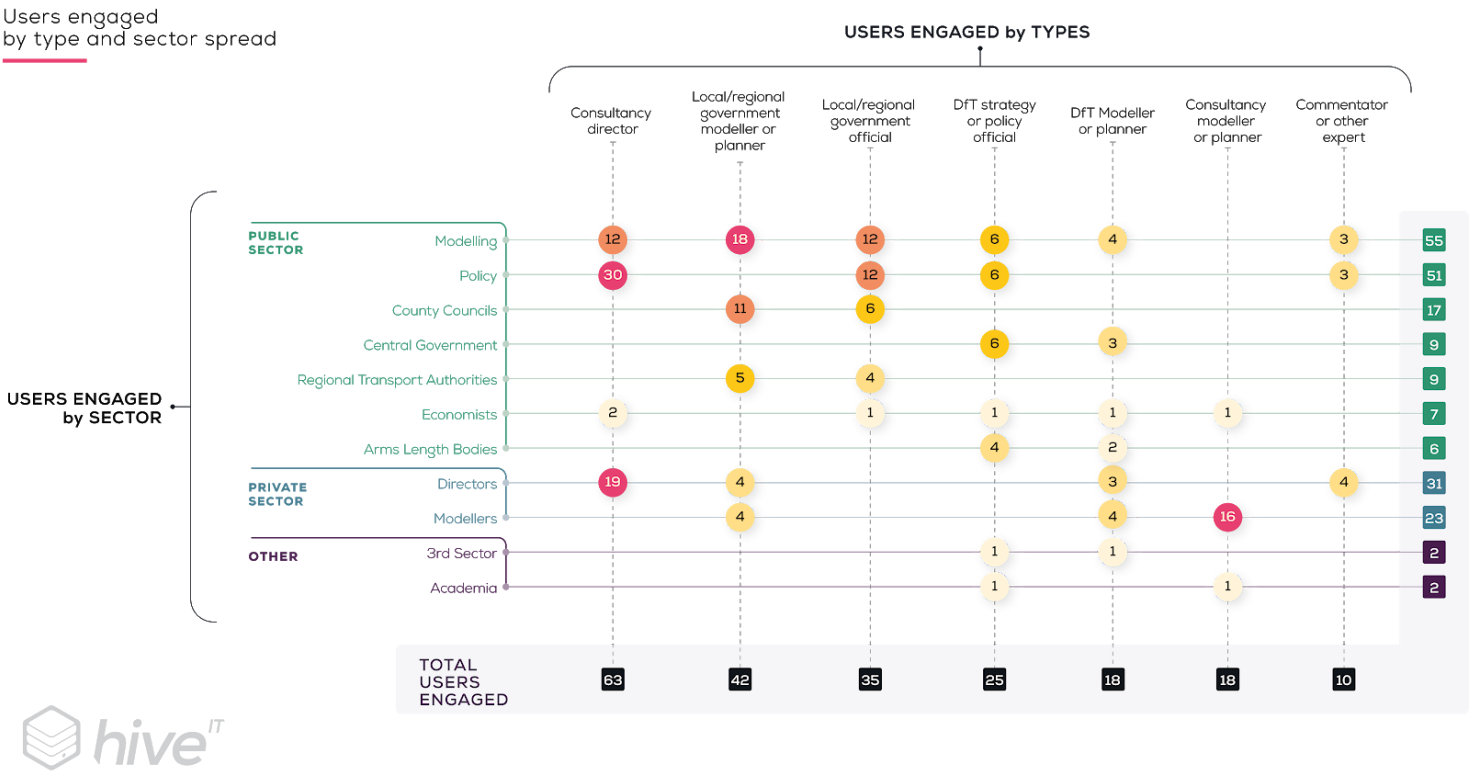
147

SURVEY RESPONSES



Many users may carry out more than one of these roles. The roles represent the hats people wear and their needs at that time, rather than individuals, and are based on our findings and observations.

There is a large crossover of roles and responsibilities in the industry. For example, a director in a consultancy could also create models like a modeller, carry out assessments against NTEM for LAs like a local public sector modeller and contribute to national policy and strategy for the government like a DfT strategy or policy official. Their needs, frustrations and the recommendations to address those are specific to the role they are carrying out.



A larger version of this diagram can be found in Appendix A.

The user types

Private sector consultants

Those working in privately owned, for-profit companies, primarily providing consultancy services to central and local government. Examples include WSP, Atkins, AECOM, Arup, Minnerva.

Consultancy Director

63 screener survey respondents, 13 directly engaged with

This is a senior level leadership role, responsible for strategy, sales, consultancy and staff supervision. Consults with and acts on behalf of central and local government and academia. Often also acts as a private sector modeller or planner.

Typical job titles include CEO, Associate director, Managing Director, Technical Director, Principal Modeller/Planner.

NAME

Consultancy Colin

MARKET SIZE

20 %

TYPE

Consultancy Director

Demographic

Male 49 years

London

CEO, Associate director, Managing Director, Technical Director, Principal Modeller/Planner.

Quote

"It's the single source of truth..."

Skills

Computer/tech confidence

0 25 50 75 100

Technology

Background

Colin represents directors and principals working in privately owned, for-profit companies, primarily providing consultancy services to Central and Local Government. Examples include WSP, Atkins, AECOM, Arup, Minnerva.

He holds a senior level leadership role, responsible for strategy, sales, consultancy and staff supervision. Consults with and acts on behalf of central and local government and academia.

He also often act as a Consultancy Modeller or Planner.

Details

Group: Private sector consultants
User needs: Private sector director
Sample size: 63 screener survey respondents, 13 directly engaged with

Typical user stories

- I need the inputs, assumptions and processes within NTEM to be made clear
  - So that I understand how the numbers are arrived at
  - And so that I can explain discrepancies between NTEM and my models
- I want guidance available on how and when NTEM should be used
  - So that my stakeholders understand it's uses and limitations
- I want to have a fixed release schedule for new versions
  - So that I can plan for updates to my models and software

Goals

- Deliver good quality work
  - We're happy
  - The client is happy
  - The business is sustainable
- Advance client goals
- Find new business
- Find new clients
- Get repeat business
- Get to the truth of the matter
- Advise clients as to best policy decisions
- Avoid unnecessary liability
- Happy, fulfilled workforce
- Provide tools people need to make 'evidence based', robust, transparent VFM decisions

Frustrations

- NTEM is never 100% inline with current policy
- Not being able to explain to LA stakeholders why their models differ to NTEM
- Public sector tendering processes
- Clients don't have the budget to do a proper job

Consultancy modeller or planner

18 screener survey respondents, 9 directly engaged with

These are planners and modellers with a hands-on role creating, updating and assessing models. They work with clients directly, but supervised and funneled through more senior staff.

Typical job titles include (Senior) Transport modeller, (Senior) Transport Planner, Transport Engineer, Transport Technologist, Economist.

NAME

Malcolm Modeller

MARKET SIZE

28 %

Demographic

Male 38 years

Cambridge

(Senior) Transport modeller, (Senior) Transport planner, Transport Engineer, Transport Technologist or Economist

Quote

"Its an essential data source for travel forecasting."

Skills

Computer/tech confidence

0 25 50 75 100

Technology

Background

Malcolm represents modellers and planners working in privately owned, for-profit companies, primarily providing consultancy services to Central and Local Government. Examples include WSP, Atkins, AECOM, Arup, Minnerva.

He is a planner or modeller with a hands on role creating, updating and assessing models. He works with clients directly, but supervised and funnelled through more senior staff.

Details

Group: Private sector consultants
User needs: Private sector modeller or planner
Sample size: 18 screener survey respondents, 9 directly engaged with

Typical user stories

- I need to extract traffic growth data
  - So that I can use it in my own models
  - And so that my own models align with NTEM forecasts
- I need to to be able to access tempro anywhere without installing it
  - So that I do not have to get IT to install it for me
  - And so that I can use it on my own machine
- I want the source code to be made open source
  - So that I can analyse and understand how the model works
  - And so that I trust the model
- I need the inputs, assumptions and processes within NTEM to be made clear
  - So that I understand how the numbers are arrived at
  - And so that I can explain discrepancies between NTEM and my models

Goals

- Compliance with TAG
- Produce accurate forecasts
- Get data and forecasts quickly
- Audit, assess and sense check own and other's work
- Produce meaningful projections of future trip making
- Produce well understood assumptions
- Get the right data out
- Combine own and 3rd party data with NTEM
- Meet increasing stakeholder demand for data and analysis
- Automate as much as possible
- Get NTEM data into own models

Frustrations

- NTEM not updated often enough
- NTEM not updated on a set schedule
- Lack of up-to-date local planning data
- 'Black Box' - I don't understand what goes in and what happens
- Inaccurate data
- No account of public transport accessibility
- No freight
- Getting access to CTripEnd is complicated and takes time
- CTripEnd is very complex to use and requires very specialist knowledge
- Applying alternative planning assumptions to TEMPro is slow, clunky and has the potential for errors
- Not being able to explain to LA stakeholders why his models differ to NTEM
- Not knowing what local schemes NTEM takes into account
- Have to use 'dirty' computer off network for TEMPro

Local / Regional government

Those working in the public sector outside central government, typically with responsibility for scheme promotion and scheme appraisal. Includes local and regional authorities and some arm's-length bodies. Examples include County Councils, City Region Combined Authorities, Transport for London, Transport for the North, Highways England.

Local / Regional government official

35 screener survey respondents, 7 directly engaged with

These are senior level staff with a leadership role, responsible for policy and strategy, reporting to senior stakeholders, supervising staff, commissioning outside work, finding and assigning funding. They will consult with central government and lower level local authorities, and will often commission work from the private sector when lacking skills or capacity.

Typical job titles include Principal Transport Planner, (Transport) Programme Manager, Team Manager, Strategic Economic Infrastructure, Principal Analyst.

NAME

Richard Regional

MARKET SIZE

15 %

TYPE

Local/Regional Government Official

Demographic

Male 54 years

Surrey

Principal Transport Planner, (Transport) Programme Manager, Team Manager, Strategic Economic Infrastructure, Principal analyst.

Quote

"Reality matches the models! Never been told it doesn't, over thousands of hours!"

Skills

Computer/tech confidence

0 25 50 75 100

Technology

Background

Richard represents senior officials working in the public sector outside Central Government. Includes Local and Regional Authorities and some arms length bodies. Examples include County Councils, City Region Combined Authorities, Transport for London, Transport for the North, Highways England.

These are senior level staff with a leadership role, responsible for policy and strategy, reporting to senior stakeholders, supervising staff, commissioning outside work, finding and assigning funding, typically with responsibility for scheme promotion.

They will consult with central government and lower level local authorities, and will often commission work from the private sector when lacking skills or capacity.

Details

Group: Local/regional government
User needs: Local public sector official
Sample size: 35 screener survey respondents, 7 directly engaged with

Typical user stories

- As a local or regional public sector official
  - I want I want to preview access to upcoming releases
  - So that I can ensure my local data is correct
- I want to local authority uncertainty logs to be incorporated into the model
  - So that I trust the numbers NTEM gives me
  - So that I know what developments are in the model
  - So that I can justify NTEM outputs to my stakeholders

Goals

- Improve his local area
  - Infrastructure
  - Economy
  - Quality of life
- Make sure work is robust and follows the guidance
- Define ongoing strategy for authority
- Commission projects for council
- Do well for his team
- Secure funding
- Provide an informed business case
- Find info to prove his case
- Sell scenarios to acquire funding
- Build reputation
- Get errors with new NTEM releases in their area fixed ASAP

Frustrations

- Having to pay consultants
- Can't get unbiased advice for free
- Not enough in house modelling for all their needs
- Misaligned goals
- Not enough money from central gov
- Being constrained by NTEM

Local/Regional government modeller or planner

42 screener survey respondents, 7 directly engaged with

These are junior to mid-level planners and modellers with hands-on roles creating, updating and assessing models.

Typical job titles include (Senior) Transport Planner, (Senior) Transport Modeller, Analyst, Transportation Planning Officer.

NAME

Paula Planner

MARKET SIZE

10 %

TYPE

Local/Regional Government Modeller Or Planner

Demographic

Female 41 years

Manchester

(Senior) Transport Planner, (Senior) Transport Modeller, Analyst, Transportation Planning Officer.

Background

Paula represents planners and modellers working in the public sector outside Central Government, including Local and Regional Authorities and some arms length bodies. Examples include County Councils, City Region Combined Authorities, Transport for London, Transport for the North, Highways England.

She is a junior-mid level planner and modeller with a hands-on role creating, updating and assessing models. She may also have responsibility for scheme promotion and scheme appraisal.

Details

Group: Local/regional government
User needs: Local public sector modeller or planner
Sample size: 42 screener survey respondents, 7 directly engaged with

Typical user stories

- I need to produce traffic growth forecasts
  - So that I understand what changes to transport infrastructure are needed
  - And so that I can supply data for air quality modelling
- I need NTEM to take housing density into account in it's predictions
  - So that I can trust the model in London
  - And so that it can better model divergence in future mobility choices from housing density

Quote

“I’m fine with it - new graduates pick it up quite quickly - better than our other stuff!”

Skills

Computer/tech confidence

0 25 50 75 100

Technology

Goals

- Produce meaningful projections of future trip making
- Produce well understood assumptions
- Improve her local area
- Provide the data Richard needs to secure funding
- Provide the data Richard needs to provide an informed business case
- Apply NTEM in accordance with guidance
- Build scenarios that can be sold to acquire funding
- Build reputation
- Do as much in house as possible
- Learn
- Meet ever increasing senior management thirst for data - in house and with clients
- Fit new demand into NTEM quotas
- Quickly spot errors with new NTEM releases in their area
- Update old appraisals with new data

Frustrations

- NTEM not updated often enough
- NTME not updated on a set schedule
- Lack of up-to-date local planning data
- Can’t see what local data is taken into account
- Outside consultants being used
- Lack of internal resource to help
- Can be unclear how to fit new demand into NTEM quotas
- Not being able to explain to her bosses why her models differ to NTEM
- Not knowing what local schemes NTEM takes into account
- Local network isn’t well modelled
- Inaccurate predictions in city centres
- Can’t see uncertainty that she knows is there, especially at local levels
- No private hire
- No light rail
- No freight
- Can’t install TEMPro or data without IT admin
- Applying alternative planning assumptions is a pain
- No time to do complex scenario testing

Department for Transport

Primarily those working within the DfT — also a proxy for other central government departments, some arm's-length bodies, Transport for Scotland, and public sector consultants working closely with the Department.

DfT strategy or policy official

25 screener survey respondents, 3 directly engaged with

Responsible for policy and strategy, reporting to senior stakeholders, supervising staff, commissioning outside work, assigning funding. Includes those from the private sector working with central government at a senior level. They commission work from the private sector when lacking skills or capacity.

Typical job titles include Deputy Director, Head of Strategic Analysis, Head of London Policy Team, Head of Local Transport Analysis, Head of Appraisal and Model Development.

NAME

Davina DfT

MARKET SIZE

5 %

TYPE

DfT Strategy Or Policy Official

Demographic

Female 45 years

London

Deputy Director, Head of Strategic Analysis, Head of London Policy team, Head of Local Transport Analysis, Head of Appraisal and Model Development.

Quote

In the 30s and 40s, what does the network look like?

Skills

Computer/tech confidence

0 25 50 75 100

Technology

Background

Davina represents those primarily working within the DfT, although she is also a proxy for other central government departments, some arms length bodies, Transport for Scotland, and public sector consultants working closely with the Department.

She is responsible for policy and strategy, reporting to senior stakeholders, supervising staff, commissioning outside work and assigning funding. She also represents those from the private sector working with Central Government at a senior level. She commissions work from the private sector when lacking skills or capacity internally.

Details

Group: DfT
User needs: DfT strategy or policy official
Sample size: 25 screener survey respondents, 3 directly engaged with

Typical user stories

- I need to assess plans
  - So that I can ensure they meet TAG guidelines
  - And so that I can decide whether to provide funding
- I need a single national approved forecast
  - So that local plans remain realistic
  - And so that we have consistency in scheme appraisals
- I want to make informed predictions about the future
  - So that policy is grounded in reality

Goals

- Make sure the transport network is fit for the future
- Make evidence informed policy decisions
- Distribute money fairly
- Ensure local/regional ambitions are constrained by the national picture
- Keep the treasury happy
- “Evidence based policy, rather than policy based evidence”

Frustrations

- Being given the wrong numbers
- Economic case doesn’t match the strategic case
- I can’t have an answer because its impossible to answer my question
- Lack of funding for worthwhile projects
- Policy is a moving target

DfT modeller or planner

18 screener survey respondents, 4 directly engaged with

Modellers and economists at all levels of seniority, with a hands-on role creating, updating and assessing models. Includes those from the private sector working with central government at a practical level.

Typical job titles include Principal Transport Modeller, Economic Adviser, Analyst, Senior Analyst.

NAME

DfT Drew

MARKET SIZE

10 %

TYPE

DfT Modeller Or Planner

Demographic

Male 29 years

London

Principal Transport Modeller, Economic Adviser, Analyst, Senior analyst.

Quote

“Mode splits should categorically not be published and used!”

Skills

Computer/tech confidence

0 25 50 75 100

Technology

Background

Drew represents modellers, analysts, planners and economists working within the DfT, and is also a proxy for other central government departments, some arms length bodies, Transport for Scotland, and public sector consultants working closely with the Department.

He is a Modeller or economist at any level of seniority, with a hands on role creating, updating and assessing models. He also represents those from the private sector working with Central Government at a practical level.

Details

Group: DfT
User needs: DfT modeller or planner
Sample size: 18 screener survey respondents, 4 directly engaged with

Typical user stories

- I need to assess plans
  - So that I can ensure they meet TAG guidelines
- I need NTEM to take housing density into account in it's predictions
  - So that I can trust the model in London

Goals

- Make sure the transport network is fit for the future
- Produce evidence to inform policy decisions
- Assess Richard's models to make sure NTEM has been applied properly
- Work out the best places to site strategic infrastructure
- Understand and communicate the economic benefits of schemes

Frustrations

- NTEM being applied incorrectly
- Hard to make informed decisions about rail stations
- Lack of good data and forecasts around rail passenger numbers
- NTEM does not take into account public transport accessibility
- NTEM breaks in London
- TfL models don’t extend outside London
- Economic case doesn’t match the strategic case
- I can’t give an answer because it’s impossible to answer the question
- Policy is a moving target

Other categories

Commentator or other experts

10 screener survey respondents, none directly engaged with

Our least well-described category. Requires more targeted research in the future. Covers all other expert users, such as those in academia, or those carrying out research at organisations like Connected Places Catapult. They may create or analyse models or carry out research into the future of transport policy, strategy or modelling

Typical titles include Senior Technologist, Emeritus Professor, Professor of Transport Studies.

NAME

Ciara Commentator

MARKET SIZE

2 %

TYPE

Commentator Or Other Expert

Demographic

Female 39 years

Newcastle

Senior Technologist, Emeritus Professor, Professor of Transport Studies.

Quote

“Having an open access model is really important - transparency needs considering.”

Skills

Computer/tech confidence

0 25 50 75 100

Technology

Background

Ciara represents our least well described category. She requires more targeted research in the future to fully understand her roles and responsibilities.

Ciara represents all other expert users, such as those in academia, or those carrying out Research at organisations like Connected Places Catapult. She may create or analyse models, work with econometrics or carry out research into the future of transport policy, strategy or modelling.

Details

Group: Other users
User needs: Commentator or other expert
Sample size: 10 screener survey respondents, none directly engaged with

Typical user stories

- I want to the source code for the models and software to be made open source
  - So that I can analyse and understand how the model works
  - And so that I can find problems in the model
  - I can suggest and contribute fixes and improvements to the model
  - I trust the model
- I need to access to training appropriate to my skill level and experience
  - So that I can use NTEM appropriately
  - I can increase my skill levels and level of seniority

Goals

- Find answers, or the means to find answers
- Innovate - create the next big thing
- Find publicly available sources of free data - on population, economics, land use, transport etc
- Have an impact
- Question and influence policy

Frustrations

- Unsure if they are using NTEM correctly
- Inertia in the transport planning industry - keeps doing the same things regardless of results

Cross-cutting categories

These cut across the other categories — therefore these needs are duplicates of the ones above.

All modellers

111 screener survey respondents, 21 directly engaged with

Most direct users of NTEM have responsibility for modelling on some level, and will interact directly with models and data with varying regularity.

All scheme promoters

90 screener survey respondents, 11 directly engaged with

Promoting schemes — in order to get funding for them — is a key role throughout the private and local/regional public sector categories, and many of our users stated they have some responsibility for scheme promotion.

Having models constrained to NTEM predictions is a prerequisite for getting central and local funding.

NAME

Penny promoter

MARKET SIZE

70 %

TYPE

Scheme Promoters

Demographic

Female 49 years

Birmingham

Quote

“Not updated regularly enough - 2011 base year!”

Skills

Computer/tech confidence

0 25 50 75 100

Technology

Background

Penny represents those carrying out their responsibility for scheme promotion. Promoting schemes - in order to get funding for them - is a key role throughout the private and local public sector categories, and many of our users stated they have some responsibility for scheme promotion.

Having models constrained to NTEM predictions is a prerequisite for getting central and local funding.

Details

User needs - who is also: A scheme promoter
Sample size: 90 screener survey respondents, 11 directly engaged with

Typical user stories

- I need to extract NTEM data
  - So that I can use it in my own models
  - And so that my own models align with NTEM forecasts
  - And so that we can meet TAG guidelines and access funding
- I need walkthroughs and worked examples on how to apply NTEM
  - So that I can get my project funded
  - And so that I understand how to fit new demand into NTEM quotas
  - And so that I can do so without bothering the Department unnecessarily

Goals

- Get her scheme built
- Prove that its a good idea
- Solve a transport problem
- Promote micro and macro scenarios
- Demonstrate value for money - meet legal obligations doing so
- Discredit alternative schemes

Frustrations

- The data won’t let me answer the question in the way I want
- Off model adjustment doesn’t give plausible results
- Struggles with the guidance on reasonable approximation
- Have to get help and work with DfT to meet guidance - can't do it herself

C) The current situation

What NTEM does well

While it is important to recognise users' frustrations and unmet needs, and the opportunities for improvement this brings, it is equally important to recognise that these exist because NTEM is essential to the users' jobs. Indeed, it currently wholly or partly meets the vast majority of the critical user needs we identified.

Part of the remit of this project is to look at the long term future of NTEM, and the most important recommendation we can give is that it **must** continue to exist in some form.

This recommendation is supported by the following findings:

Drives consistency

There is a widespread recognition that a constrained national picture is essential to balance the ambitions of local authorities and scheme promoters against realistic projections of population and economic change and traffic growth.

> *"Single source of truth…."*
>
> — **Private sector director**

Essential tool

Both among those working on the big picture of long term strategy and policy, and amongst those working locally and nationally to decide on and approve the best schemes, NTEM is viewed as essential. Many users told us they could not do their jobs and would have to build it if it didn't exist.

> *"Key component and absolute necessity"*
>
> — **Public sector official**

Reliable long range forecasting

Although there are frustrations with the accuracy of specific parts of the data, overall it is viewed as providing as accurate a long range forecast as is possible.

> *"Reality matches the models! Never been told it doesn't, over thousands of hours!"*
>
> — **Public sector official**

Useful and unique data

Many of the functions were mentioned as being extremely useful, and the national picture and long term forecasting as unique.

> *"Essential data source for travel forecasting."*
>
> — **Private sector modeller**

Easy to use for basic queries

The simplicity of the majority of TEMPro was praised regularly — even among those with many change requests. It was viewed as easy for users to learn and carry out simple queries with.

> *"I'm fine with it — new graduates pick it up quite quickly - better than our other stuff!"*
>
> — **Public sector modeller**

Areas for improvement

There were some consistent problems with NTEM, TemPRO and CTripEND that were identified during the research. Understanding each users' frustrations was important and formed the basis of our overall recommendation. We identified 109 user needs and associated stories (See supporting documentation "DfT NTEM User Needs"), of which 72 needs are not currently being met (or are being partially met). These have distilled down into the 6 main themes below, alongside the most common frustrations in that theme.

Consultancy and transparency

Many users feel that there needs to be greater engagement within the community in relation to NTEM, and clearer information about NTEM itself, for example:

- There is a perception that NTEM is a "black box." Users don't understand what data goes in and what happens to it.

    - *Especially common in consultancies who have to explain discrepancies between NTEM and their own models. Also happens with those in local/regional government*
- Related to this, the community wants to understand, be consulted about and contribute to NTEM. They do not feel this takes place.
    - *All local/regional government and consultancy users*
- There is a desire to have open-source data and software to allow the community to look under the hood, provide feedback and increase their engagement.
    - *All local/regional government and consultancy users*

Guidance and documentation

The guidance is complex, lengthy, technical and inaccessible. Many of our findings mirror those from the 2018 consultation[1] "Transport appraisal and modelling strategy: informing future investment decisions". To understand exactly what NTEM is for, what to do in certain circumstances, or where an output has come from is viewed as extremely challenging.

For example:

- Worked examples and walkthroughs would be appreciated around how to handle local planning assumptions exceeding NTEM constraints.
    - *Local/regional government and DfT users*

- Having the technical, instruction and help information split out and cross referenced would make finding relevant information a more manageable cognitive task.
    - *All users*

Up to date and accurate

There is widespread frustration with the lack of updates, and the uncertainty about when they will come. Allied to this is frustration is the accuracy of some of the data. For example:

- There is a strong desire for better, more recent local planning data.

[1] *https://www.gov.uk/government/consultations/transport-appraisal-and-modelling-strategy-informing-future-investment-decisions*

    - *All local/regional government users and consultancy users working for them*
- The consistent overestimation of road traffic over time, and of trips in dense urban areas, were both mentioned repeatedly.
    - *Local/regional government users*

TEMPro ease of use

Although many users commented that they found TEMPro easy to use, the same users often described it as "clunky" and identified areas for improvement. For example:

- Several users found the interface for inputting alternative planning assumptions for multiple years very frustrating and error prone.
    - *Local/regional government modellers*
- Finding issues and looking up MSOA codes can be very time consuming without charting and mapping functionality.
    - *Local/regional government modellers*
- One person commented that they often hit the "reset selection" button accidentally due to its positioning, and requested a confirmation dialogue and that it be moved.
    - *Consultancy modeller*
- Several users noted that they use NTEM data to produce trips and trip matrices, and this can take a great deal of their time. A Senior Analyst in a regional transport body said "Everyone's done that" when requesting this feature, referring to the transport modelling community's use of NTEM.
    - *Consultancy modeller*s, *local/regional government modellers*
- Having to download and install the data files individually was a common complaint.
    - *All modellers*

Installing and accessing the model and software

We identified concerns and issues with accessing the model and associated software in its current form. For example:

- There is a widespread perception that some or all functionality should be online and accessible from any computer.
    - *All modellers*

- The guidance documents are not accessible to users of varying expert levels.
    - *All users*
- TEMPro is unusable for many users with access needs as identified in the supporting accessibility audit delivered to DfT.

Future uncertainty

The entire community is uncertain about the effects of future mobility. While recognising this is currently unavoidable, there is a strong desire for guidance and a common approach to looking at the future.

- *All users, but especially local/regional government users*

Typical uses

These are taken directly from our interviews and surveys.

NTEM

Forecasting

- Forecasting future growth — TAG constrained or not
- Quick and easy source for predictions of traffic growth, population growth, economic change, car use, land use

Model creation

- Combining with other data sets to create own models — e.g. public transport ticket sales, mobile data, NTS, local planning data
- Source of future growth in microsimulation and junction models
- Data source for air quality models
- Readily available source of free data

Scenario testing

- Should we close a road or narrow it?

Check and validate models

- Validate base transport models
- Checking strategic models against NTEM growth
- Check scheme promoter models

- Analyse economic benefits of schemes
- Maintain consistency with local models

Other

- To create origin/destination insight
- Predicting effects on transport network, future network change
- Network change management

TEMPro

As well as being the main interface to NTEM for the majority of users, TEMPro is also used as a quick source of data and sense checking, even for those who have access to NTEM in other ways.

Quick check or source of simple numbers

- Trips per day in Bedford — order of magnitude
- Convenient way to get small, specific amounts of NTEM data
- Quick comparison to figures from elsewhere
- Ad-hoc only, not significant amount of data
- "Check what we're looking at doesn't look mad"

Simple scenarios

- Carry out high/low forecasts using TEMPro
- Apply alternative planning assumptions to NTEM
- Select areas where growth is desired, use alternative assumption function to tweak growth characteristics for each project

Time saving functionality

- Combines NTEM with NTM local adjustment factors (does it all for you!)
- Export or copy and paste to spreadsheets

CTripEnd

CTripEnd is a component of NTEM; it represents a more flexible implementation for integration into advanced models compared to TEMPro.

CTripEnd is typically used by more technical users with specific use cases around integration with systems or models.

- Integrate NTEM data into users' own models
- Use scripts to get data out and into PostgreSQL (an open-source database)
- Restructure NTEM to focus on their model area better. Add new household, population and job estimates from LAs, etc., as NTEM is out of date.
- Generating forecasts embedded in forecast development via their own zone system to produce latent demand.
- Provides latent demand for variable demand modelling.

Part 2: Recommendations

A) Detailed changes

We recommend that the Department for Transport make the following changes to TEMPro, NTEM and the CTripEd component. [2]

They can be broken down into quick wins, medium term and longer term as follows:

Short term quick wins (Q)
These can be implemented without extensive consultation or complex changes.
Medium term improvements (M)
These can be made to existing software and models but require more complex work or consultation.
Longer term recommendations (L)
In the most part, these require a complete rebuild of the model and extensive discussions and consultation.

Improve the guidance

(Needs group: *Guidance)*

- Short term, update where possible:
    - Improve the NTEM page on GOV.UK — Key information and data is hidden behind "read more" links on the NTEM download page. During research it became clear some users were unaware of information and files hidden behind these, therefore these should be removed (Q)
    - Provide walkthroughs and worked examples (Q/M)
- Medium term, rewrite the guidance:
    - *See also paragraph 7.4, 7.15–7.19, Transport appraisal and modelling strategy: informing future investment decisions*

[2] *Supporting identified user needs are contained within the "DfT NTEM User Needs" spreadsheet where you can filter by the "Needs Group" column as described under each heading. They are prioritised according to impact and number of users affected.*

    - Guidance aimed at different expertise levels (M)
    - Move it to the web (M)
    - Ensure it is accessible (M)
    - Have separate usage guides, technical documentation and help files (M)

Provide regular updates

(Needs group: *Updates)*

- Update more often — probably every 2 or 3 years (M)
    - Only a few users wanted high frequency releases — however, this is because of the issues they face with new releases changing the model they work with, and the complexity of integration
    - The 2–3 year schedule is specified to minimise those issues. However, other users wanted access to the most up-to-date data at all times. If users like scheme promoters were able to fix the version they used at the start of a project as their constraint, this would allow more regular data updates to take place without affecting them
- Update on a fixed schedule (M)
- Give the community pre-release access (Q)

Be open and transparent

(Needs group: *Open & transparent, accuracy)*

- Consult and explain (Q)
    - Transparent box, not black box (Q)
    - Seminars, webinars & conferences (M)
    - *See also paragraph 7.21, Transport appraisal and modelling strategy: informing future investment decisions*
- Open source/Open data (L)
- Show inputs, assumptions, regressions, etc. (M)
- Show uncertainty (L)

Move online

(Needs group: *Online)*

- Provide as much functionality online as possible (M)
- Provide APIs for that functionality (M)

- Use cloud services where possible — for example, to provide CTripEnd access as Software as a Service (SaaS) (M/L)

Introduce new functionality

(Needs group: *New functionality)*

- Improvements to TEMPro (Q)
    - Batch facility for alternative planning assumptions, allowing the request of multiple years with the same assumptions, and better ways to input those values
    - Include DfT defined scenarios in TEMPro (Q/M) - once the 5 alternative scenarios are finalised, publishing them via TEMPro would be a practical improvement
- Scenarios
    - As well as DfT defined scenarios, look at narrative scenarios taking into account various future mobility trends (M)
- Maps graphs and charts (Q)
    - Users of all kinds asked for this for quickly spotting errors and outliers, as well as understanding MSOA codes
- Take housing density into account in the model to ensure it is accurate in large cities
    - For example, in London and Manchester (high density areas) the relationship in NTEM between income and car ownership breaks down (Q)
- Include Freight modelling (L)
    - Currently 10–20% of road traffic can come from freight, but forecasts are provided as a nationwide figure, without the kind of modelling NTEM provides. This means modellers have to access and integrate 2 sources of data, and are aware that freight figures lack the accuracy and rigour of other traffic types

Make it accessible

(Needs group: *Accessibility)*

- Ensure users with access needs can get and use the data (Q/M/L)
- Ensure they can read and understand the guidance (M/L)
- Move as much as possible online to enable this (M/L)

Introduce new data

(Needs group: *Data, Accuracy)*

- LA planning data (L)
    - The lack of up-to-date local planning data is a common issue among all users. This includes recent LA planning data, such as uncertainty logs, which has been requested by users of all types, especially those working with local and regional authorities
- Provide schema? (L)
    - Getting LA data in a set format is a major problem in the above point. One user suggested that the Department could (perhaps with MHCLG) provide a common format to simplify the task for LAs and the DfT

Make it adaptable to the future

(Needs group: *Futureproof)*

- Future mobility (L)
    - Being able to incorporate new data, observations and predictions as they become available to make the modeling of future mobility more accurate, ensuring there is an ongoing common source of up-to-date forecasts
- Outcome focussed modelling
    - Being able to input a desired outcome, and see which levers could be pulled to achieve that (L)
- Industry trends and best practice (L)
    - Have the potential to adapt to changing trends — for instance the move towards agent-based or behavioural modelling
- New data sources (L)
    - Have the potential to integrate new data sources into the model as they emerge, including big data
- Monitor progress with and engage with TfL/TfN and others developing advanced models to see how these inform and change best practice, and what can be reused from their efforts

Further research recommendations

Under-represented users

Due to the constraints of time within this discovery phase, there are a number of users to whom Hive IT either did not manage to engage with, or were not proportionally represented in the research. As a general recommendation, we would suggest that the DfT attempts to engage (directly or utilising the tools created for this discovery) with the following users:

- Academia
- Campaigning groups

We would recommend engaging with them in order to ensure that there are no new user needs specific to these user types that require representing.

Data contributors

We engaged with local authority users, who expressed a strong desire to have their planning data more accurately represented, and a willingness to take steps to enable this — along with a worry about additional work as a result. We also spoke to Telefonica, who expressed a strong desire for DfT to license their data.

Due to the timescale constraints and the initial scope of this discovery phase, Hive IT was not able to engage with other contributors of data to the NTEM model, such as ONS or NTS.

We did not identify other potential suppliers of data over the course of our research. We were also unable to talk to the academic community to understand the research taking place there, or any providers or users of big data outside of telecoms.

B) Questions for the Department

There are some fundamental questions this project has thrown up with regard to NTEM. Our research has uncovered how its users make use of it, and their issues around this. There are aspects of our recommendations that may have political implications, and areas where user needs are finely balanced in opposing directions.

Should NTEM focus on its core purpose, or expand to try and be as useful as possible?

- While being as useful as possible is desirable, it may have cost implications, and risks the model losing focus

Can all the inputs be made open data?

- This is important, as it allows full transparency of the inputs, but there are considerable barriers
- Could the non-anonymised data be anonymised without adverse effects on accuracy?
- How?
- Would licenses still be needed in this case?

Does the DfT have a role in helping coordinate local planning data

- Can it do so in a way that reduces, rather than adds to, LA workload?
- Given the benefits to LAs in having up-to-date local planning data in the model, could the DfT work with MHCLG on this?

What update frequency is best?

- Or what is the highest practical release frequency?
    - Could high frequency data updates take place with scheme promoters fixing their model version to the start of their project?
- How to balance the advantages of regular updates with the problems this will cause?
- Could a scheme promoter lock down their model at the start of their project and be assessed against that, allowing more regular updates to be ignored?
- In this case, is this appropriate if there is a large discrepancy in their forecasts using the old and new model? Should there be a check?

Is a single core scenario still appropriate?

- If not, how would this work in terms of scheme assessment?

How should data with low certainty be treated?

- There is a feeling it should be removed in some areas, but many find it useful — but would like to understand the relative accuracy

C) Potential approaches

We recognise that there is a discussion to be had within the DfT about funding, staffing, timescales and the practicality of potential approaches.

In order to inform that discussion, Hive IT suggest the following approaches with regards to the detailed recommendations:

1) Continue to consult with the industry

Approaching this as a programme of work, rather than a series of ad-hoc engagements, should ensure the consultation is ongoing and carried out throughout the Department, rather than relying on individual actions. This may prove especially important when other projects kick off. This should include sending out a public version of this report, and communicating decisions made as a result wherever possible.

Hive IT believes that this can be undertaken internally by the DfT with no need for a defined GDS phase. We recommend creating a small (potentially part time) team consisting of a Product Manager, Delivery Manager and Content Designer to create a roadmap for engagement, define communication methods, create content and confirm timescales to ensure that this recommendation is enacted upon and remains forefront of the Department's strategy. It would also be a recommendation that feedback from the community is gathered by consulting them regularly, to ensure that the approach can be adapted if necessary.

By dedicating a team and time to this project the DfT can ensure it is continued, and the community remains engaged, even when there are many competing calls on people's time. This team should exist for the duration of the NTEM model and the services it provides.

2) Ongoing updates to TEMPro

We recommend creating a prioritised backlog of enhancements to TEMPro, both while it exists as a stand alone application and as an online

service. We believe that this backlog can be informed by an existing list of changes/issues which the DfT hold currently, supplemented with findings from this user research (detailed in survey and interview responses).

For example, if batching of planning assumptions (TASM Common analytical scenarios or chart/graph/map functionality) can be added to the existing application, this should be done, and would provide considerable benefits.

This would provide an excellent opportunity to demonstrate ongoing commitment to improving the service.

Again, Hive IT believes that this can be undertaken by the DfT and their existing service providers with no need for a defined GDS phase. We recommend that this backlog is maintained and prioritised by a defined DfT Product Manager, who can work with suppliers to implement changes and updates via an agile project methodology. We would also recommend engaging a user researcher when new features or updates are released, to ensure that iterative development maintains and strengthens the system offering.

3) Interim guidance updates

Where specific guidance items have been requested during research, they should be added to the guidance wherever possible. Hive IT believes that this can be implemented by the Transport Appraisal and Strategic Modelling team.

4) Guidance rewrite

Hive IT recommends that a further project phase is initiated in order to undertake a more fundamental rewrite of the NTEM guidance, with a view to bringing it online.

We would suggest that a team with the following expertise would be beneficial to undertaking this next stage:

- DfT Product Manager

- Delivery Manager
- DfT subject matter experts
- Content Designer
- Interaction Designer
- User Researchers

Stage 1

We recommend that this is undertaken over a fairly short period (2 months) with a focus on exploring how best to provide guidance which meets the identified user needs. The output of this further phase should be:

- A defined information architecture
- Digital prototype for the user interface of an online version
- Guidance on the best way to structure and use appropriate language with content rewritten (if needed)
- User research findings from continuous user testing throughout the project
- A defined minimum viable product backlog
- An estimate of the time and team needed to build an online version and/or create a new offline version

The additional staff for this phase could be provided by DfT digital or externally, but will require a considerable commitment from the DfT NTEM subject matter experts.

This phase is the equivalent of an alpha in GDS terms, and is intended to produce all the information and guidance needed to create the new guidance.

Suggested timeline: 2 months
Suggested budget: £80,000 – £120,000
Suggested team: 6 team members (2 internal, 4 external)

Stage 2

Producing the revised guidance in accordance with the recommendations (the equivalent of the beta phase) should be primarily carried out by the DfT experts, with ongoing guidance from content and interaction design and user research. We expect external costs to be in the region of

£60,000 – £100,000, although the internal time required would of course be extensive.

5) Online TEMPro

Our recommendation would be that a project should be undertaken to make some or all of the TEMPro functionality a web-based service for the most common queries.

Stage 1

Initially, we recommend undertaking a 4 week discovery phase (utilising those users who have agreed to be further involved in research) specifically to identify the core uses of TEMPro. We would suggest that a team with the following expertise would be beneficial to undertaking this next stage:

- DfT Product Manager
- Delivery Manager
- User Researcher(s)

The output of this further discovery phase should be a defined MVP & associated user research which can then be used to inform a further phase.

We are recommending this approach as our research has identified:

- The most used functionality of TEMPro should be provided by a web-based service in line with GDS guidelines — this is both best practice and a GDS requirement
- This should consider ultimately using a future cloud-based version of NTEM as its data source, but could be implemented well in advance of that happening
- This will facilitate
    - Access anywhere, any time
    - Cross platform, IT admin free use
    - APIs and JSON feeds
    - Batch requests and exports
    - Charts, graphs and maps
    - Accessibility for those with access needs

Suggested timeline: 1 month
Suggested budget: £25,000 - £35,000
Suggested team: 4 team members (1 Internal, 3 external)

Stage 2 & 3

Should the discovery phase confirm the requirement and feasibility, the next steps are usually alpha and beta phases, taking the service through to being live.

While the detailed discovery is necessary to provide more accurate estimates, we would expect these two phases together to be in the **ballpark of £250,000 to £350,000**.

6) Interim NTEM update

Consideration should be given to an interim NTEM release before the major new version, updating the non-census data, if this could be done more than 18 months before a full new release. Hive IT believes that this can be implemented by the internal team.

7) Ground up rewrite for the next NTEM version

There should be a major new version of NTEM released as soon as possible after the release of the 2021 census results in 2022/23. This might be locally installable and/or a cloud service.

- The next major version of NTEM should be rewritten in Python, using open-source databases (probably PostgreSQL)
- The model and as much as possible of the data should be publicly available.
- All code should be released on the DfT GitHub account
- Every effort should be made to use open data and to provide anonymised, license-free versions of other data sources
- This enables
    - Open and transparent agenda
    - Housing density to be taken into account
    - Incorporation of new data sources
    - Showing accuracy and uncertainty

    - Regular scheduled updates by simplifying and automating the inclusion of updated data
    - In context guidance
    - Less frustration around CTripEnd access

A rewrite is, of course, a large project, but it could be carried out internally or with a transport consultancy. There is no dependency to wait for the next major release to be issued before commencing work to create a new version of NTEM.

Stage 1

Hive IT recommends the DfT define an approach to undertaking this work which aligns with their internal strategy and milestones, whilst following GDS guidance. We highly recommend continued input from user research and interface and content design to maintain alignment with user needs, accessibility and to ensure that help and guidance is fully integrated and in context.

We suggest an initial phase to look at the feasibility of aspects like making the software open source, making the source data publicly available, and providing a cloud-based version and additional functionality required by users. This phase, the equivalent of an alpha in GDS terms, allows the development to go ahead with a degree of certainty about the scope of the project and the practicality of the improvements. It would also clarify the costs and timescales and help plan that around the upcoming UK census.

Hive IT would recommend a suggested team of:

- DfT Product Manager
- Delivery Manager
- Blended DfT/external team of 2 Modellers & Software Engineers, depending on DfT availability
    - E.g. 2 x DfT
    - 2 x external
- 0.25 Content Designer
- 1 x Interaction Designer
- 0.75 x User Researcher

Suggested timeline:* 2 *months

Suggested budget: between £120,000 and £180,000
Suggested team: 6 team members (4 external/DfT digital, 2 internal)

Stage 2

While stage 1 is necessary to fully understand the costs for a full build, the scale of this project, and of creating transport models in general, leads to an estimate of **approx £1.5 to 2 million** . Due to the expert nature of the work required, we suggest the development is undertaken inside the DfT or by an external consultancy, or a combination of the two. It is vital that user research, interaction and content design is involved throughout the project.

Closing Summary

Over the course of 6 weeks, Hive IT have endeavoured to uncover the users, uses, needs and frustrations of the NTEM model.

Without the engagement from DfT staff and the transport modelling community, this project would not have been possible. To have engaged with the number of users we have, over the course of a short project, is testament to the desire to explore how NTEM can be sustained, maintained and improved for future use. Our research conclusively found that the NTEM model is integral to transport modelling across the country and should continue to exist.

Whilst our recommendations are based on the user needs we uncovered, Hive IT recognises that the DfT now needs to take time to consider these and explore a route forwards in a number of areas.

It is worth noting that the tools used to undertake this discovery, and the data generated from completing it are now under the ownership of the Department for Transport and we would encourage the DfT to use these to support future research.

Additionally, the feedback of undertaking this research was overwhelmingly positive, and the approach by the DfT of beginning to engage with NTEM users was recognised and appreciated by those people we spoke with. We would highly recommend continuing to communicate openly with users.

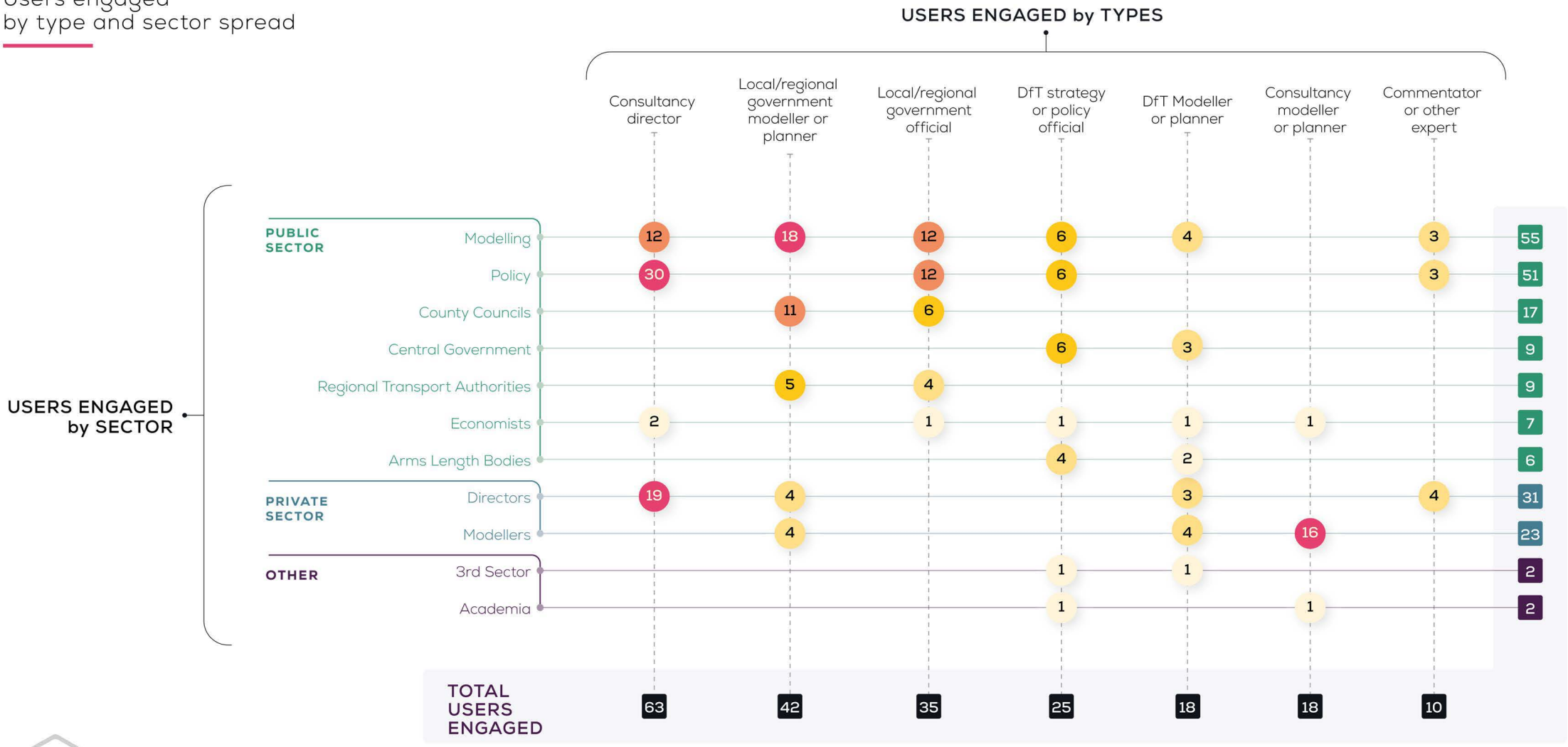
Hive IT believes that by implementing the recommended quick wins alone, the NTEM service will be more accessible, usable and engaging in the immediate short term, and that the wider roadmap of iterations will allow NTEM to truly support better transport for the public in the future.

Appendices

A) About the users

User split between
modellers and scheme promoters

Users engaged by type and sector spread

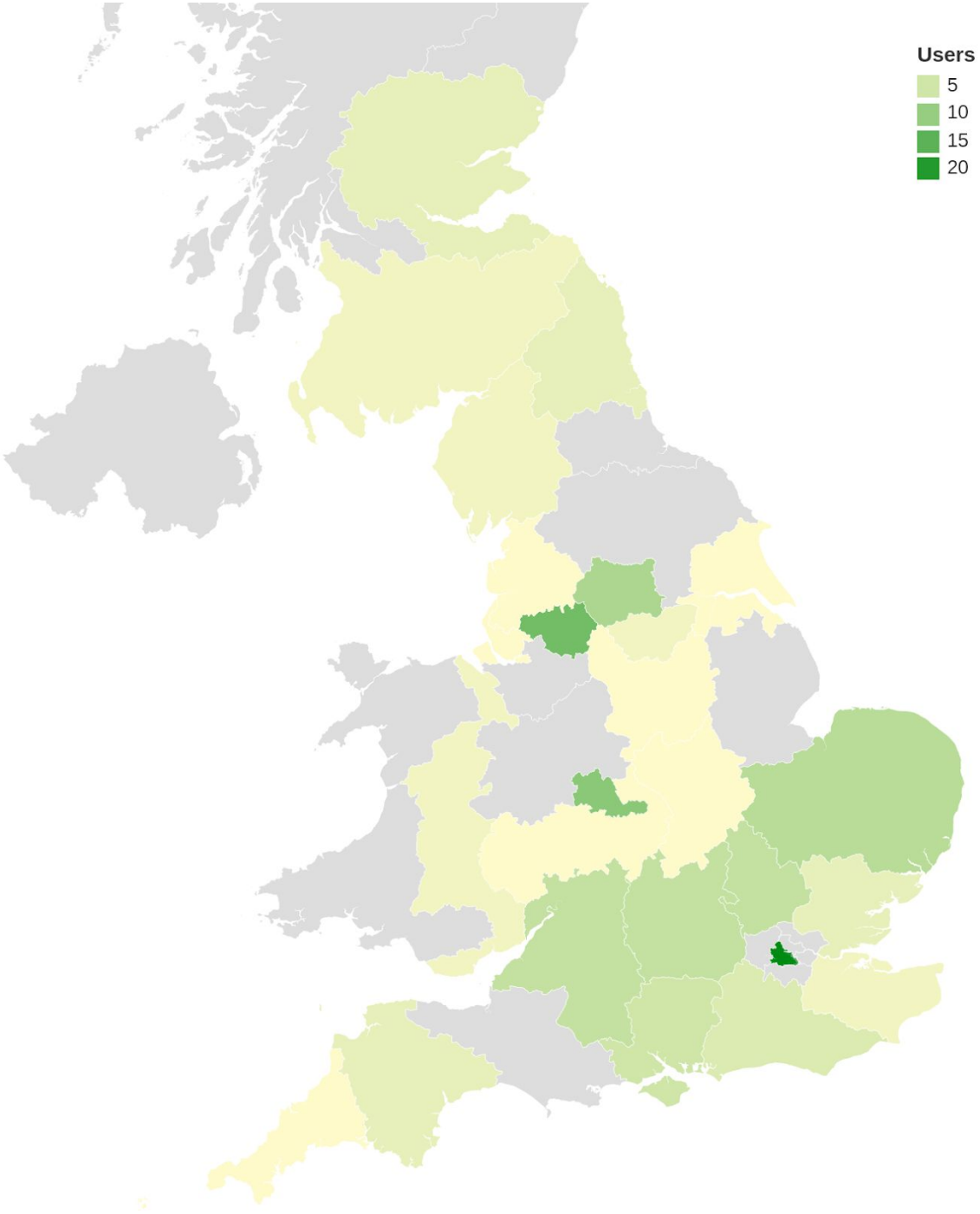


hive IT

Type of model produced against sector for NTEM users

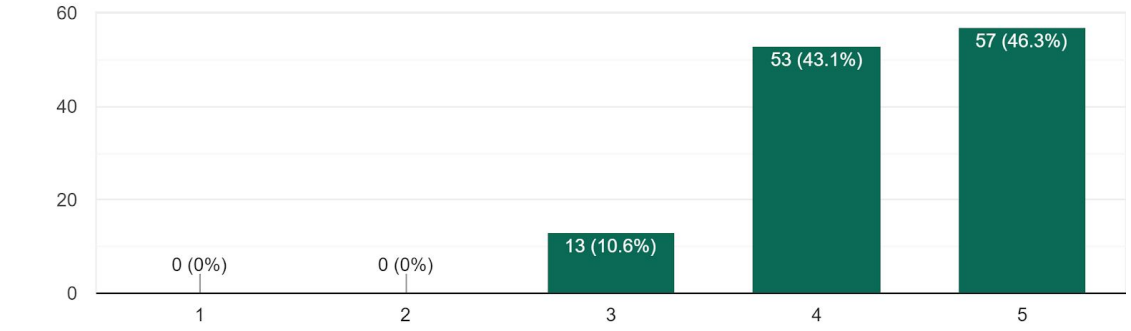
hive IT

User locations



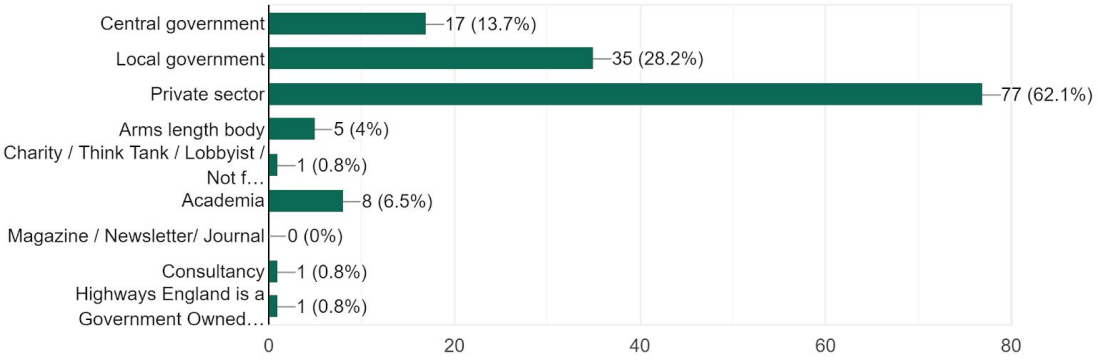
How confident are you using computers and technology?

123 responses



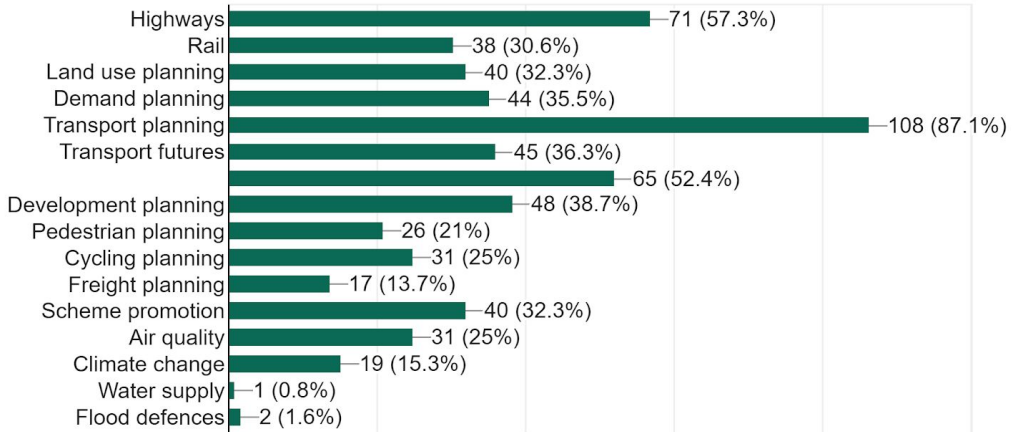
What kind of organisation do you work for?

124 responses



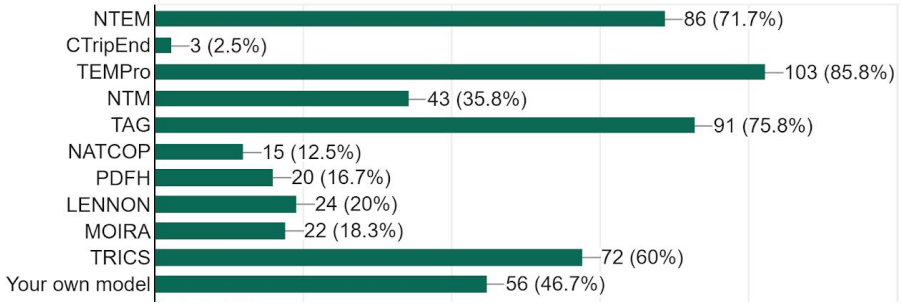
Do you work in any of the following sectors?

124 responses



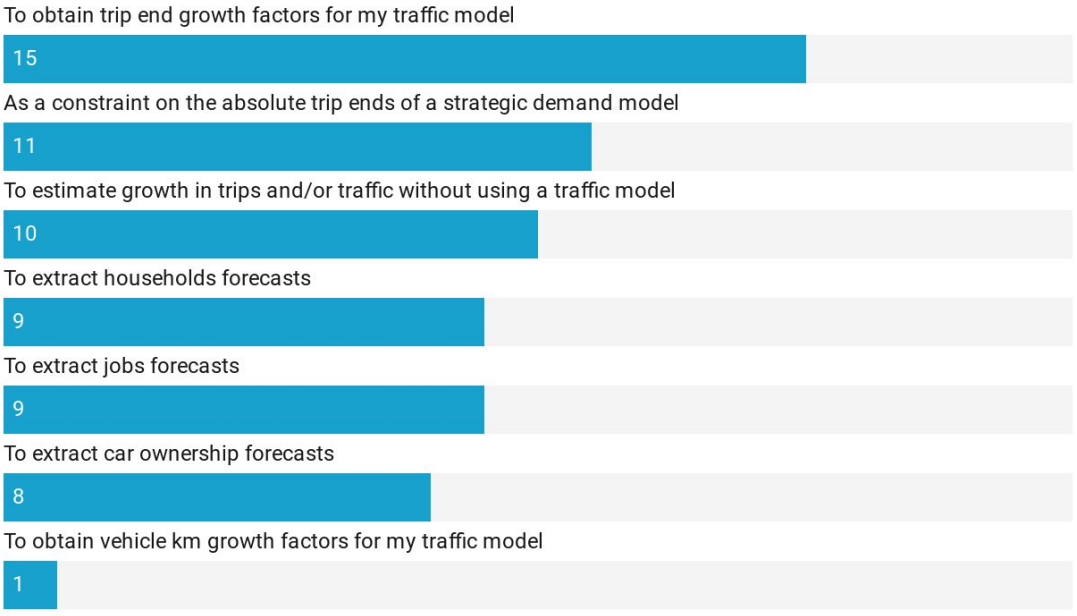
Do you use any of the following?

120 responses

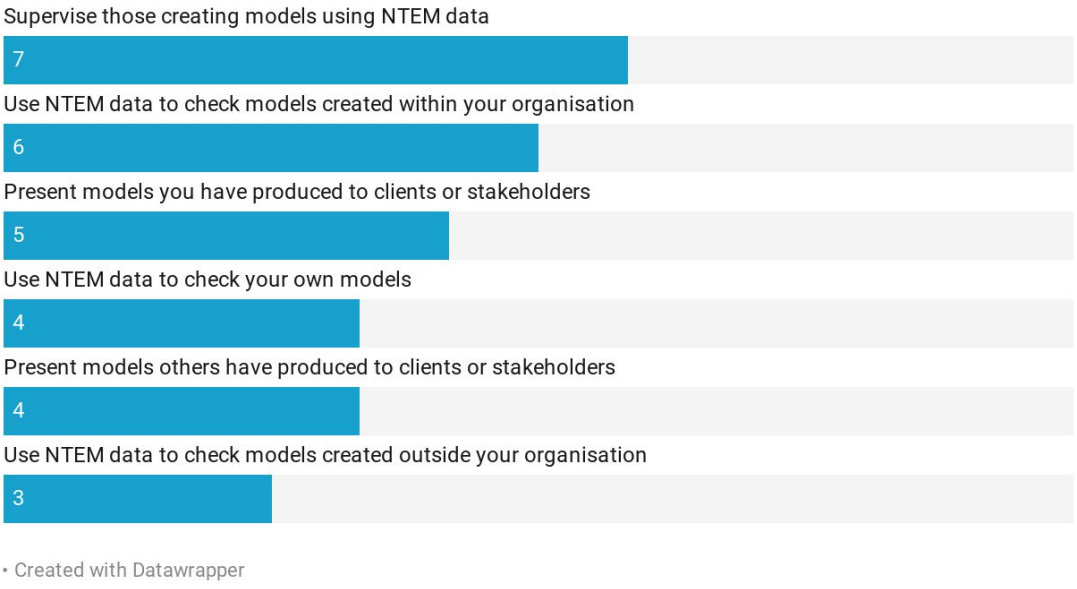


B) Use of NTEM

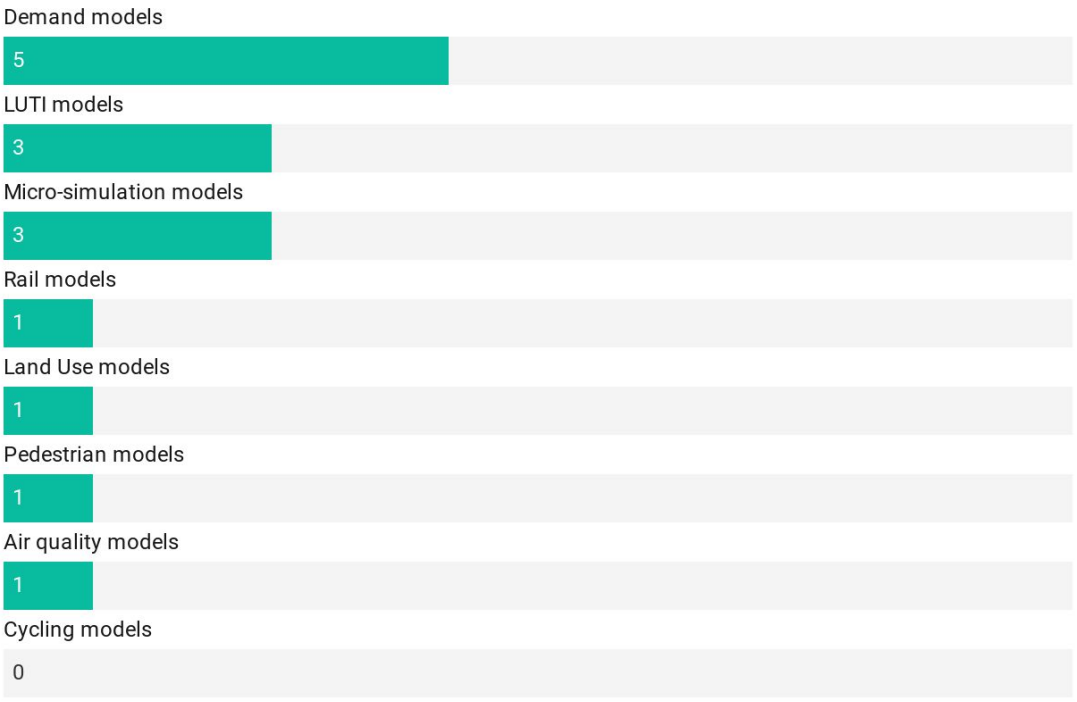
What do you use the NTEM model for?



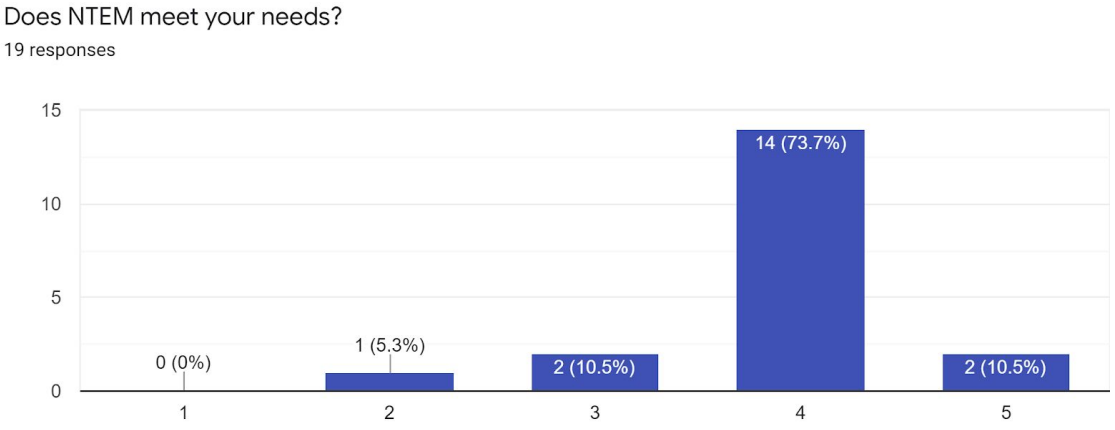
In your role, which of the following tasks do you carry out?



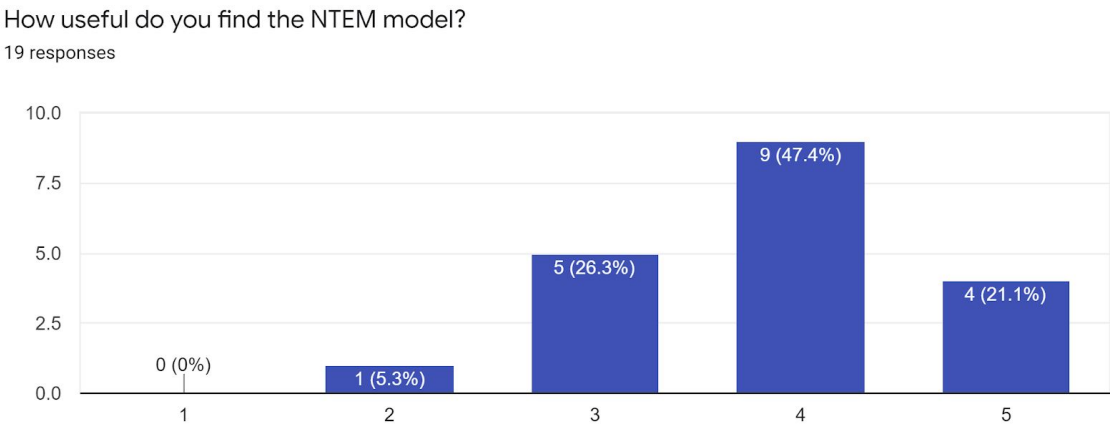
What types of models do you carry out those tasks on?



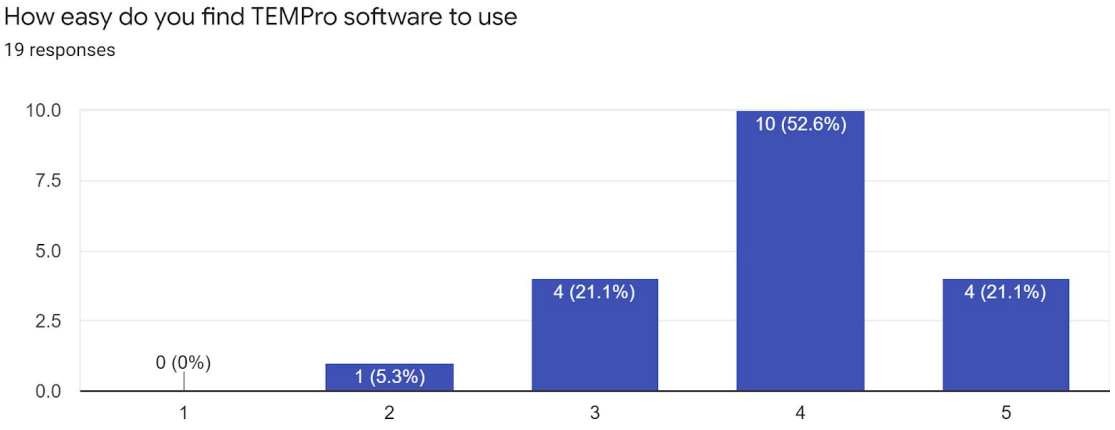
Does NTEM meet your needs?



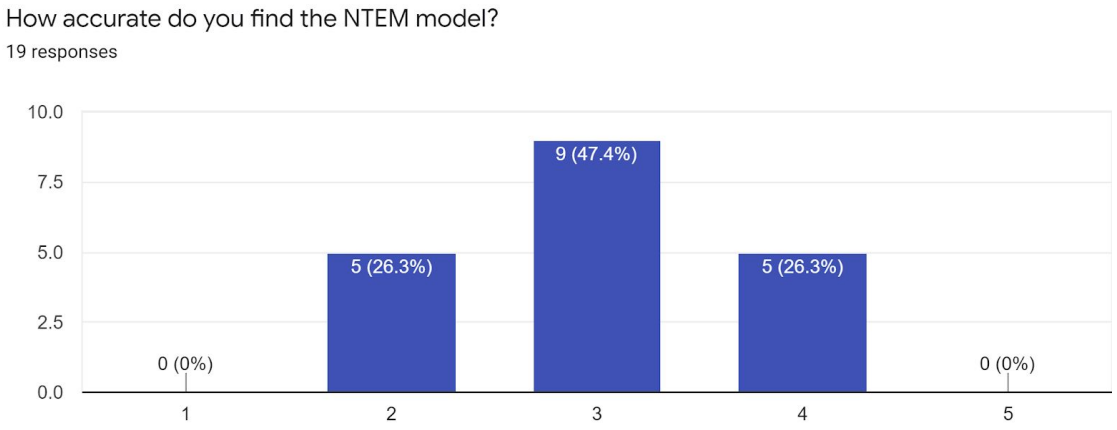
How useful do you find the NTEM model?



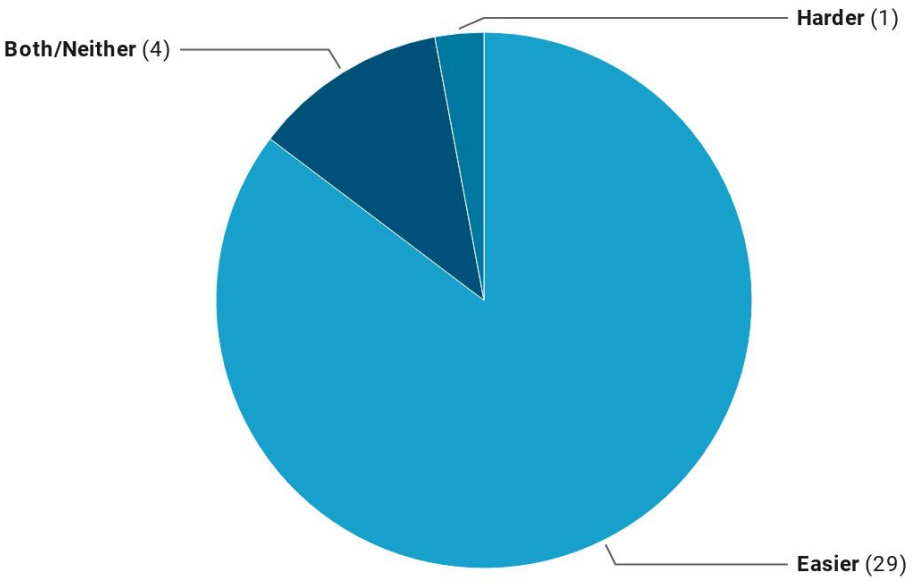
How easy do you find TEMPro software to use



How accurate do you find the NTEM model?



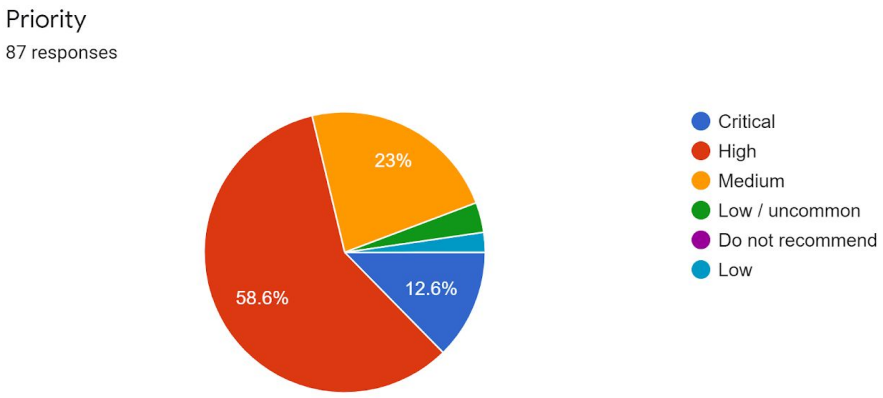
On balance, do you think NTEM and TEMPro make your life easier or harder?



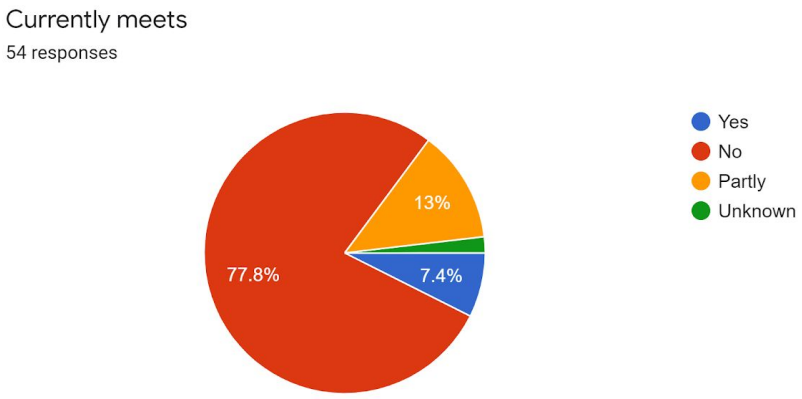
• Created with Datawrapper

C) User needs breakdown

Priority of the user needs



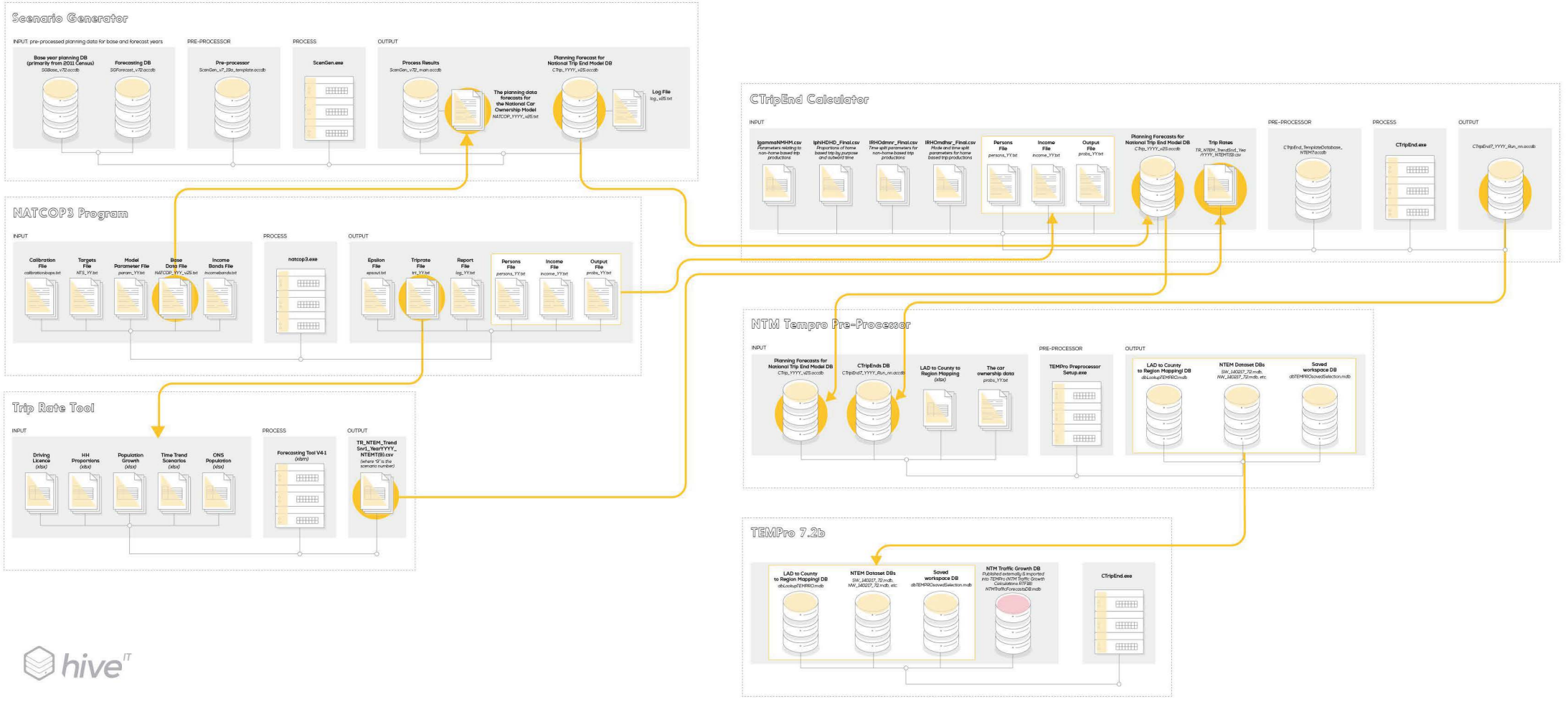
User needs currently met



D) Data flow

As part of our research, we looked carefully at the NTEM model from a data perspective. This allowed us to create a data flow model to represent the process the data moves through, which should help communicate the model to the wider transport community and increase visibility of NTEM as a whole. It can also be used to inform future projects or phases relating to NTEM.

data flow chart



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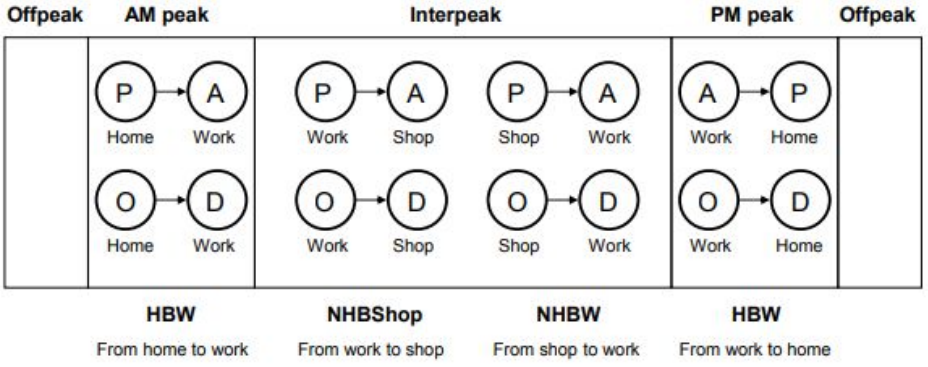
E) Glossary and definitions

Term	Definition
ALB	Arm's-length body
AMS	Appraisal and Monitoring System
BCR	Benefit Cost Ratio
BRES	Business Register and employment survey
CAV	Connected and Autonomous Vehicles
CFPI	Commission to future proof Infrastructure
COBALT	Cost and Benefit to Accidents — Light Touch
DIADEM	Dynamic Integrated Assignment and DEmand Modelling
EV	Electric Vehicle
ITS	Institute for Transport Services
LA	Local Authority
LENNON	DB of ticket sales
LTDS	London Travel Demand Survey
LUTI	Land Use Transport Interaction Model (scotland)
MaaS	Mobility as a Service
MHCLG	Ministry of Housing, Community, Local Government
MOIRA	Rail model of Rail Timetables
MSOA	Middle Layer Super Output Area
MVP	Minimum Viable Product
NATCOP	National Car Ownership Programme (sub model)
NIC	National Infrastructure Commission
NRTF	National Road Traffic Forecasts
NTEM	National Trip End Model
NTM	National Transport Model
NTS	National Travel Survey
ONS	Office for National Statistics
PDFH	Passenger Demand Forecasting Handbook
RDG	Rail Delivery Group
RTSC	Rail & Transport Strategy Center (Imperial College)
S106	Section 106 town and country planning act
SIG	Special Interest Groups
TAG	Transport Analysis Guidance (formerly known as webTAG)
TASM	Transport Appraisal and Strategic Modelling (division)

TEMPro	Trip End Model Presentation Program
TFGM	Transport for Greater Manchester
TFL	Transport for London
TfN	Transport for North
TIS	Transport Infrastructure System
Treasury Green Book	Guidance Issued by HM Treasury on how to appraise policies, programmes, Projects
TRICS	A database of traffic surveys and a system for analysing that data
Trip	A trip is a one-way course of travel between two locations, or ends, for a given purpose. A trip can be from origin to destination (origin–destinations) or from Production to attraction (productions–attractions).
Trip End	The start or finish of a journey or trip, either in terms of origin–destinations or production–attractions. Origin / destination (O/D) : the trip ends are characterised by the beginning (origin) and end (destination) of the trip Production / Attraction (O/D) :Trip ends are characterised by production (the location where the decision to travel is made) and attraction (the reason for travel)
Trip End types	Origin: The start point of a trip Destination: The end point of a trip Production: the location where the decision to travel is made, the home end of a trip Attraction: the reason for travel the activity (eg work, shop, school)
Trip end comparison (From TAG unit M1 Appendix B)	 **Figure 4 Example of P/As and O/Ds for a sequence of trips**
TUBA	Transport Users Benefit Appraisal