Bus Back Better Support Programme

Support Package 2
Data and analysis toolkit

Supported by

MOTT MACDONALD

ARUP

Introduction

Purpose of the toolkit

This toolkit aims to provide high-level methods that use data to identify areas of opportunity for improving bus services.

It also aims to monitor and assess the outcomes from service interventions. This includes considering the number of users, customer satisfaction, service performance, journey purpose and non-user surveys.

- **Number of users:** it is essential to monitor the number of users by day/service/journey to understand fully current travel patterns and emerging trends;
- **Customer satisfaction surveys:** it is important to find out what users think about the service;
- **Service performance data:** to understand if journey times are consistent;
- **Journey purpose:** it is essential to identify why people are using the bus, particularly new users; and
- **Non-user surveys:** to identify why people won't use the bus. This is important to generate new users.

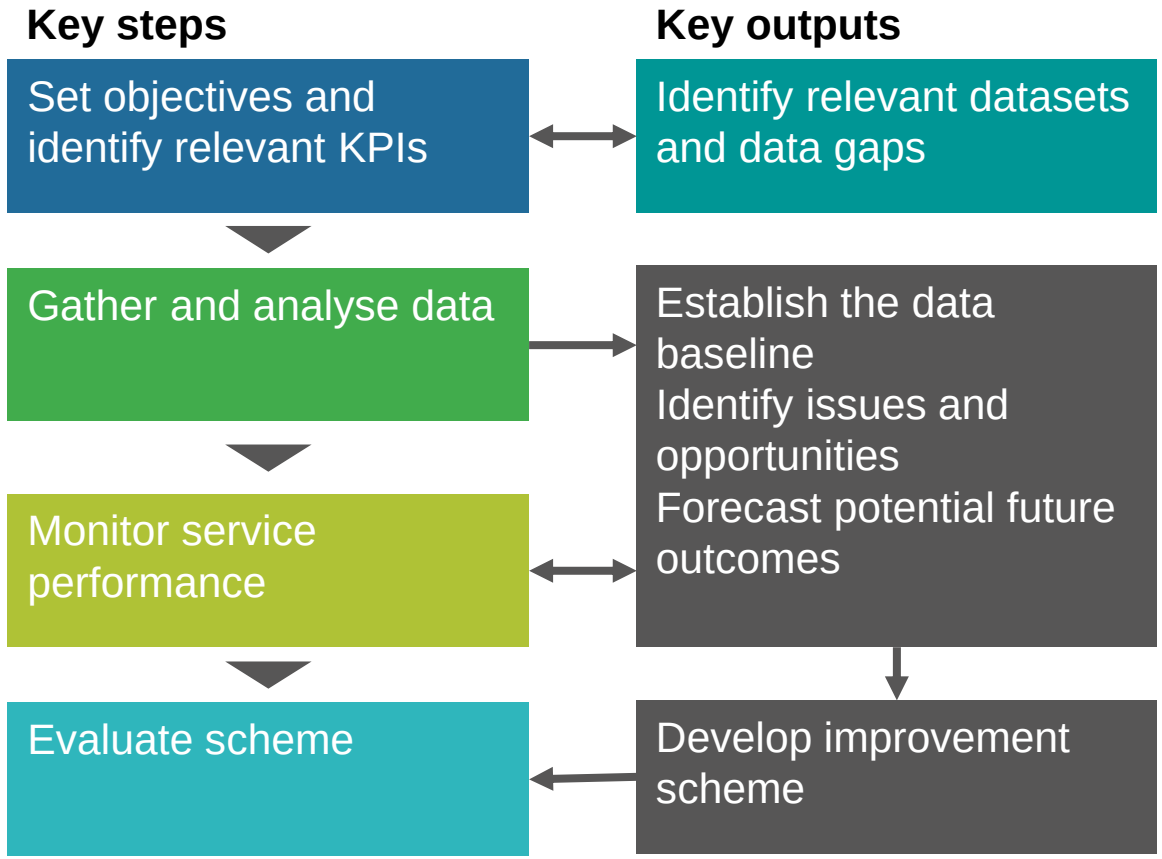
Introduction

Toolkit structure

This toolkit is structured around the five sections, and reflects the overall standard process for the monitoring and evaluation of transport infrastructure initiatives such as bus services:

1. **Key performance indicators.** Outlines the primary metrics that should be used to assess bus service performance
2. **Data range and availability.** Provides an overview of data range and availability from
3. **Analysis for baseline and forecasting.** Presents methods for the analysis of baseline patronage and forecasting into the future
4. **Monitoring performance.** Covers the principles and methods for the monitoring of bus data against performance indicators
5. **Evaluation.** Provides high-level guidance on how to determine whether initiatives are meeting the objectives set out

The data-driven monitoring and evaluation process.



1. Key performance indicators

Key performance indicators

Overview

The first step in delivering a bus service or infrastructure initiative is to identify the strategic objectives set out in the relevant local transport plan or transport strategy.

Identifying the relevant performance indicators to measure progress towards the strategic objective is key. This includes establishing a current, baseline level of performance and forecasting potential future scenarios based on a range of potential interventions or initiatives.

Bus service and infrastructure initiatives delivered by any level of government should be delivered in line with HM Treasury's Green Book, which provides guidance on how to appraise policies, programmes and projects.

This chapter will describe typical performance indicators that are useful for assessing bus service or infrastructure initiatives.

These indicators include the three main key performance indicator groups (patronage, punctuality and passenger satisfaction – also known as the **three Ps**), as well as a range of other indicators to help understand how and why people are using buses, such as journey purpose and non-user feedback.

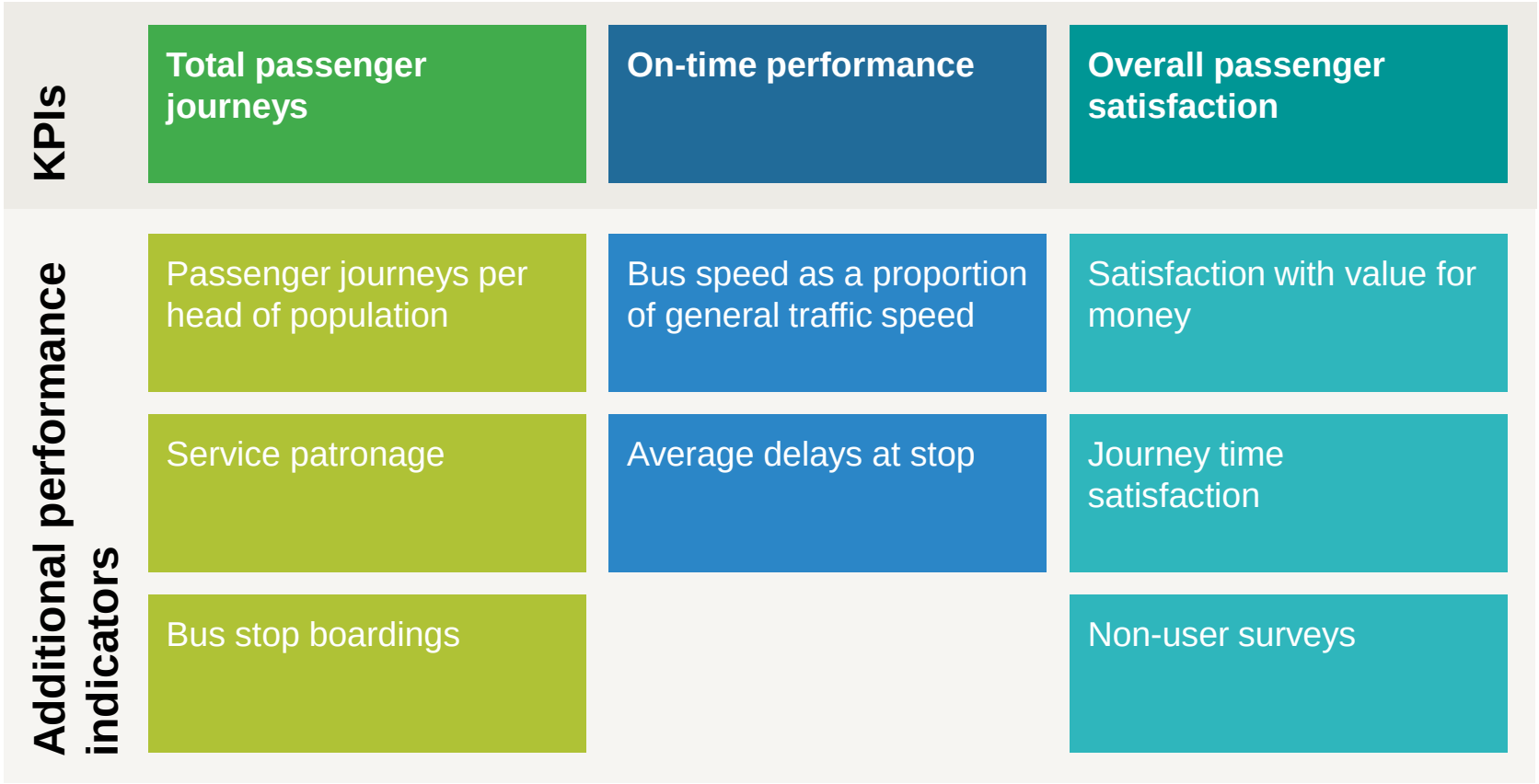
These performance indicators are described in more detail over the next pages.

Key performance indicators

Additional performance indicators

The **three Ps** can be supplemented with additional data to create a more complete picture of the quality of a bus service and inform the scope of specific initiatives to improve the passenger experience and drive patronage growth.

These additional performance indicators generally fall within a broader category of one of the three Ps. Additional work may be required to gather or produce this data and should be considered as part of the data collection scope.



Key performance indicators

Total passenger journeys

Patronage is the most basic indicator of the number of people using the bus. The main objective of the national bus strategy is to generate more demand for bus services and therefore have a higher number of farepayers. This indicator can be provided at various levels from an agglomerated group of services or at local authority level, to individual services and individual journeys by day.

Passenger journeys per head of population

Passenger journeys per annum divided by the number of residents of a local authority.

Service patronage

The number of passengers boarding a bus service (bus route).

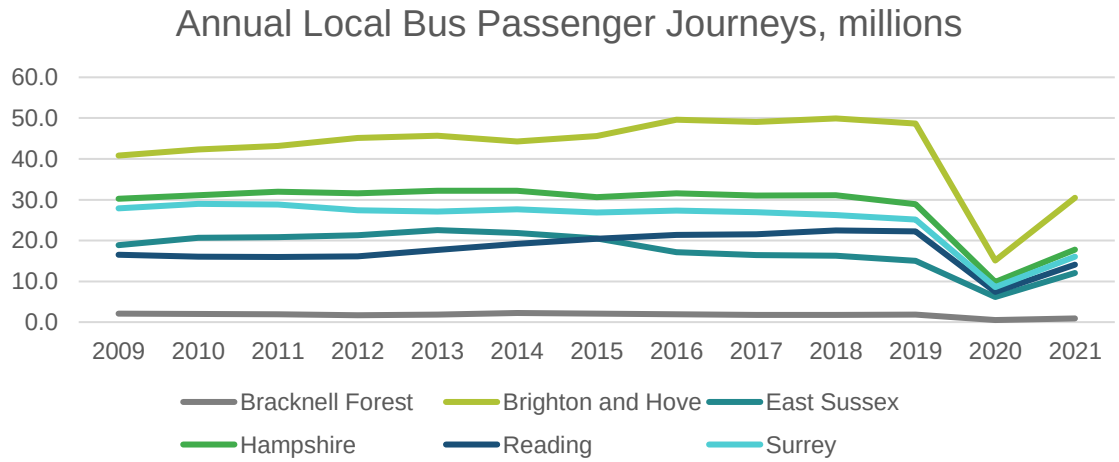
Bus stop boardings

The number of passengers boarding any bus service at a particular bus stop.

Data for total passenger journeys might be sourced from:

- Passenger journeys per head of population by region (annual) - BUS01b
- Passenger journeys on local bus services by local authority (annual) - BUS01e

Please refer to 2. Data range and availability for further information on data sources.



Key performance indicators

On-time performance

The main indicator of performance is punctuality, ie the proportion of journeys operated that arrive on time, that is by the Traffic Commissioners' definition of being no more than one minute early or five minutes later than the published timetable.

Average bus speed and as a proportion of general traffic speed

These are actual bus speeds summarised by Analyse Bus Open Data, compared to general traffic speeds captured by the DfT or by automatic traffic counters at comparable locations.

$$\text{Speed proportionality} = \frac{\text{Bus speed}}{\text{General traffic speed}} \times 100$$

Average delays at stop

This is the arrival delay at a bus stop compared to expected timetable arrival as calculated and summarised by Analyse Bus Open Data. Average delay can be calculated for a service or corridor

Reliability

This is the number of journeys completed compared to expected journeys for a bus route or service.

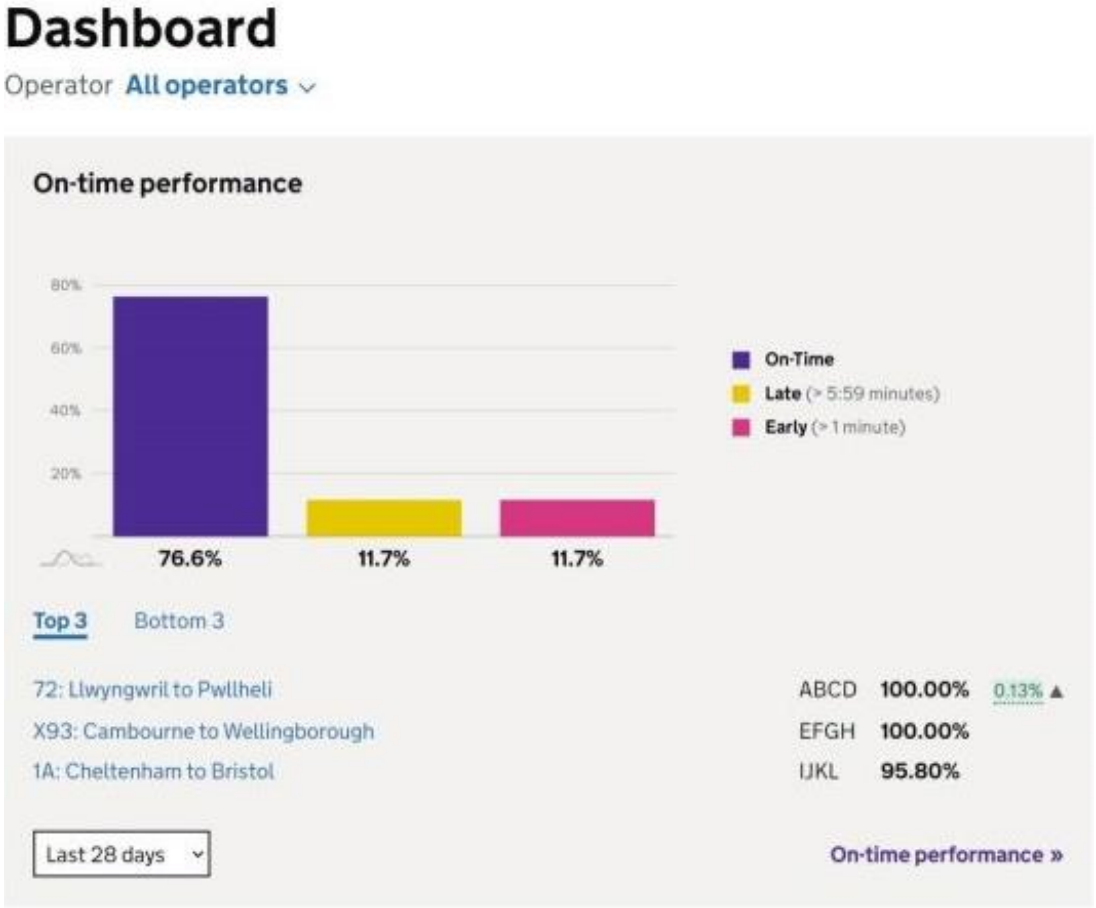
Key performance indicators

On-time performance

Data for on-time performance might be sourced from:

- Non-frequent bus services running on time by LA – BUS09a
- Average excess waiting time for frequent services by LA –BUS09b
- Analyse Bus Open Data (ABOD) can give a detailed view of punctuality at local authority level, service level, and corridor level
- Using Real Time Information from operators can also give an accurate picture of reliability and punctuality.

Please refer to 2. Data range and availability for further information on data sources.



Example of ABOD Dashboard showing On-time performance

Key performance indicators

Overall passenger satisfaction

Customer surveys can provide valuable information about the reasons why people choose bus as their mode of travel. They can also provide an indication of what aspects of bus services could be improved in the future, by asking questions around the following themes:

- **Value for money:** do customers believe the service provided meets their expectations against cost
- **Journey time:** how long users waited against how long they expected to wait
- **Journey purpose:** understanding why people are travelling by bus is important for service planning
- **Non-user surveys:** to better understand why people are not choosing to travel by bus. This can help to understand and overcome the barriers to bus travel

Transport Focus undertake annual bus passenger surveys which collects some of this information.

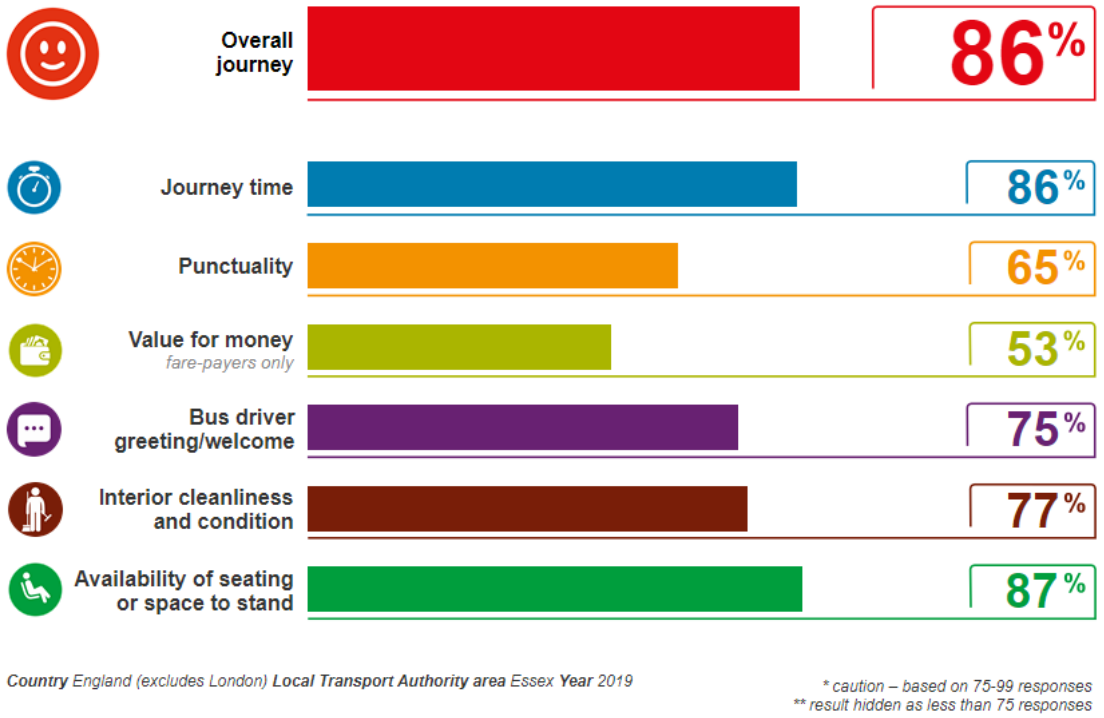
Key performance indicators

Overall passenger satisfaction

Data for passenger satisfaction might be sourced from:

- Bus Passenger Survey from Transport Focus
- Bus User Weekly Survey, national level only from Transport Focus
- Ad hoc sources such as Local Transport Plans, operator surveys, and complaints data

Please refer to 2. Data range and availability for further information on data sources.



Key performance indicators

Area selection

It is important to consider the level - national, regional, local or by corridor/service - at which data is collected, analysed, monitored and evaluated.

Much of the freely available bus data statistics are found at a national level, which may not be useful when trying to assess the performance of specific routes, services or operators. Understanding the limitations of scale will narrow down which data sources should be used.

Performance indicators should be monitored at a local authority level, to provide relevant insights and as datasets are more likely to remain comparable over time. Monitoring and evaluation stages can incorporate smaller-scale indicators to identify and assess more specific interventions.

National and regional data should only be used as a benchmark of service performance in the absence of baseline data.

For local authority-level analysis, DfT and Transport Focus datasets provide a high-level view of performance patterns.

For corridor or service-level analysis, data should be sourced from operators either directly or through ABOD/BODS.

Target Area	**Data Availability**		
	Patronage	**Punctuality**	**Passenger Satisfaction**
National	From DfT	From DfT	From Transport Focus
Regional	From DfT	From DfT	Some data from Transport Focus
Local Authority	From DfT	From DfT and Analyse Bus Open Data	Some data from Transport Focus
Corridor or Service	From Operator	From Operator and Analyse Bus Open Data	Some data available from Operator/ Requires surveys

2. Data range and availability

Data range and availability

Overview

The key driver of Bus Back Better is to improve services, which will in turn attract and retain more users. This will generate more revenue that can then be used to improve services further.
Collecting and analysing appropriate data will be important to demonstrate changes in demand particularly in response to measures introduced through BSIPs.

The aim of the data gathering stage is to:

- Understand issues that constrain bus services from realising their full potential
- Encourage more people to travel by bus
- Improve the experience of existing passengers
- Enable bus users to plan routes, understand costs, and predict bus arrival times.

A wealth of bus data is available, and this section aims to outline the most reliable and accessible data sources. Most datasets are collected automatically via electronic monitoring, but some are still collected from field and passenger surveys.

Automatic Vehicle Location (AVL)
In England 98% of buses have an AVL device installed, which sends GPS ‘pings’ at regular intervals, allowing the vehicle to be tracked along its journey.

Electronic Ticket Machines (ETM)
Over 90% of buses have ETMs. These capture and analyse details of every passenger transaction across the network, from ticket type purchased, to total passenger numbers.

Manual methods
Typically qualitative surveys are undertaken by monitoring bus performance in the field, interviewing passengers at bus stops, or using other survey means such as annual or linear surveys.

Data range and availability

Key data sources and supplementary data sources

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Data will typically be available from one of the six sources listed below. Key data sources are industry standard, easy to access and analyse. Supplementary sources may not be in standard formats, are not collected at regular intervals, and may be difficult to access or analyse.

Key sources

Department for Transport

High level bus statistics data tables

Analyse Bus Open Data (ABOD) Service

Analysed real time and timetable information

Transport Focus

Data on customer profile and satisfaction

Supplementary sources

Local bus operators

Patronage figures, real time data and commercial information

Bus Open Data Service (BODS)

Raw real time and timetable information

Other

Surveys by LAs

Stakeholder feedback

Previous studies

Key data sources

Department for Transport

DfT provides an annual overview of bus statistics in England, and this data is derived from an annual survey of local bus operators.

DfT data is disaggregated by:

- Country
- London, metropolitan and non-metropolitan areas
- Regions
- Urban-rural classification
- Local Authorities

Local Authority is the lowest level of disaggregation available, and datasets with this disaggregation are recommended for KPIs and monitoring.

How to access

The main page for bus statistics can be found in the Buses section of the DfT website.

Format

Bus statistics are available in a spreadsheet format and can be opened with common spreadsheet editors like Excel.

Relevant datasets

- Local bus passenger journeys (BUS01)
- Local bus vehicle distance travelled (BUS02)
- Bus reliability and punctuality (BUS09)
  - Non-frequent bus services running on time (BUS09a)
  - Average excess waiting time for frequent services (BUS09b)

All of the above datasets are disaggregated by local authority and can be used to monitor performance. Annual figures are provided from 2004 onwards.

Key data sources

Transport Focus

Transport Focus, sponsored by the DfT, is an independent watchdog representing the interests of Britain's road, rail, tram and bus users. This organisation leads advocacy campaigns with evidence generated by in-house research and undertakes regular surveys for transport users, including bus users.

Transport Focus bus-related data is most frequently collected at the national level, but some is disaggregated to the local authority level or operator areas.

How to access

The main page for bus surveys can be found in the Bus Passenger Survey section of the Transport Focus Data Hub. Access does not require log-in.

Format

Bus passenger survey data can be downloaded through the advanced analysis tab, LTA area as a filter, year as a column, and satisfaction as a row. The generated table can then be exported to Excel.

Relevant datasets

- Overall satisfaction with journey
- Satisfaction with waiting time and punctuality
- Satisfaction with journey time and factors affecting it
- Satisfaction with value for money
- Context to the journey, journey purpose and reason for choosing the bus
- How passenger checked bus arrival times
- Facilities: rating the bus and bus stop

Figures are provided from 2014 onwards, but reporting period depends on local authority or operator.

Key data sources

Analyse Bus Open Data service

Analyse Bus Open Data (ABOD) is the visual output form of BODS. The ABOD platform shows granular, service-level and stop-level bus performance, helping local authorities and operators understand which routes have the most potential for improvement.

How to Access

ABOD access is limited to bus operators and local authorities. These organisations can gain access to ABOD by emailing support@itoworld.com and an invitation will be sent to join the service. Users have access only to local bus services that are relevant to them.

Format

The ABOD platform is interactive, and data is shown via dashboard visualisations, tables, and maps. Some table information can be exported as a spreadsheet for further analysis.

Relevant Data

- On-time performance for local buses, including timeline and distribution
- Number of vehicle journeys (day profile for up to previous 90 days)
- Vehicle counts
- Active feed monitoring (which operators are sending AVL data to BODS)
- Average delay per stop
- Reliability, number of actual services against scheduled services
- Actual journey time, average/minimum/maximum per corridor or service, or individual journey speeds
- Actual bus speeds, average/minimum/maximum per corridor or service, or individual journey speeds

All of the above datasets can be disaggregated down to single journeys and up to local authority level. Historical data is available up to 2020 for some sets.

Analyse Bus Open Data service

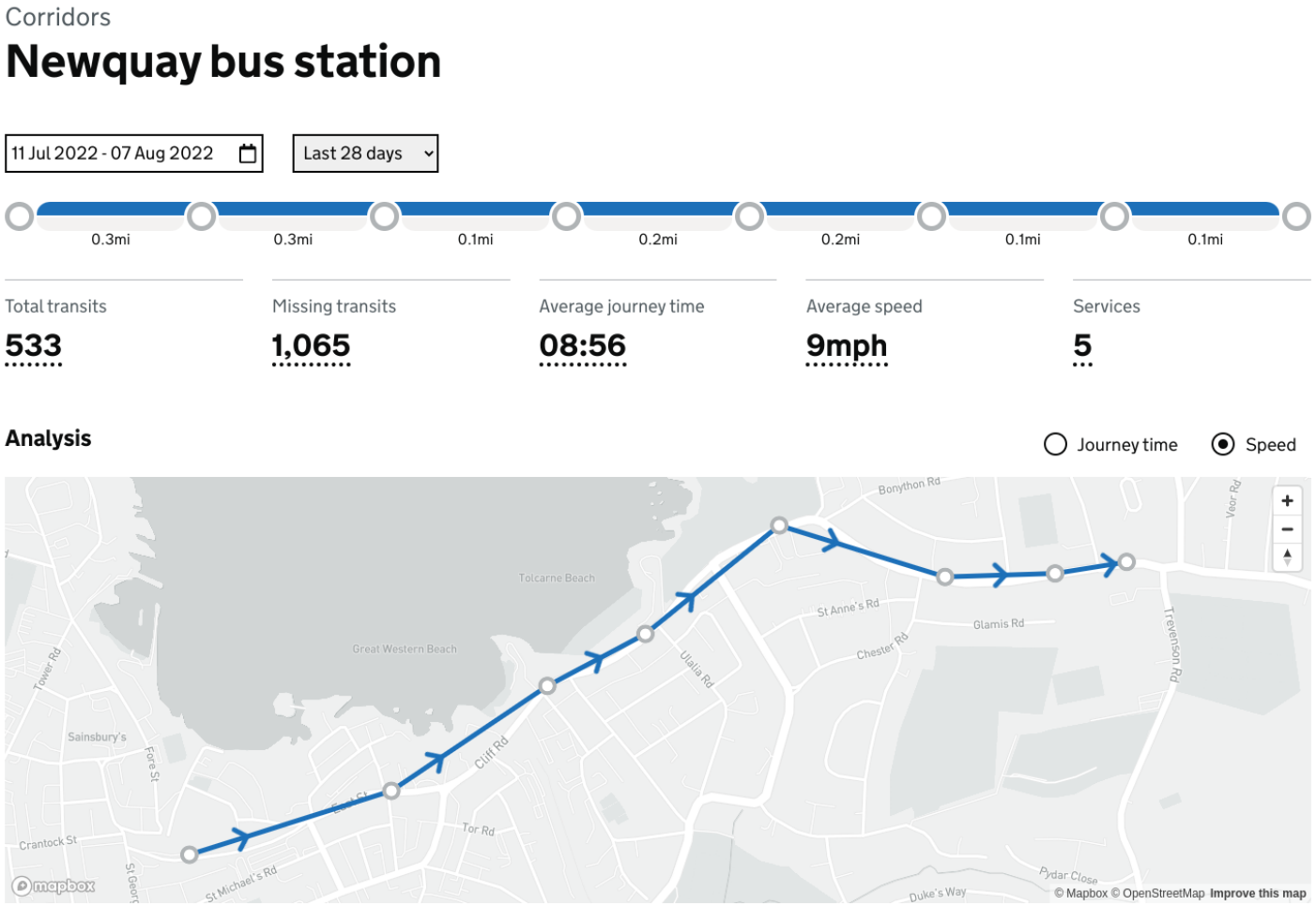
Data extraction - example

The ABOD service is able to show

- average journey times
- average speeds
- number of services (routes) and
- number of journeys

over a predetermined period. In the example opposite, this is selected as 4 weeks (28 days).

Corridor selection is interactive, and the user is able to select a series of bus stops to create a bespoke corridor of the desired length and extents.

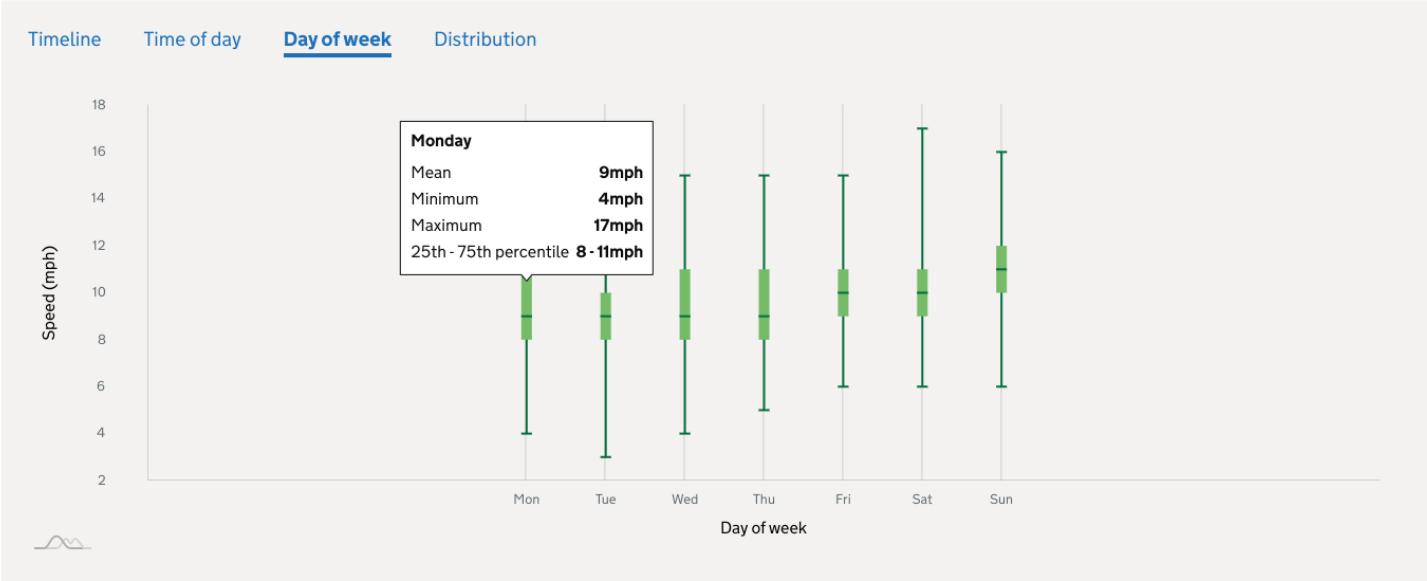


Analyse Bus Open Data service

Data extraction - example

The ABOD Corridor analyst is also able to show speed and journey time data disaggregated by days of week and time of day, as shown on the image (top right).

The tool lists the targeted services and other useful information such as reliability (scheduled vs recoded transits).



Services

Service ▲	NOC	Operator	Scheduled transits	Recorded transits	Average journey time	Average speed
91: Newquay - Fraddon	FCWL	First Kernow	28	23	07:30	11mph
91: Newquay - Gloweth	FCWL	First Kernow	200	178	08:29	10mph
91: Newquay - Truro	FCWL	First Kernow	108	88	09:02	9mph
ATLA: Newquay - Mawgan Porth	FCWL	First Kernow	46	42	09:23	9mph
ATLA: Newquay - Padstow	FCWL	First Kernow	224	202	09:22	9mph

Supplementary data sources

Local bus operators

Local bus operators hold the most data on their services and are the owners of electronic ticket machines (ETM) and automatic vehicle location (AVL) data on their vehicles. However, this data may not be in an industry-standard format as the data cleaning process may be carried out by a third party.

How to Access

By contacting the operator, subsidiary or transport group. Data releases may be at the discretion of the organisation, as some sets may be commercially sensitive or subject to GDPR.

Format

Data formats may vary from operator to operator, and may not follow standard schema (see next page).

Relevant data

- Passenger transactions, including different types of concessions
- Patronage (boardings per stop, per service)
- AVL real time information (RTI) data
- Feedback on journey and journey ratings
- Complaints data
- Manually collected data, such as surveys
- Data collected through web registrations

It is recommended that RTI data is accessed through BODS/ABOD unless the data is only available through the operator. The operator may be a good source for more detailed patronage data, but release of this information may require an NDA or non-distribution agreement.

Local bus operator data

Examples of RTI data outputs from operators

Vix Technology is a provider of the hardware and software to provide real time passenger information on buses. Features of their RTI outputs include:

- Two-dimensional data (rows contain multiple data points, and columns contain various data groups).
- ‘Easy’ to analyse manually but time inefficient.
- Most popular product for bus operators and local authorities.

JMW Systems is another provider of the hardware and software to provide real time passenger information on buses. Features of their RTI outputs include:

- Unidimensional data (rows contain only one datapoint).
- Easy to filter, clean and analyse with automation but unrealistic to analyse manually.
- Used by Southampton and Slough, but otherwise not widely known.

						Timing Point	NonTiming Point	NonTiming Point	NonTiming Point	NonTiming Point	Timing Point	NonTiming Point	N
Time	Location	Route	Start Time	Arrival time	Type	Whitefield Farm (1900HAA00204)	The Langley Tavern (1900HA08040 3)	Lepe Road, Chalewoo (1900HAA913 1)	Chapel Lane (1900HA08049 1)	Hampton Close (1900HA08048 8)	Blackfield Crossroa (1900HA08046 1)	Primary School (1900HA08045 9)	R C (8
Thu	Bluestar Totton	9	05:32	06:19:00	Schedule Run Time	0.00	1.00	1.00	1.00	2.00	3.00	3.00	
Thu	Bluestar Totton	9	05:32	06:20:00	Actual Run Time	0.00	0.62	1.00	1.10	1.67	2.35	4.03	
Thu	Bluestar Totton	9	05:32	05:32:00	Dwell Time	0.05	0.00	0.03	0.00	0.05	0.03	0.00	
Thu	Bluestar Totton	9	05:56	06:52:00	Schedule Run Time	0.00	1.00	1.00	1.00	2.00	3.00	3.00	
Thu	Bluestar Totton	9	05:56	06:53:00	Actual Run Time	0.00	0.62	0.88	1.20	1.53	2.15	3.22	
Thu	Bluestar Totton	9	05:56	05:56:00	Dwell Time	0.05	0.00	0.00	0.05	0.00	0.07	0.05	
Thu	Bluestar Totton	9	06:15	06:15:00	Schedule Run Time								
Thu	Bluestar Totton	9	06:15	06:15:00	Actual Run Time								
Thu	Bluestar Totton	9	06:15	06:15:00	Dwell Time								
Thu	Bluestar Totton	9	06:35	06:35:00	Schedule Run Time								
Thu	Bluestar Totton	9	06:35	06:35:00	Actual Run Time								
Thu	Bluestar Totton	9	06:35	06:35:00	Dwell Time								
Thu	Bluestar Totton	9	06:55	08:09:00	Schedule Run Time	0.00	1.00	2.00	2.00	3.00	5.00	5.00	
Thu	Bluestar Totton	9	06:55	08:11:00	Actual Run Time	0.00	0.70	1.13	1.25	2.00	3.70	5.50	
Thu	Bluestar Totton	9	06:55	06:55:00	Dwell Time	0.05	0.00	0.05	0.00	0.23	0.23	0.00	
Thu	Bluestar Totton	9	07:00	07:00:00	Schedule Run Time								
Thu	Bluestar Totton	9	07:00	07:00:00	Actual Run Time								

Stop Run Time Report

Timestamp	Operator	Service	Jny	Veh	Stop Code	Stop	Arr	Dep	Destination	Exp Wait Time	Wait Time	Exp Run Time	Run Time
13/02/2020	First	4	1	64036	03700356	Cippenham, St Andrews Way		03:03:40	Heathrow Central	--:--	--:--	--:--	--:--
13/02/2020	First	4	1	64036	03700357	Cippenham, Everitts Corner	03:04:56	03:04:56	Heathrow Central	00:00	00:00	01:27	01:16
13/02/2020	First	4	1	64036	03700358	Cippenham, Burnham Lane	03:05:57	03:05:57	Heathrow Central	00:00	00:00	01:25	01:01
13/02/2020	First	4	1	64036	03700251	Slough Trading Estate, Dover Road	03:07:19	03:07:19	Heathrow Central	00:00	00:00	02:08	01:22
13/02/2020	First	4	1	64036	03700252	Slough Trading Estate, Westgate	03:08:40	03:08:56	Heathrow Central	00:00	00:16	01:07	01:21
13/02/2020	First	4	1	64036	03700253	Slough Trading Estate, Leigh Road	03:09:42	03:09:42	Heathrow Central	00:00	00:00	00:53	00:46
13/02/2020	First	4	1	64036	03700254	Slough Trading Estate, Twinches	03:10:28	03:11:03	Heathrow Central	00:00	00:35	00:35	00:46
13/02/2020	First	4	1	64036	03700255	Slough Trading Estate, Salt Hill Three	03:11:20	03:11:35	Heathrow Central	00:00	00:15	01:25	00:17
13/02/2020	First	4	1	64036	03700382	Chalvey, Salt Hill Park	03:13:11	03:13:11	Heathrow Central	00:00	00:00	02:51	01:36
13/02/2020	First	4	1	64036	03700337	Slough Town Centre, Library (Stop	03:14:43	03:14:43	Heathrow Central	00:00	00:00	02:17	01:32
13/02/2020	First	4	1	64036	03700324	Slough Town Centre, Wellington	03:15:44	03:20:05	Heathrow Central	01:00	04:21	01:52	01:01
13/02/2020	First	4	1	64036	03700311	Slough Town Centre, Sorting Office	03:21:51	03:21:51	Heathrow Central	00:00	00:00	01:30	01:46
13/02/2020	First	4	1	64036	03700309	Langley, Uxbridge Road Sainsbury's	03:22:37	03:22:37	Heathrow Central	00:00	00:00	01:29	00:46
13/02/2020	First	4	1	64036	03700074	Langley, St Bernards Convent	03:23:24	03:24:04	Heathrow Central	00:00	00:40	01:08	00:47
13/02/2020	First	4	1	64036	03700077	Langley, Kaywood Close	03:24:20	03:24:20	Heathrow Central	00:00	00:00	01:08	00:16
13/02/2020	First	4	1	64036	03700079	Langley, Upton Court Road Junction	03:25:21		Heathrow Central	--:--	--:--	00:59	01:01
13/02/2020	First	4	1	64036	03700081	Langley, Drake Avenue	03:25:51	03:25:51	Heathrow Central	00:00	00:00	00:49	00:00
13/02/2020	First	4	1	64036	03700082	Langley, Cedar Way	03:26:07	03:26:22	Heathrow Central	00:00	00:15	00:43	00:16
13/02/2020	First	4	1	64036	03700085	Langley, Ditton Park Road	03:27:08		Heathrow Central	--:--	--:--	01:26	00:46
13/02/2020	First	4	1	64036	03700087	Langley, The Toby	03:29:31	03:29:31	Heathrow Central	00:00	00:45	00:48	00:00

Supplementary data sources

Other sources

A local authority may have additional data, collected as part of previous transport schemes, that can help contextualise information from other sources.

This can include traffic and behaviour data or stakeholder feedback. Other useful information can also be found in sites for the Office of National Statistics, Traveline or data.gov.uk.

How to Access

Liaising with internal teams on data collection, and public access webpages.

Format

Varies, but can include spreadsheets, reports, maps and others.

Relevant data

- Automatic traffic counts and speeds (LA)
- Stakeholder Feedback related to transport schemes (LA)
- Mode share data (LA)
- Operators NOC (National Operator Codes)
- Timetables TNDS (Traveline National Dataset)
- Timetable changes Traffic Commissioners: local bus service registration
- Bus stops NaPTAN (National Public Transport Access Nodes)
- Census Data Office for National Statistics

Key data sources

Bus Open Data Service

The Bus Open Data Service (BODS) is a DfT-funded service in England, established in 2020. BODS provides bus timetable, vehicle location and fares data for every local bus service in England in an open-access, open-source platform.

In England 98% of buses have an Automatic Vehicle Location (AVL) device installed. AVL is used to track vehicle location in order to monitor punctuality and provide real time service information to customers and is available both as live and recorded data. Data is uploaded by operators using a standardised framework, which makes it easy to view, analyse and compare using the Analyse Bus Open Data (ABOD) service platform .

How to Access

BODS data can be accessed through the DfT BODS site.

Format

Datasets can be downloaded in text-based formats such as XML and GTFS, and have specific organisational elements (schema) applied to each data type. GTFS is composed of a series of text files collected in a zip file, and these are best viewed in PowerBI or Tableau as different datasets are interlinked and very large. BODS data can also be accessed via API, which requires a free account to be created on the BODS website.

Relevant Data

- timetable data, static from last operator update
- bus location data from AVL, live (updated every 30 seconds) and archive
- fares data, static from last operator update

It is not recommended to access BODS data directly, as the process can simplified by accessing timetable and journey data from Analyse Bus Open Data.

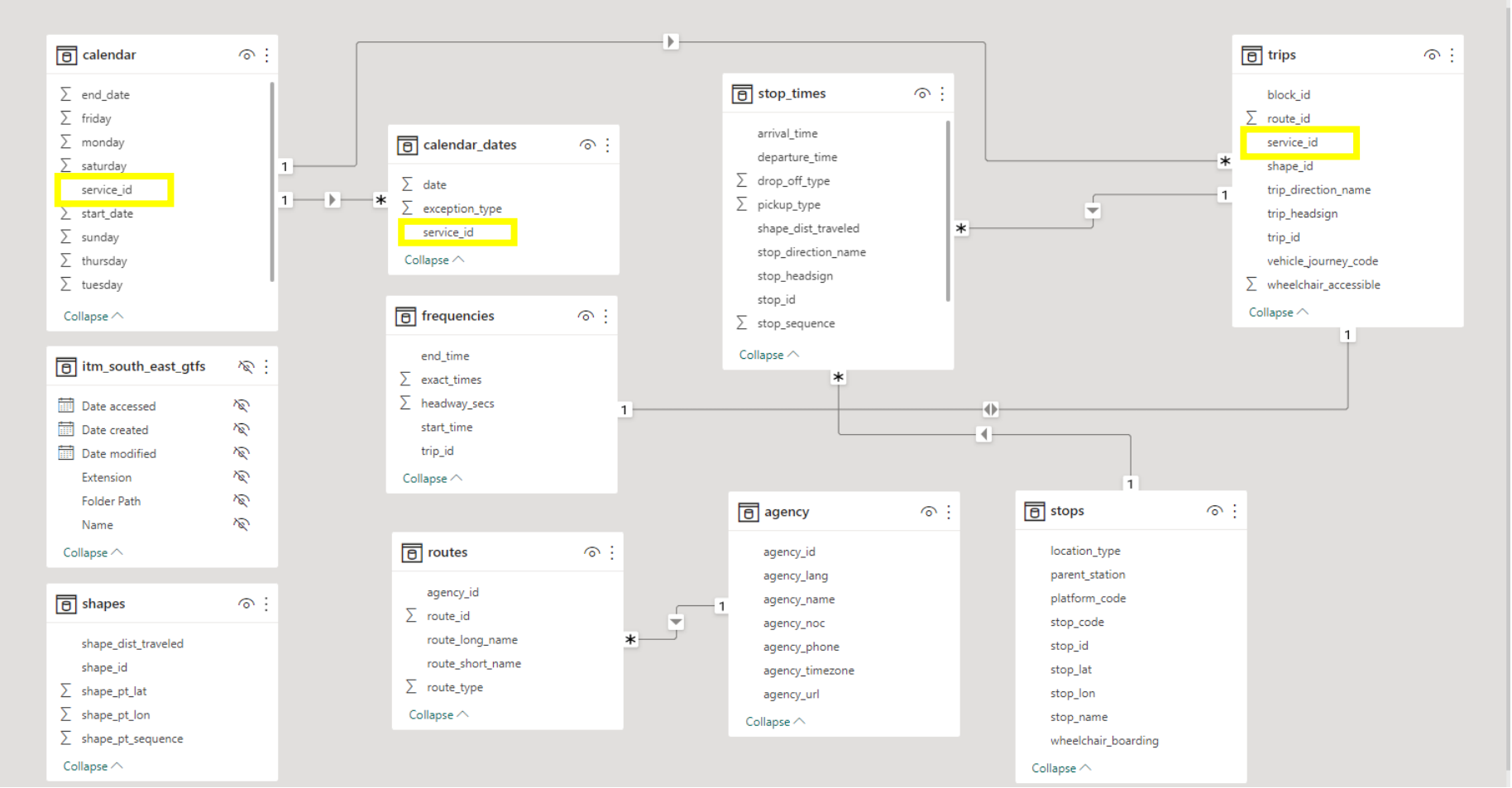
Bus Open Data Service

Data extraction - example

Supported by

Data from BODs comes in a variety of text-based formats. Unless they have existing capability to access and analyse this data using the necessary software, it is not recommended that LTAs analyse BODS data directly. Datasets are complex, with very large file sizes and requiring bespoke dataflows to be developed. ABOD provides access to BODS datasets through a user-friendly portal.

Right: Example of an interconnected GTFS download from BODS as viewed in PowerBI. Different datasets connect to each other via common fields, such as **service_id** (highlighted).



Accessing data sources

Level of skill required

The ability to access, download and interpret data varies depending on the data source used. The table below summarises the requirements for accessing and then interpreting the different types of data that have been discussed in this chapter.

Data source	Public access	Ease of accessibility	Technical requirements
Department for Transport	Yes	High	Microsoft Excel
Transport Focus	Yes	Medium	Microsoft Excel and navigating the Advanced Analysis page of Transport Focus
Bus Open Data Service	Yes	Low	PowerBI, Tableau, or Python plus knowledge of API calls.
Analyse Bus Open Data service	No, Local Authorities and Operators only.	High	No technical requirements.
Operator	No, by request only.	Low	Microsoft Excel, Python, plus knowledge of spreadsheet analysis

Data range and availability

Gap analysis

One of the major limitations with collecting and analysing data is the availability of valuable, consistent datasets which can inform the three KPIs and additional performance indicators.

A summary of the main limitations are shown in the table opposite, based on the data sources used and which KPI they relate to.

Passenger satisfaction data can be treated slightly differently to the automatically collected data points from DfT, BODS/ABOD and bus operators. This is because this data is usually manually collected at a local level.

Guidance on how to action the collection of passenger satisfaction data is shown on the next page.

Data Source	KPI	Dataset	Limitations
Transport Focus	Passenger Satisfaction	Journey satisfaction	Not all local authorities included
Operators	Patronage	Number of users per stop/per service	Operators may not share commercially sensitive data.
Operators	Punctuality	Average Journey Time, Variability	Operators may only have raw data that has not been processed to the recommended standards.
DfT	Punctuality	Excess Waiting time	Data available only for frequent services
Analyse Bus Open Data	Punctuality	Speed, Delay, Journey Time, Reliability	Not all bus services available, small operators may not upload data to BODs
Bus Open Data Service	Punctuality	Speed, Delay, Journey Time, Reliability	Difficult to download datasets, requires access via API

Data range and availability

Sourcing and collecting passenger satisfaction data

If there are gaps in the available dataset on passenger satisfaction, there are several direct opportunities to source or gather this data.

Liaise with Transport Focus: Transport Focus collects satisfaction data by local authority. Get in touch with Transport Focus directly to understand the next cycle of surveys planned for your LTA area, and to see if you can include additional questions on the survey.

Transport Focus survey method: If no information is available in the data hub, LTA can undertake their own surveys. More information on the Transport Focus methodology can be found here. The paper questionnaire can be found here in pages 76-83.

Contact operator: Local bus operators may gather their own customer satisfaction and complaints information.

Theme (factor)	Questions
1 Bus driver	• Satisfaction with bus driver: Appearance • Satisfaction with bus driver: The greeting/welcome you got • Satisfaction with bus driver: Helpfulness/attitude • Satisfaction with bus driver: Time to get to seat • Satisfaction with bus driver: Smoothness/freedom from jolting • Satisfaction with bus driver: Safety of the driving
2 On bus environment and comfort	• Availability of seating or space to stand • Comfort of the seats • Amount of personal space • Provision of grab rails to stand/move within the bus • Temperature inside the bus • Personal security • Ease of getting off the bus
3 Bus stop condition	• General condition/standard of maintenance • Freedom from graffiti/vandalism • Freedom from litter
4 Boarding the bus	• Satisfaction with route/destination information • Ease of getting onto the bus • Satisfaction with time taken to board
5 Timeliness	• Satisfaction with waiting time • Satisfaction with punctuality
6 Bus cleanliness and information on-board	• Satisfaction with exterior cleanliness/condition • Satisfaction with interior cleanliness/condition • Info provided inside bus
7 Access to the bus stop	• Distance from journey start • Convenience/accessibility
8 Bus stop safety and information	• Information provided at the stop • Personal safety at stop
9 Journey time	• Satisfaction with on-bus journey time
10 Value for money	• Satisfaction with VFM (fare-payers only)

Above: Transport Focus survey key themes and associated questions.

Data range and availability

Summary of data sources

Data Type	Dataset	Source	Link
Patronage	Passengers on local bus services by LA in England from 2009/10	DfT	bus01.ods (live.com)
	Passenger journeys on local bus services per head by LA in England from 2009/10	DfT	bus01.ods (live.com)
	Elderly and disabled concessionary passenger journeys on local bus services by LA, England from 2009/10	DfT	bus01.ods (live.com)
	Elderly and disabled concessionary passenger journeys on local bus services by LA as a % of total bus journeys, England from 2009/10	DfT	bus01.ods (live.com)
Commercial	Estimated net support paid by central and local government (at current prices) for local bus services: England by local authority, annual from 2000/01	DfT	bus05i.ods (live.com)
	Estimated net support paid by central and local government (at constant prices) for local bus services: England by local authority, annual from 2000/01	DfT	bus05ii.ods (live.com)
Punctuality	Non-frequent bus services running on time by local authority: England, annual from 2004/05	DfT	bus09.ods (live.com)
	Average excess waiting time for frequent services by local authority: England, annual from 2004/05	DfT	bus09.ods (live.com)
	On-time performance for Local Authority, Operator, Corridor or Stop	ABOD	Analyse BOD
	Average delay per stop	ABOD	Analyse BOD
	Reliability, number of actual services against expected services	ABOD	Analyse BOD
	Average Bus Speed, by corridor or service	ABOD	Analyse BOD
Passenger Satisfaction	Bus User Weekly Survey, England	Transport Focus	TF Data Hub
	Bus Passenger Survey at a Local Authority level with annual reporting	Transport Focus	TF Data Hub

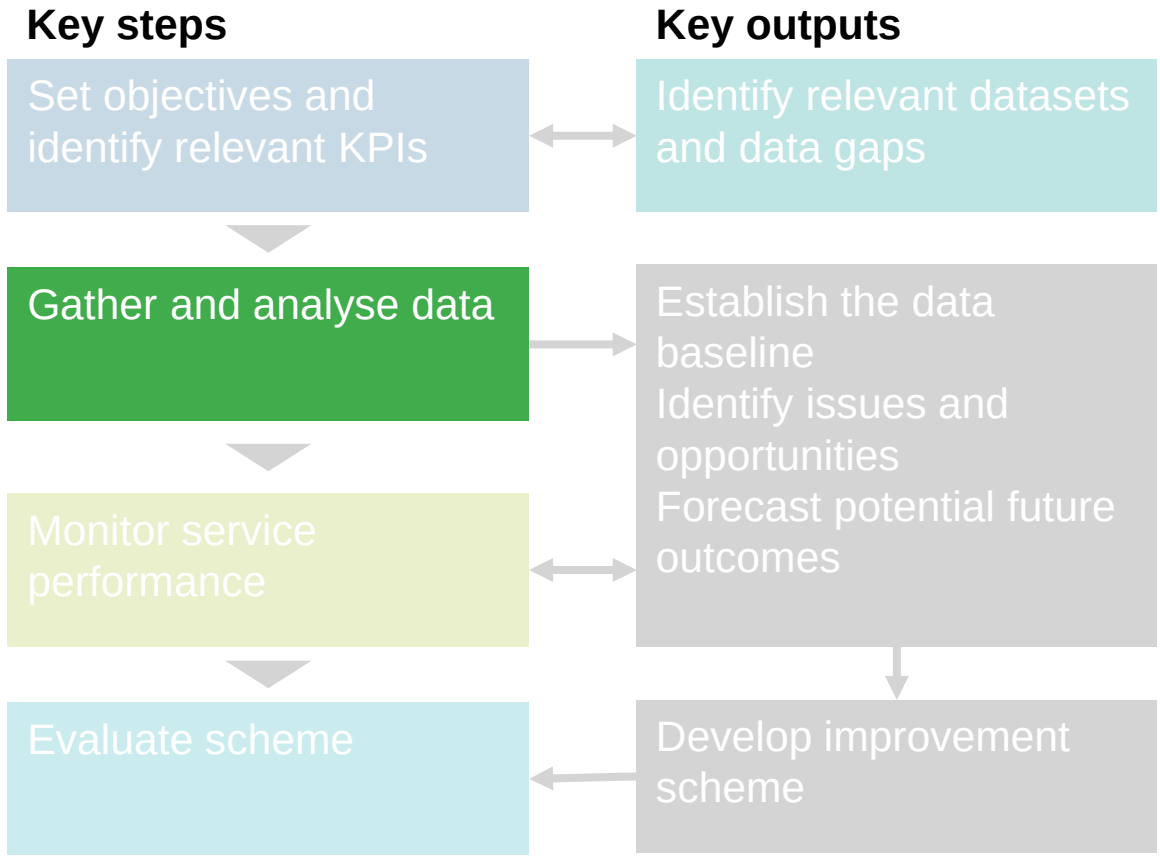
3. Analysis for baseline and forecasting

Analysis for baseline and forecasting

Overview

This section will provide an overview of the potential transport modelling options available to forecast bus patronage data.

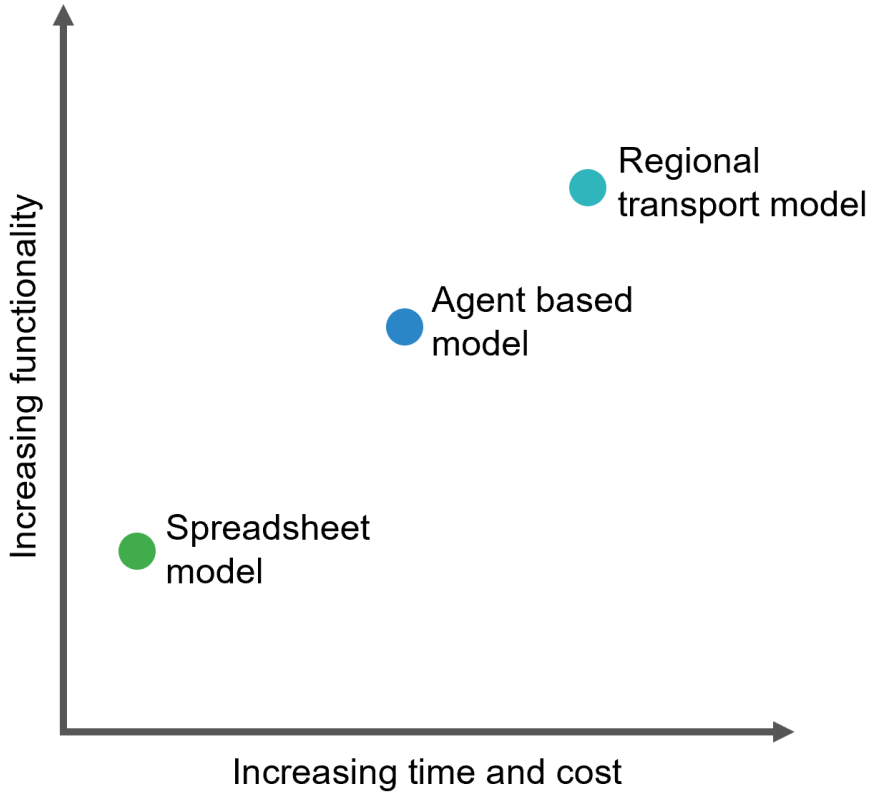
Establishing a data baseline and effectively forecasting patronage are essential components in the evaluation of bus initiatives, both in the scheme development phase and once operational.



Analysis for baseline and forecasting

This chapter will provide a description of the relevant forecasting methods and the advantages, disadvantages and estimated costs associated with each of these modelling options is presented.
The relative functionality of the methods presented are summarised in the table below and graph opposite.

Method	Scale	Functionality vs time/cost
Non-assignment, spreadsheet-based model	Small/ Regional (aggregate)	High functionality Minimum time/cost
Agent based model	Regional	Simple functionality Medium time/cost
Regional highway and public transport model	District/ Regional	Medium functionality Significant time/cost



For each method, a table is included on the overview page which shows which kind of data can be used with that type of model, as shown below.

Customer satisfaction	Real time information	Patronage	Revenue	Delays
Bus speed	Journey time	Trip OD	Payment method	Ticket type

Spreadsheet based models

Overview

Input data options

Customer satisfaction	Real time information	Patronage	Revenue	Delays
Bus speed	Journey time	Trip OD	Payment method	Ticket type

A spreadsheet based model is a standalone tool which contains information about base year bus patronage data and applies scenario assumptions and elasticities to predict how this will change into the future.

This is the simplest method of analysis in this toolkit. It can be used to quickly and effectively model scenarios associated with bus proposals using simplistic assumptions about how certain interventions will affect patronage. For example, the impact on fare income in a region if patronage increases 10% on individual routes as a result of additional services. This requires historical data to provide an empirical basis for such assumptions and caveats should be clearly identified when using this kind of approach.

Patronage assignment as a result of significant changes to routes cannot be reliably forecast using this method.

Below: Forecast demand analysis, bus use and supply data 1999-2022, TfL

Bus journeys analysis (2001/02-2011/12)	
2001/02	1,430,000,000
2011/12	2,344,000,000
Change	914,000,000
minimum annual increase	58,630,000

Bus journeys analysis 2011/12-2021/22)	
2011/12	2,344,000,000
2021/22	2,554,090,000
Change	210,090,000
minimum annual increase	20,206,823

Advantages

- Simple, assessing elements of bus strategy without a full assignment model.
- Can easily apply assumptions / elasticities to existing patronage data.
- No specific modelling software required.

Disadvantages

- Limited functionality – unable to assess multiple scheme elements.
- Relies on simplistic assumptions.
- Not suitable for mass transit assessment.
- Small scale with limited scope for change.
- Limited ability to on assignments.

Accessibility and application

- Accessible to all spreadsheet users except for licensed model (e.g. Metropolitan Bus Model)
- Simple spreadsheet models can be undertaken internally with in-house training
- More complex spreadsheet models may need specialist expertise.

Relatively cheap to develop

<6 months to develop and implement

Spreadsheet based models

Example - Metropolitan bus model (MBM)

Metropolitan bus model (MBM) is an Excel-based model used to consider the impact of bus subsidies in English metropolitan areas.

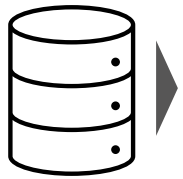
It was developed and used by Urban Transport Group (UTG) to inform its work. It also contributed to a report estimating the impact of covid-related funding withdrawal/renewal by Steer Group[1]. The model is based on the positive-correlation between demand and supply.

The key features of this model are:

- Aggregate at regional level
- Bespoke spreadsheet
- Data source: ticket sales data
- Annual demand only
- Assess the impact of a high level external factors i.e. regulation.

INPUTS

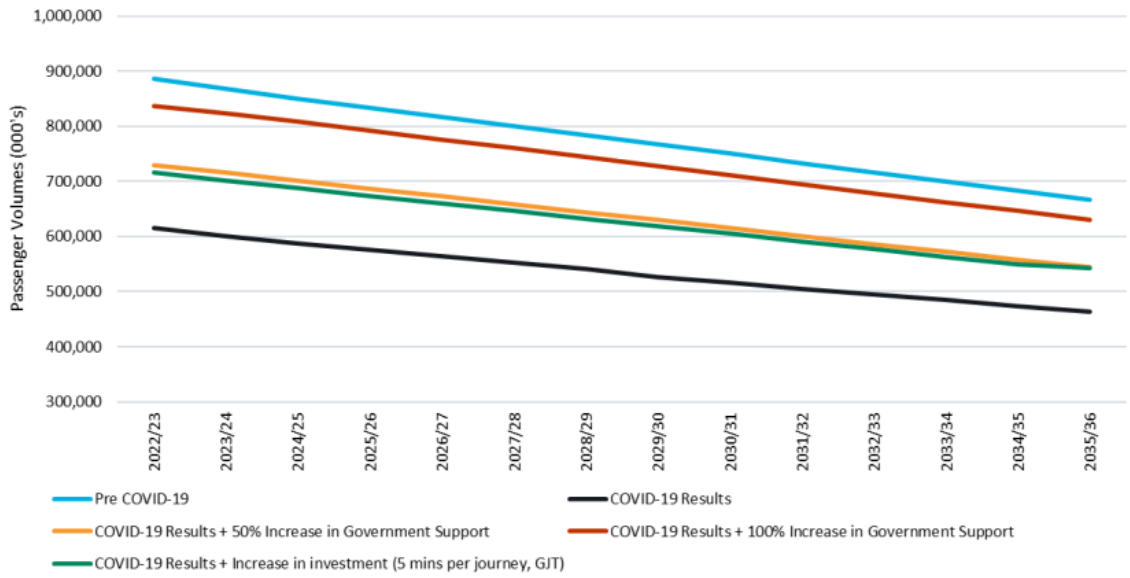
- Demographics
- Public funding
- Wider economy i.e. GDP



OUTPUTS

- Patronage forecasts
- Operator behaviour
- Fare forecasts
- Mileage forecasts
- Public funding requirements

Below: Forecast patronage with various funding scenarios for bus patronage[2]



1: Urban Transport Group: Metropolitan Bus Model, https://www.urbantransportgroup.org/metropolitan-bus-model
2: Continuing COVID Funding Support for Urban Public Transport "Figure A.4 Prepared by Steer with outputs from the UTG – Metropolitan Bus Model, 2022."

Agent based models

Overview

Input data options

Customer satisfaction	Real time information	Patronage	Revenue	Delays
Bus speed	Journey time	Trip OD	Payment method	Ticket type

An agent-based model calculates the movement of individual users of the transport network based on their activities taking place over the course of a day and respective travel choices. Whilst this method would require the most up-front effort among methods listed in this toolkit, it has the benefit of better reflecting unique travel preferences and constraints at individual level. The model could also:

- Be useful for demand responsive modelling
- Provide a tool to generate model outputs to highlight carbon emission hotspots

However, it is acknowledged that this method hasn't been discussed in the Transport Analysis Guidance unit yet (though to be included in the foreseeable future). The scale of investment required and the value that can be delivered is very dependent on specific research questions, but an initial model build over 3-6 months is reasonable.

Cost varies but typically less expensive than full multi-modal models

< 6 months for initial model but could be 1-2 years for more detailed model

Advantages

- More detailed modelling of traveller behaviour at the individual level
- More detailed representation of interventions on decision making, including equity
- Can assess mode shift across different modes
- Can assess new technologies including autonomous vehicles and MaaS
- Can be used for areas without buses in the baseline year
- Modular development – early insights developing over time

Disadvantages

- Emerging guidance within TAG that sets out how ABM models should be developed
- Not suitable for Green Book business cases
- Can require significant additional data

Accessibility and application

- Limited access via the developer
- Requires knowledge of ABMs and technical skills of big data analyses.
- Suggest to commissioning the analyses to consultancies

Agent based models

Example - Suffolk ABM

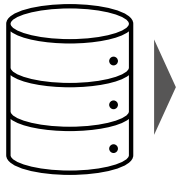
Suffolk Agent Based Model (ABM) was developed by Arup for Suffolk County. It's multi-modal and represents the entire county.

Specific scenarios were developed to support the Suffolk Bus Service Improvement Plan to understand the impact of increasing frequencies on existing routes or adding new routes.

The model was developed using open data from Open Street Map, NTS travel diary data, census data and proprietary GTFS data to inform public transport schedules. The outputs included demand data at an agent level, which could be aggregated by routes, operators or geographical area. The outputs of the model can tackle issues of equity, sustainability, new modes and changing behaviours beyond the ability of traditional transport metrics.

INPUTS

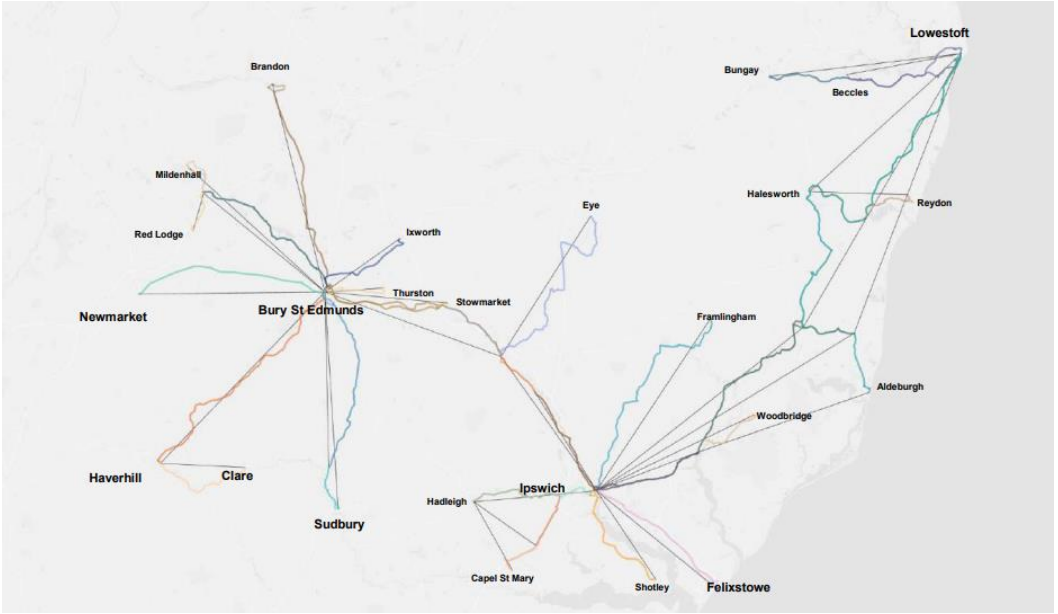
- Network data
- PT schedule (GTFS)
- Activities/agent assumptions



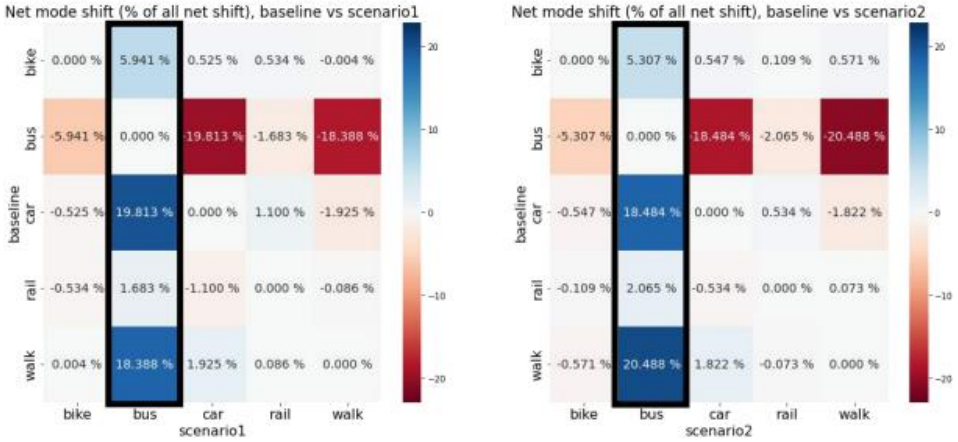
OUTPUTS

- Mode share/shift
- Bus ridership
- Trip purposes
- Demographics

Below: Bus strategy scenario design



Below: Example of tabular output from the model.



Regional transport models

Overview

Input data options

Customer satisfaction	Real time information	Patronage	Revenue	Delays
Bus speed	Journey time	Trip OD	Payment method	Ticket type

A regional or district public transport and demand model, that can integrate highway model information with public transport information to create a model of the higher-order or strategic transport network for an area.

This built model can be used to factor demand for different modes based on certain elasticities, such as cost, travel time, or service frequency, with the demand factors identified applied to the model.

Whilst this method would require more up-front effort it has the benefit of future forecasts being simpler and calibrated to the existing network. The model could also:

- Be locally calibrated making specific predictions of movements by mode.
- Start with one or more components of an existing wider model from agencies with existing models such as Transport for London or DfT.
- Can be integrated with other tools to generate model outputs associated with other organisational objectives, such as highlighting carbon emission hotspots or addressing socioeconomic disadvantage.

Advantages

- Good for high-level network coverage and representation of network demand across a district or region
- Can provide localised demand forecasts
- Testing for demand model convergence (between the demand and the assignment) is straightforward

Disadvantages

- Can have a lot of ‘noise’ that can skew results as a given relationship may not be simply defined
- Some modes i.e. park and ride may be difficult to represent
- Level of detail of network across the whole model may differ
- Calibration could be complex

Accessibility and application

- Most models are accessible at a cost
- Suggest to commissioning the analyses to consultancies

Typically a high expense to develop

1-2 years to develop and implement

Regional transport models

Policy Responsive Integrated Strategy Model (PRISM), West Midlands

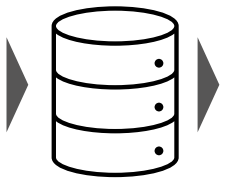
The Policy Responsive Integrated Strategy Model (PRISM) is a multi-modal disaggregate demand model of the West Midlands Metropolitan Area. The clients are the seven Metropolitan districts of the West Midlands, National Highways and Transport for West Midlands (TfWM).

The model comprises separate highway and Public Transport (PT) assignment models based in VISUM and linked together with a demand model in ALOGIT. TfWM is responsible for its update and maintenance, and a framework has been set up to provide expert advice. A new base year model is being developed by Mott MacDonald in the meantime.

It can be used to assess schemes, focusing on car ownership, destination choice, and time of day choice. Base year matrices are required as input. Simple functionality can be added and updated in the model.

INPUTS

- Base year matrices
- PT fares
- Demographics
- Planning data targets

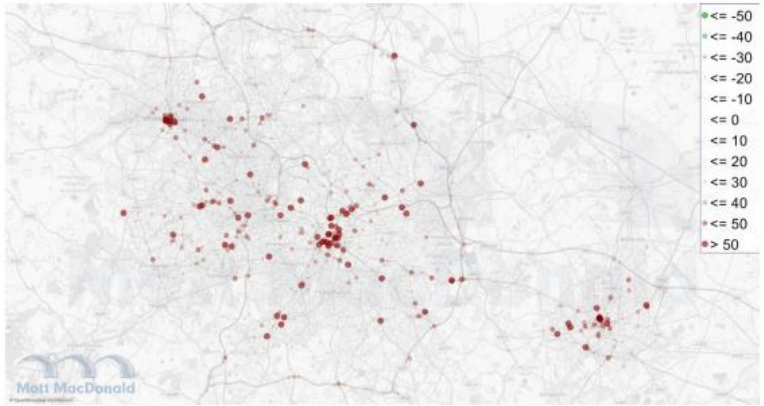


OUTPUTS

- Vehicle kilometrage
- Delays (journey time/speeds)
- Trips
- Mode share

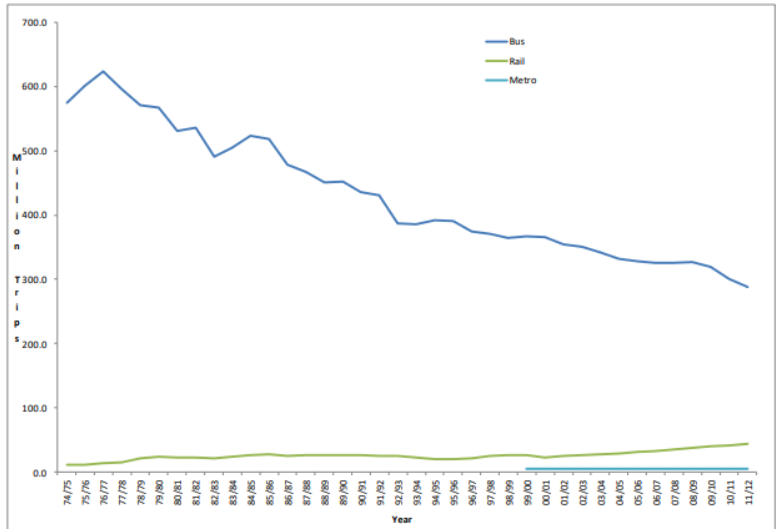
Below: Example of delay output from the model

Figure 3.4: Change in the maximum RFC of turns for each node between 2011 and 2031 in the IP period



Below: Example of demand trend output from the model

Figure 4.1: Annual West Midlands Public Transport Demand Trends (Million trips per annum)



Transport for West Midlands, About PRISM, http://corporate.tfwm.org.uk/strategy/data-insight/transport-modelling/about-prism/
RAND, The PRISM Model: Evidence on Model Hierarchy and Parameter Value, https://www.rand.org/content/dam/rand/pubs/technical_reports/2007/RAND_TR280.pdf
Mott MocDonald, PRISM Forecasting Report (PRISM 4.7), http://corporate.tfwm.org.uk/media/3503/prism-47-reports-2-forecasting-report_v9_20190118.pdf

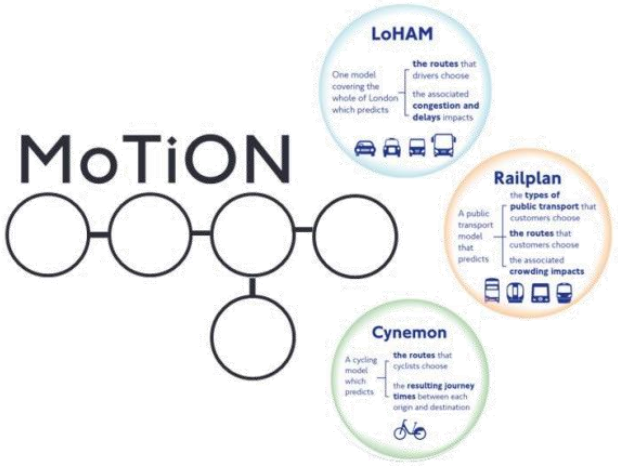
Regional transport models

TfL MoTiON (Railplan)

Model of **t**ravel **i**n Lond**on** (MoTiON) is a multi-modal strategic transport model of London and the surrounding area. It's based in the software CUBE developed by Citilabs. It incorporates TfL's highway model (LoHAM), TfL's cycling moden (Cynemon) and TfL's public transport model (Railplan).

It is a demand model and incorporates the strategic assignment models to understand route choice. Railplan is the respective public transport assignment model.

It covers Greater London and uses demand surveys and smartcard data to validate and predict current and future scenarios. The key output is modal share, of which further insights can be ascertained.



Below: Percentage in the origins of weekday demand for public transport from 2011 to 2041 from LTS

INPUTS

- Land use assumptions
- Bus service interventions

OUTPUTS

- Mode share
- Bus ridership
- Crowding level
- Passenger travel time and distance by mode

TfL, London's Strategic Transport Models, https://content.tfl.gov.uk/londons-strategic-transport-models.pdf

Regional transport models

National Highways Regional Transport Models (RTMs)

National Highways maintains five strategic highways models covering the whole of England. TfSE, TE and EEH are all within the Southeast Regional Model (SERTM) coverage. They are SATURN models focussing on Strategic Road Networks (SRN) and demand models in DIADEM. There are no bus routes included in the RTM, although it can output the impact of congestion levels, new bus lanes or other priority measures on bus journey times in the forecasting years once bus routes and frequencies are included in these scenarios.

The model generally has limited public transport representation, and bus fares are fixed in the respective modelled year. The network needs to be refined and updated if focusing on a smaller area or using a different baseline year. National Highways provides access to the model at a cost.

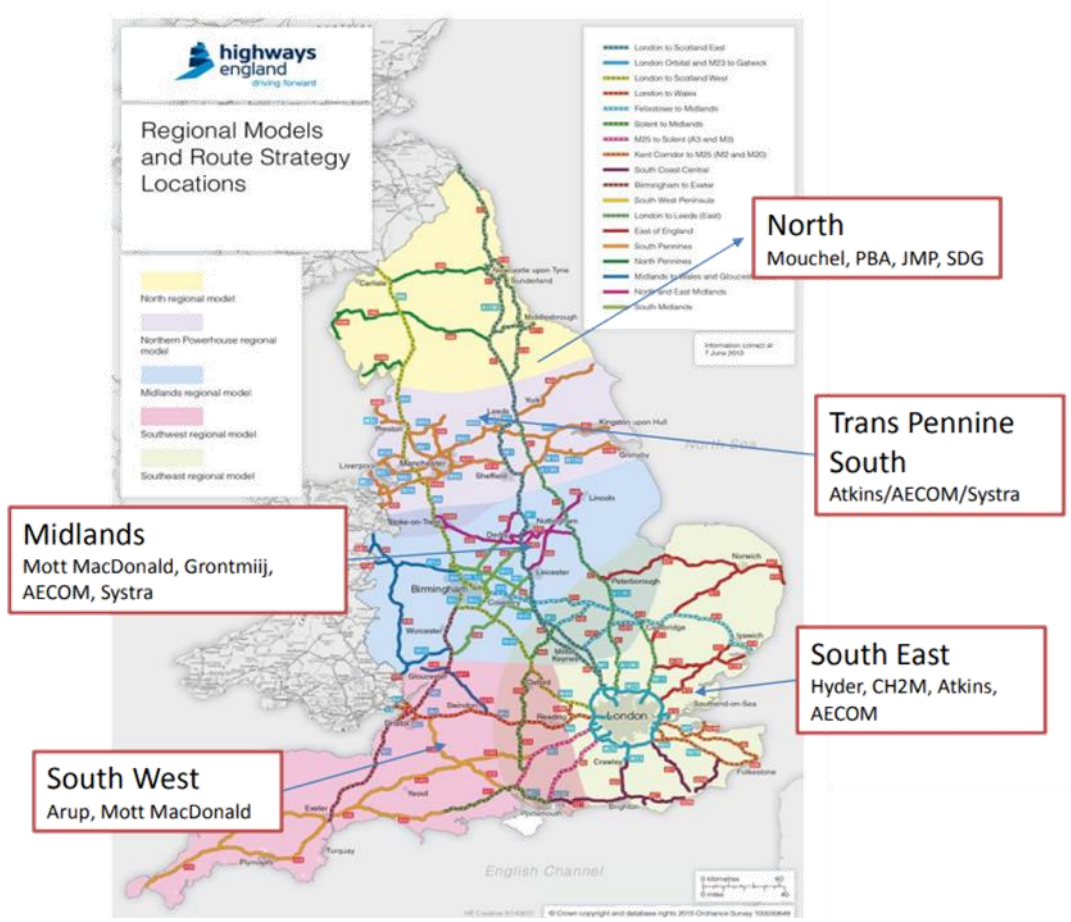
INPUTS

- New updates
- Intervention
- Bus fare

OUTPUTS

- Bus journey time
- Bus mode share

Below: Regional models and route strategy locations – Highways England



Summary and considerations

It is important to select an appropriate model based on the limitations and requirements of what kind of scheme you are trying to assess:

- Study area
- Existing models that can be used or adapted
- Data collection required to run the model
- Data processing required of model outputs
- Availability of baseline data
- Desired outputs
- Time and budget available
- Output granularity

Key		
Highly suitable	Very easy	++
Moderately suitable	Easy	+
Neutral/Not applicable	Neutral/Not applicable	0
Marginally unsuitable	Slightly difficult	-
Highly unsuitable	Difficult	--

Factors	Example considerations	Method options		
		Spreadsheet-based model	Regional highway and public transport model	Agent based model
Study area/scale	Local	++	+	+
	District/Regional	-	++	++
Timeframe & budget	Tight	++	--	--*
	Long-term	0	++	++
Outcome granularity	Aggregate	++	+	+
	Disaggregate	--	+	++
Desired output (excl. patronage)	Modal shift	--	-	++
	Equity	--	--	++
	Carbon impact	-	+	++
Baseline data	Without buses	--	+	++
Data collection	-	++	+	--
Data process	Small dataset	++	0	0
	Big dataset	--	++	++
Existing model to use	-	+	++	+

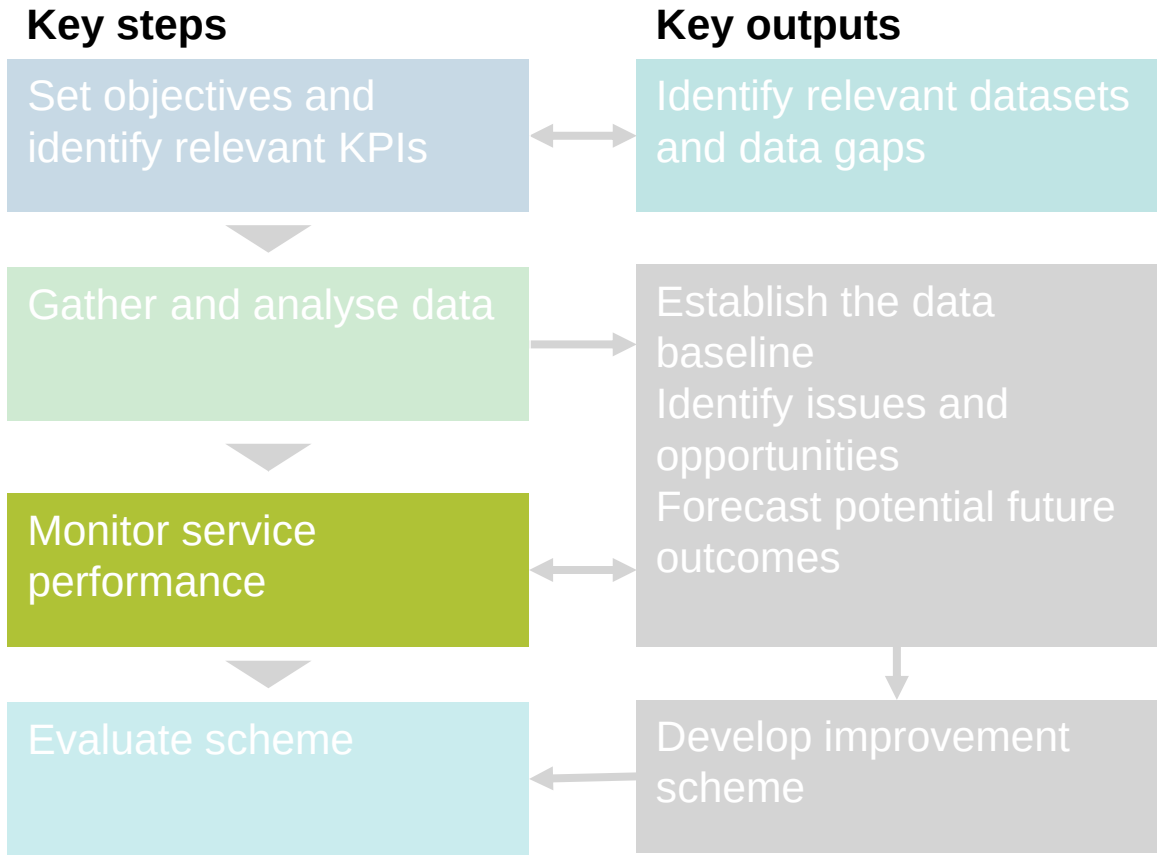
4. Monitoring performance

Monitoring performance

Overview

Monitoring seeks to check progress against KPIs and can be defined as the formal reporting and evidencing that schemes are successfully delivered, milestones met and changes in outcomes tracked over time.

Monitoring provides valuable evidence throughout the lifetime of a bus initiative or scheme and is essential in the final step, evaluation.



Monitoring performance

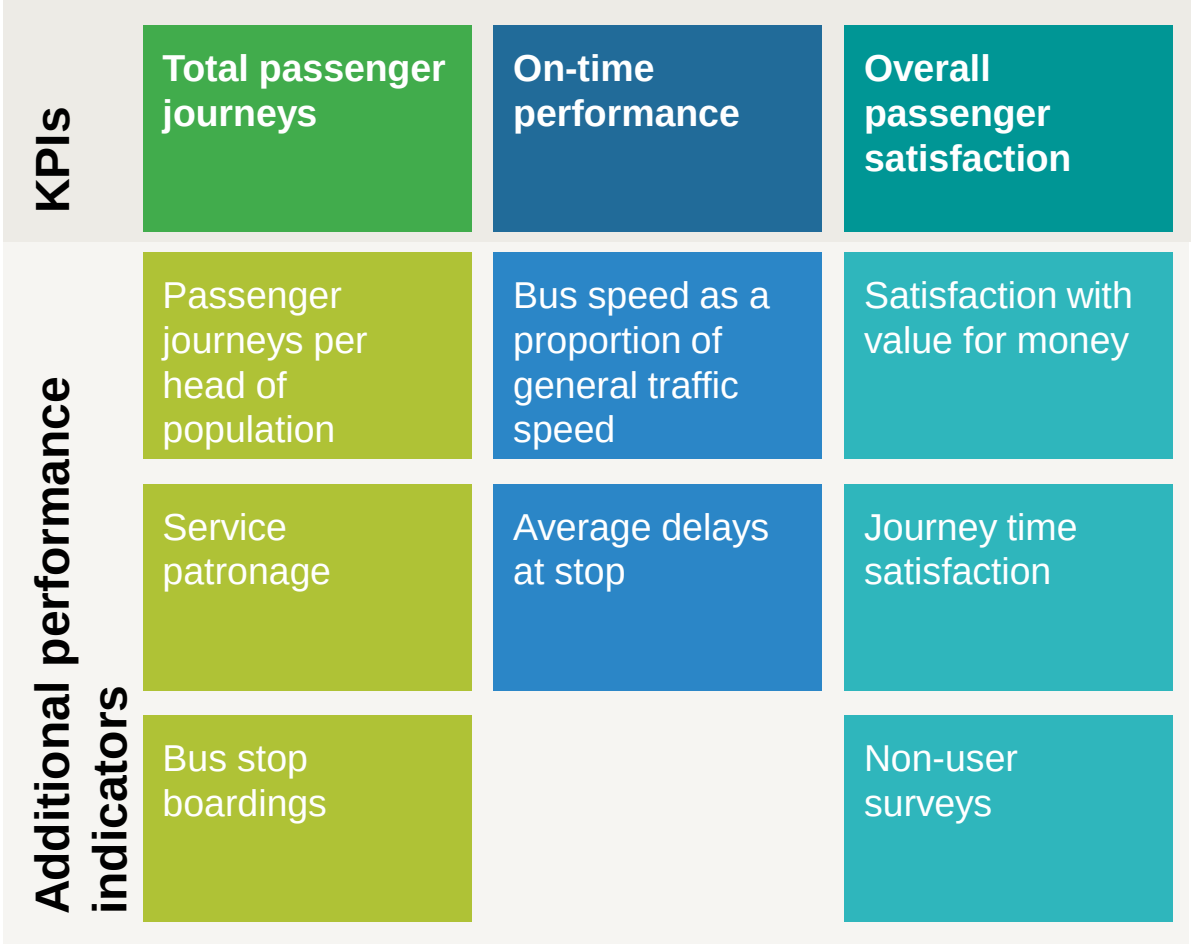
Performance indicators

After setting objectives, determining KPIs and then gathering data, the monitoring stage can begin.

Monitoring of KPIs should take place at least annually, as both DfT and Transport Focus release data annually, on patronage (DfT) and passenger satisfaction (Transport Focus).

However, if relevant data is available more frequently than this, it may be worthwhile to track performance over shorter intervals as well to identify any short-term issues.

Monitoring can include additional performance metrics that can help isolate local impacts. If a high-level objective is to focus on growing the user base, additional data such as non-user surveys, and individual service patronage may be useful in identifying potential barriers to growth.



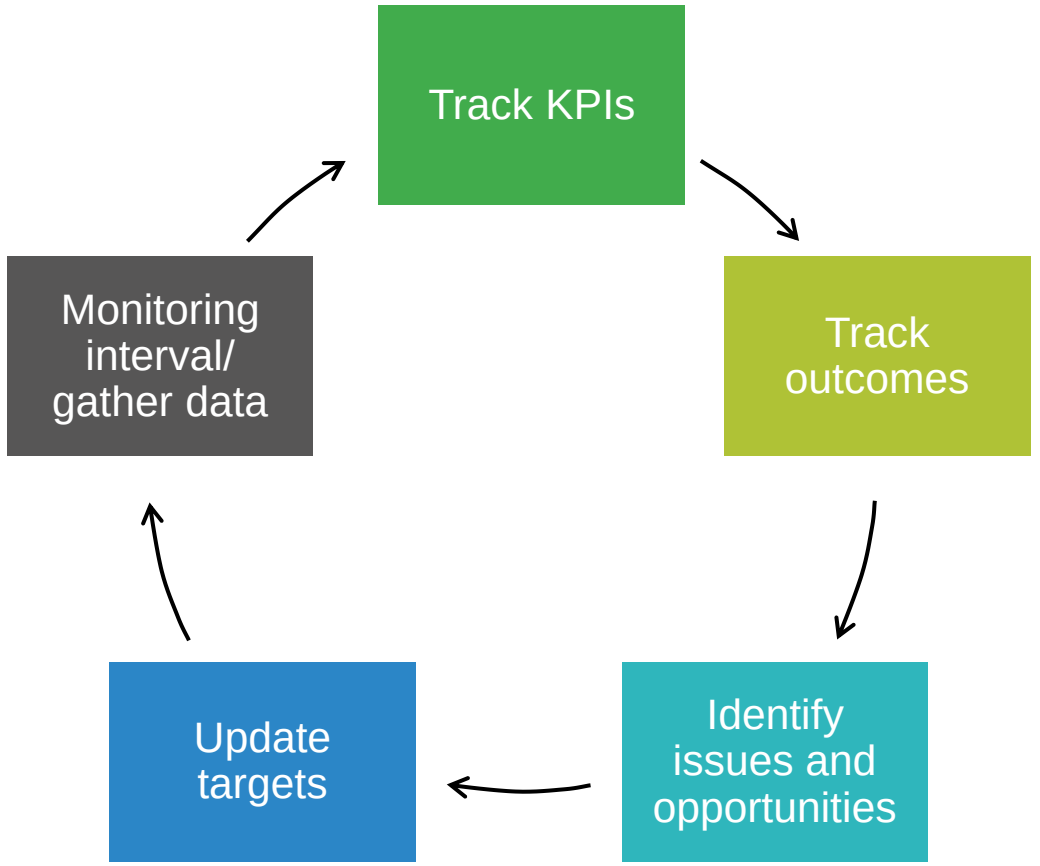
Monitoring performance

Key steps

Monitoring must involve identifying appropriate and set time intervals at which data will be collected and analysed. It must also set the interim performance targets that are intended to be achieved across these time intervals to demonstrate progress towards the scheme objectives. The key steps in monitoring are therefore:

1. Gathering of data over set monitoring periods
2. Tracking of KPIs. Using this data to track Patronage, Punctuality and Passenger Satisfaction over time, as well as any supplementary performance indicators.
3. Tracking outcomes. Identifying what has worked, what has improved, and perhaps what has not delivered a positive outcome over time.
4. Identifying where there are issues and opportunities in the delivery of a scheme that can be actioned to better meet the desired outcomes.
5. Updating KPI targets to align to new baselines.

Monitoring Process



Monitoring performance

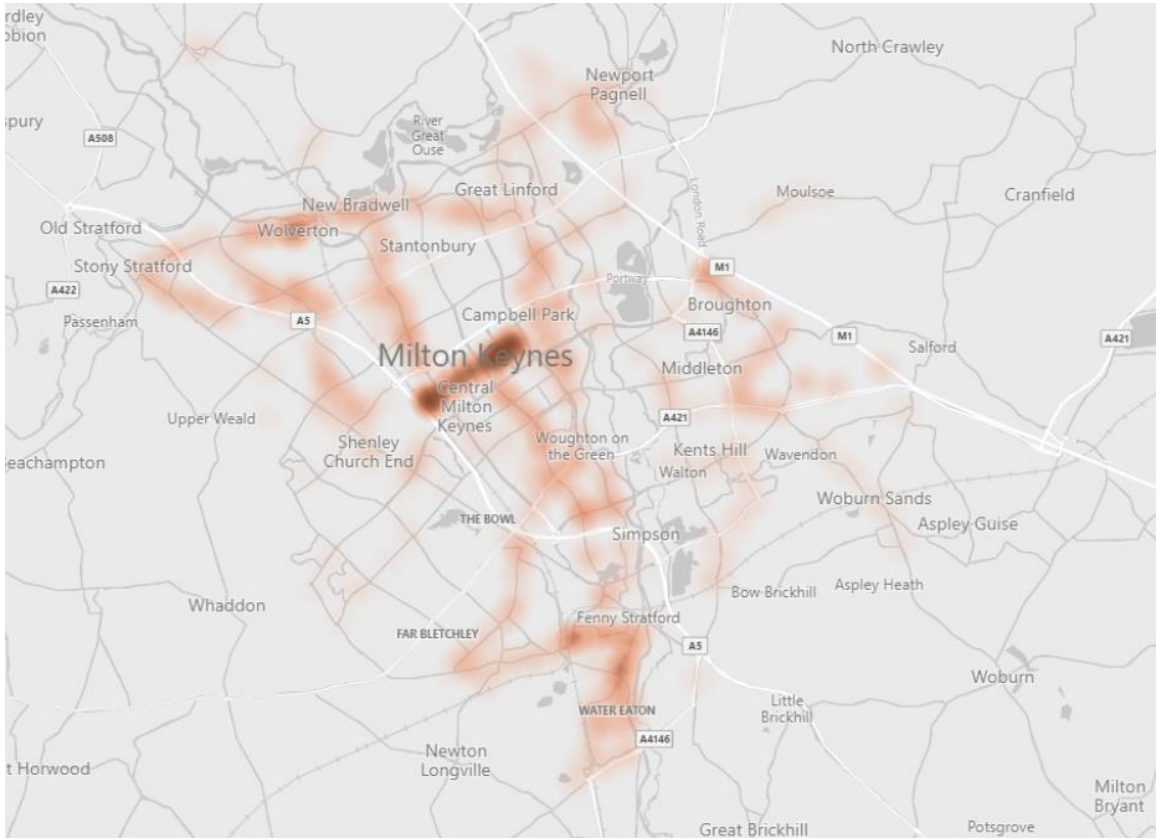
Patronage

It is recommended that the patronage KPI is monitored at least annually at a local authority level to assess overall trends across the region. Other metrics to report on within this category include:

- Patronage for specific services
- Boarding figures at key bus stops
- Patronage data on popular origin-destination pairs
- Individual operator data to infer customer satisfaction

This data is best presented in two keys ways:

- In line graph form to show progress over time towards the interim and ultimate KPIs. This can be disaggregated in many ways, including individual route, operator, corridor, etc.
- In geospatial form (GIS) to show visually where there are areas of high and low demand. These could include:
  - Heat maps of bus stop activity (as shown opposite)
  - Maps with line thickness on routes or corridors to show patronage volumes.



Above: Example of a bus stop activity plot using GIS from BODS

Monitoring performance

Punctuality

It is recommended that the punctuality KPI is monitored annually at a local authority level. The data sources identified in chapter 2 allow for punctuality to be measured at more regular intervals than patronage. However, it is recommended monitoring is undertaken for various time periods during the year, for example before and during school holidays or for peak hour and off-peak journeys.

ABOD also allows for data to be measured in specific locations or corridors, or for a specific service. This can enable data to be captured for the following metrics:

- Bus speeds along target corridors for different time periods
- Average lateness at a bus stop
- Service reliability for a target route

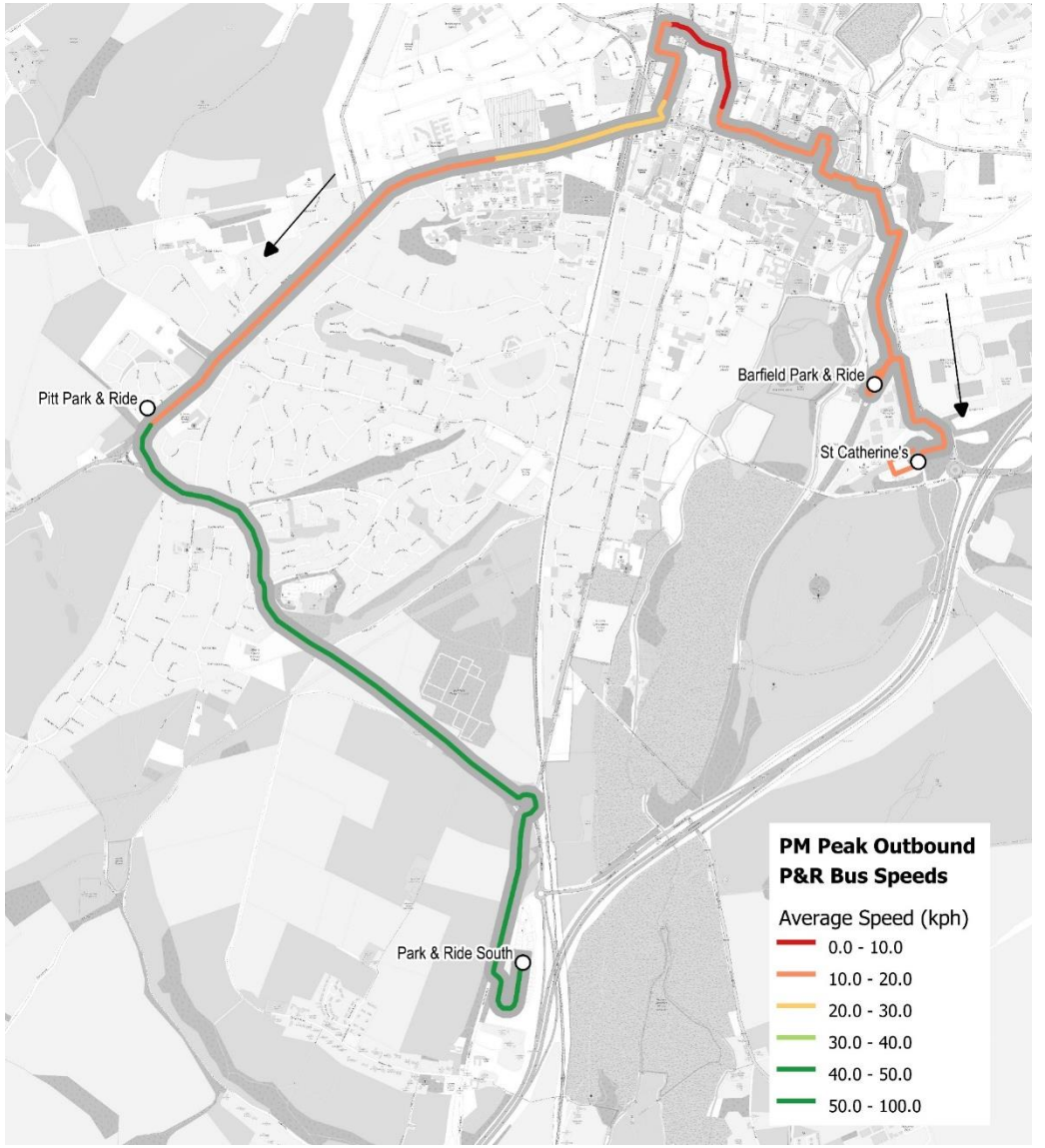
Monitoring performance

Punctuality

Punctuality data is then best presented:

- In graph form to show progress over time towards the interim and ultimate KPIs. There are many ways this could be shown and is dependent on how the KPIs are defined, but could include:
  - Proportion of services where the bus arrived at most stops on-time, where on-time is defined by the traffic commissioner, and “most” is open to individual definition.

- In geospatial form (GIS) to show visually where there are areas of poor punctuality. These could include:
  - Maps showing average on-time performance of bus stops (eg whether services are often early or late to a stop).
  - Maps with routes or corridors coloured to show average speed (as shown opposite).



Above: Example of a bus speed plot from real time information provided by a bus operator

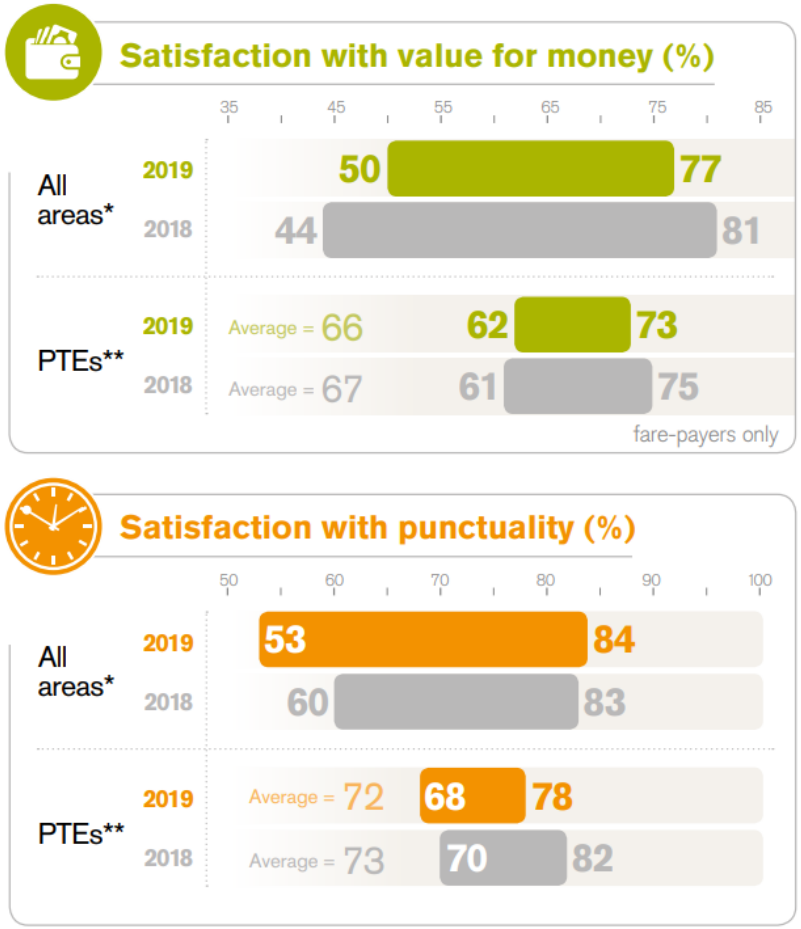
Monitoring performance

Passenger satisfaction and non-user perceptions

It is recommended that the passenger satisfaction KPI is monitored annually at the local authority level. Additional information can be gathered at more frequent intervals through additional surveys, both using Transport Focus methodology, or more bespoke, focused in-person surveys or online outreach.

Passenger satisfaction data is then best presented:

- In chart form to show how customer satisfaction with aspects of their journey varies over reporting periods
- In geospatial form (GIS) to show visually where there are areas with higher or lower levels of satisfaction.



Above: Example of findings from the Transport Focus 2019 satisfaction survey.

Monitoring performance

Summary

A summary of typical metrics used to monitor KPIs are shown in the table opposite, and the typical scale that these are analysed at.

Note that these are not a comprehensive list of metrics that must be used for monitoring KPIs and progress towards KPI targets. Metrics should reflect local conditions, the specific objectives and outcomes being targeted by an individual scheme or initiative, the scale of the area that is being monitored and the availability of data.

KPI	Metric	Source	Scale/area
Patronage	Bus users per head	DfT	For Local Authority Level
	Number of boardings per stop/per service	Operator	For target area
Punctuality and reliability	Average Bus Speeds	ABOD	Per service or corridor
	General Traffic Speeds	DfT, ATCs	To compare with bus speeds, for target area
	Excess Waiting time/Delay at Stop	DfT, ABOD	For local authority level and target services/corridors
	On time performance	DfT, ABOD	For local authority level and target services/corridors
	Reliability	DfT, ABOD	For local authority level and target services/corridors
Passenger satisfaction	Satisfaction Scores	Transport Focus, Operator	Bus passenger survey for some local authorities

5. Evaluation

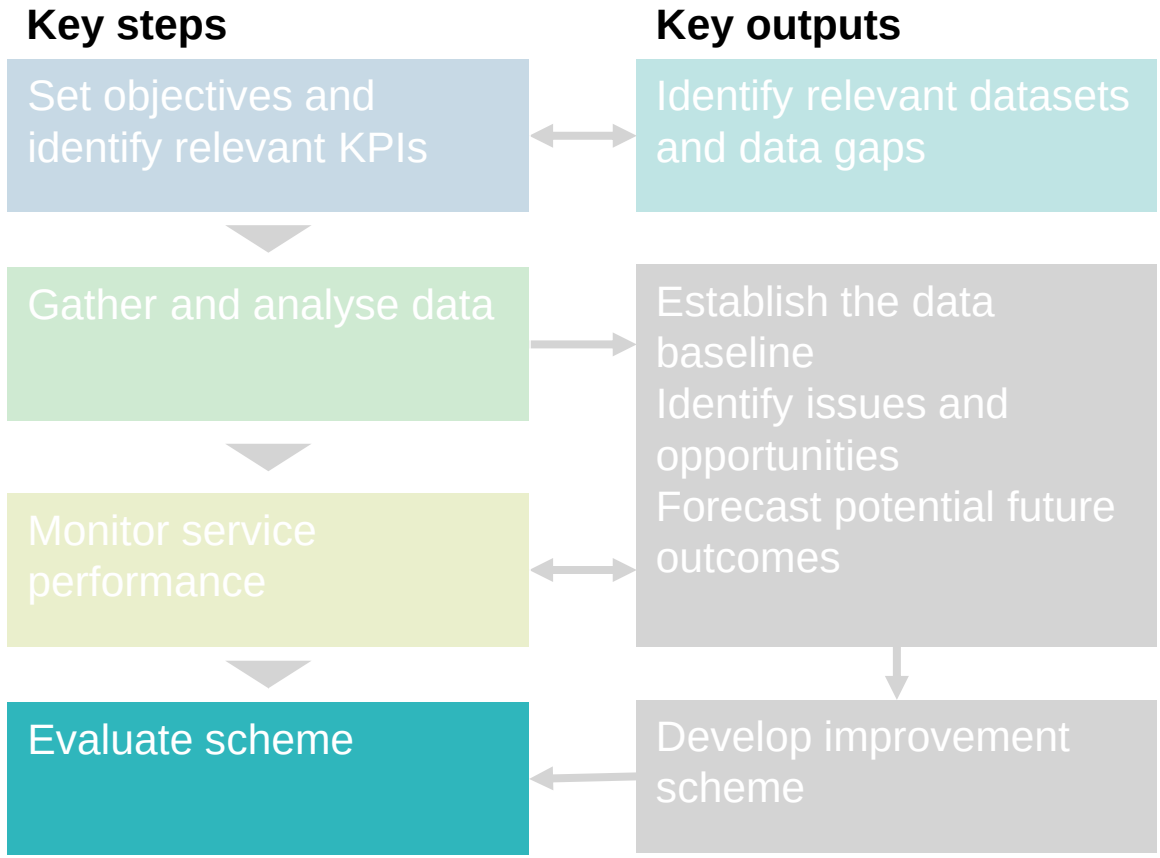
Evaluation

Overview

Evaluation is the assessment of effectiveness and efficiency of the intervention after implementation.

It seeks to measure and attribute outcomes and impacts generated by the intervention in order to assess whether the anticipated benefits have been realised and whether any unanticipated impacts have occurred.

It is a systematic process for understanding the relationships between an intervention's design, implementation and impact within the context in which it is delivered. It involves understanding how an intervention is being or has been implemented, what effects it has, for whom and why. It identifies what can be improved and estimates its overall impacts and cost-effectiveness.



Evaluation

The importance of evaluation

Improvement schemes must be evaluated according to their intended objectives and outcomes.

Evaluation must be carried out after implementation to allow improved management and adaptations, leading to more effective operational delivery. It can also be used post-implementation to assess the value of intervention, gain insights into customer needs and summarise lessons learnt throughout delivery.

Leading evaluation guidance includes:

- TAG Unit E-1 evaluation
- HM Treasury's Magenta Book
- HM Treasury's The Green Book
- Post-Opening Project Evaluations (National Highways, 2022)

Evaluation to assess and manage the intervention success is important because:

It facilitates transparency and accountability

It aids in the development of the evidence base of future schemes

It can be used to improve current interventions

It provides lessons which can inform the design and planning of future interventions

Evaluation

Principles and process

General principles of a high-quality evaluation include:

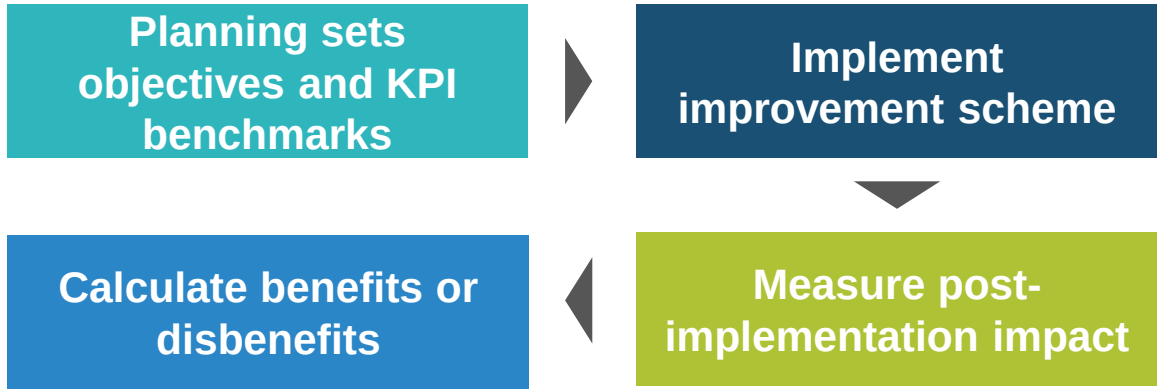
1	**Being useful, credible, robust and proportionate**
2	**Having clear objectives to guide data collection and analysis**
3	**Developing indicators to assess the intervention outcomes**
4	**Conducting the evaluation in a timely manner**

The first, second and third principles are established in earlier chapters of this toolkit. To summarise these, **objectives** are set earlier in the project planning and development process and are driven by overarching strategic objectives contained in documents such as local transport plans, ensuring they are relevant and credible. The **indicators** used to assess the intervention outcomes are the KPIs and supplementary performance indicators that drive the selection of data sources used to inform the monitoring process.

This chapter focuses on the fourth principle, evaluation.

The purpose of evaluation is to determine the effectiveness of a scheme - sufficient time should therefore be provided to allow for changes in bus user behaviour.

The point at which evaluation should occur is not set in stone. It could be as long as one year after scheme implementation to reflect a full cycle of seasonal changes, or much shorter, such as one to two months, if changes are significant enough to induce major changes to transport network conditions. The process involved in an evaluation is shown below.



Evaluation

Evaluation methods for different intervention or scheme types

Intervention	Method	Data required	Description	Evidence base
Concession (Money)	Cost benefit analysis	• Costs of delivery compared to benefits • Value for money • Ticket sales	Economic evaluation to determine whether the costs of the intervention have been outweighed by the benefits achieved.	
Service performance	Patronage data	• Patronage data • Bus speeds • Collision data • Journey times / delays	Evaluate the service performance achieved across a number of KPIs.	TAG Guidance
Customer experience	Customer satisfactory survey, social media discourse analysis	• Journey time • Waiting time • Driver behaviour • Journey smoothness and safety • Comfort (riding, boarding and alighting, cleanliness) • Bus stop conditions • complaints	Evaluate the customer experience and potential for mode shift / increased patronage.	

Evaluation

Evaluation methods for different intervention or scheme types

Intervention	Method	Data required	Description	Evidence base
Modal shift	Customer satisfaction surveys, social media discourse analysis	• Travel mode • FMLM travel mode • Alternative travel mode • Usage frequency • Journey purpose	Evaluate the mode shift achieved from the measures implemented. This can then be used to evaluate carbon and air quality impact (as discussed below).	
Zero emission	Customer satisfaction survey, spreadsheet analysis	• Emission factors • Mode shift proportions	The evaluation approach is currently being finalised but will include programme-level monitoring of outputs, outcomes, and costs, including data to inform analysis of carbon impacts, and process evaluation interviews with local transport authorities, bus operators, and other involved parties.	Monitoring and evaluation of the Zero Emission Bus Regional Areas scheme https://www.gov.uk/government/publications/dft-monitoring-and-evaluation-programme/dft-evaluation-strategy-and-programme-2022

Glossary

Acronym	Description
BBB	Bus Back Better
KPI	Key performance indicator
BODS	Bus Open Data Service
ABOD	Analyse Bus Open Data service
RTI	Real time information
DfT	Department for Transport
LA	Local authority
TfL	Transport for London
LTA	Local transport authority
ABM	Agent based model
TF	Transport Focus

Appendix A: Sample Outputs

South East