



Department  
for Environment  
Food & Rural Affairs

# Emissions Factors Toolkit v9

## User Guide

May 2019



Department of  
**Agriculture, Environment  
and Rural Affairs**  
[www.daera-ni.gov.uk](http://www.daera-ni.gov.uk)



Llywodraeth Cymru  
Welsh Government



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Any enquiries regarding this document/publication should be sent to us at:

[laqmhlpdesk@uk.bureauveritas.com](mailto:laqmhlpdesk@uk.bureauveritas.com)

Change Log

Version	Date	Details of Changes Made
1	May 2019	Released with EFT 9.0

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# Introduction

This road traffic Emissions Factors Toolkit (EFT) user guide has been compiled by Bureau Veritas in the role of Project Manager for the Local Air Quality Management (LAQM) Helpdesk and should be used in conjunction with Version 9 of the Toolkit.

The EFT is published by Defra and the Devolved Administrations to assist local authorities in carrying out Review and Assessment of local air quality as part of their duties under the [Environment Act 1995](#)<sup>1</sup>. It is of particular interest for use in the assessment of measures implemented as part of LAQM Air Quality Action Plans (AQAPs), and policy interventions on road traffic emissions, such as the Clean Air Zones (CAZs) and other measures, that form part of the [UK national plan on compliance with EU Limit Values](#)<sup>2</sup>. It is a tool that allows users to calculate road vehicle pollutant emission rates for oxides of nitrogen (NO<sub>x</sub>) and Particulate Matter (PM - PM<sub>10</sub> and PM<sub>2.5</sub>), for a specified year, road type, vehicle speed and vehicle fleet composition. Carbon dioxide (CO<sub>2</sub>) emission rates can also be calculated for petrol, diesel and alternative fuelled vehicles.

The purpose of this user guide is to explain in detail the methodology, datasets and assumptions used in the development of the EFT, and to provide guidance on its use. This user guide also consolidates information regarding previous versions of the EFT, their main changes and updates that have occurred over time.

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<sup>1</sup> <http://www.legislation.gov.uk/ukpga/1995/25/contents>

<sup>2</sup> <https://www.gov.uk/government/publications/air-quality-plan-for-nitrogen-dioxide-no2-in-uk-2017>

# The Emissions Factors Toolkit (EFT)

## About the EFT

The latest EFT can be downloaded from the [LAQM website](#)<sup>3</sup>. It provides emission rates for 2017 through to 2030 and takes into consideration the following information available from the [National Atmospheric Emissions Inventory \(NAEI\)](#)<sup>4</sup>:

- Fleet composition data for motorways, urban and rural roads in the UK (excluding London);
- Fleet composition based on European emission standards from pre-Euro I to Euro 6/VI (including Euro 6 subcategories);
- Scaling factors reflecting improvements in the quality of fuel and some degree of retrofitting; and
- Technology conversions in the national fleet.

In addition, the EFT utilises bespoke vehicle fleet information and projections for London provided by Transport for London (TfL) in early 2018, taking account of the Mayor's recent announcement to bring the [Ultra-Low Emission Zone \(ULEZ\) forward to 2019](#)<sup>5</sup>:

- Fleet composition data in London for motorways, central, inner and outer areas.

The EFT can be used to provide the following information:

- Emission rates as g/km/s, g/km, or kg(or tonnes)/year from the total traffic for NO<sub>x</sub>, PM<sub>10</sub>, PM<sub>2.5</sub> and CO<sub>2</sub>;
- Calculation of PM<sub>10</sub> and PM<sub>2.5</sub> from tyre and brake wear and road abrasion emission sources;

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<sup>3</sup> <https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html>

<sup>4</sup> <http://naei.beis.gov.uk/>

<sup>5</sup> <https://tfl.gov.uk/modes/driving/ultra-low-emission-zone>

- Source apportionment for Light Duty Vehicles (LDVs) and Heavy Duty Vehicles (HDVs), or individual vehicle classes. This includes a breakdown of emissions for conventional vehicle types which include 8 conventional vehicle categories (such as petrol and diesel cars) for the UK plus taxis for London, and alternative vehicles such as hybrid petrol cars (depending on user information). A full list of the vehicle categories available within the EFT is provided below:

Conventional Vehicle Types	Alternative Vehicle Types <sup>b</sup>	
Petrol Cars	Full Hybrid Petrol Cars	E85 Bioethanol LGV
Diesel Cars	Plug-In Hybrid Petrol Cars	LPG LGV
Petrol LGV	Full Hybrid Diesel Cars	B100 Rigid HGV
Diesel LGV	Battery EV Cars	B100 Artic HGV
Rigid HGV	FCEV Cars	B100 Bus
Artic HGV	E85 Bioethanol Cars	CNG Bus
Buses/Coaches	LPG Cars	Biomethane Bus
Motorcycles	Full Hybrid Petrol LGV	Biogas Bus
Taxi <sup>a</sup>	Plug-In Hybrid Petrol LGV	Hybrid Bus
	Battery EV LGV	FCEV Bus
	FCEV LGV	B100 Coach
<sup>a</sup> Zero Emission Capable (ZEC) Taxis are included within this vehicle category. Whilst ZECs are included within the default fleet assumptions for London, in areas outside of London the proportion of ZECs must be user defined by the user – see Note 4 for further information.		
<sup>b</sup> A full description of the vehicle type nomenclature is available in the Glossary and Definitions.		

- Calculation of annual emissions in kg/yr for each vehicle type and Euro Emission Standard for NO<sub>x</sub>, PM<sub>10</sub> and PM<sub>2.5</sub>; and
- Calculation of the fraction of primary NO<sub>2</sub> emissions (f-NO<sub>2</sub>) for the provided input data.

All calculations are based on the average fleet composition for a given year and road type (urban, rural, motorway) and whether that road is in London or outside. However, advanced options are also available to allow users to alter fleet composition information.

The calculations procedure for generating the vehicle emissions in g/km, g/km/s and kg/year or tonnes/year can be found in Appendix A and the EFT process map can be found in Appendix B.



## Details of the EFT (Version 9)

**Note 1:** Updates to the EFT can include both minor and major changes that may affect the output of the Tool. In order to be confident that your outputs are the most up to date, it is strongly recommended that you use the latest Version/Issue of the Tool.

Defra and the Devolved Administrations have provided an updated Emissions Factors Toolkit (Version 9) which replaces all previous versions, which should no longer be used.

The EFT is updated regularly in order to keep it current with the latest available data.

For Version 9 of the EFT, through close liaison with the NAEI and London Atmospheric Emissions Inventory (LAEI) teams, Road Traffic Emission Projection assumptions for NO<sub>x</sub> and PM have undergone technical peer review.

Version 9 incorporates:

1. Updated basic fleet assumptions for 2017-2030 in line with DfT, NAEI and TfL projections;
2. Updated Euro class compositions for 2017-2030 in line with DfT, NAEI, and TfL data (inclusive of Euro 6 subcategories);
3. An update to the fraction of exhaust PM<sub>10</sub> emitted as PM<sub>2.5</sub> from 0.95 to 1;
4. Updated fuel scaling factors for PM;
5. Inclusion of a new Advanced Option 'Simple Entry Euro Compositions' that allows users to input User Defined Euro Classes in a simplified manner;
6. Inclusion of a new Advanced Fleet Option 'Fleet Projection Tool' that allows users to project their user defined Euro fleet information from a Base Year (e.g. a local Euro fleet derived from Automatic Number Plate Recognition (ANPR) surveys) to a future Projection Year. This option is only available outside of London;
7. Inclusion of Taxis (Black Cabs) as a vehicle option outside of London;

8. Inclusion of primary NO<sub>2</sub> fraction (f-NO<sub>2</sub>) outputs weighted as a function of road length;
9. Inclusion of emissions based upon variable road gradient on each link;
10. Inclusion of emissions based upon variable HDV load on each link;
11. Inclusion of CO<sub>2</sub> emissions for User Defined Euro Classes, either entered via the Euro Compositions or Simple Entry Euro Compositions 'Advanced Options'.

A list of the data sources used for the development of the current EFT can be found in Appendix C.

## Details of Historic Versions of the EFT

EFT Version / Issue	Release Date	Reason for Release / Summary of Changes
<b>Version 9.0</b> <b>(Current Version)</b>	May 2019	See “Details of the EFT (Version 9)” page 5.
<b>Version 8.0.1</b>	December 2017	Minor bug fixes and/or enhancements: <ul style="list-style-type: none"> <li>• Correction on bus and coach split on London roads when entering data using the Alternative Technologies traffic format input option only;</li> <li>• Compatibility with Excel 2007 and 64-bit instances of Excel.</li> </ul>
<b>Version 8.0</b>	November 2017	<p>Updated NO<sub>x</sub> and PM speed emission coefficient equations, taken from the European Environmental Agency (EEA) COPERT 5 emission calculation tool, including Euro 6 subcategories;</p> <p>Ability for the user to define LGV petrol / diesel percentage split via the Euro Compositions advanced option;</p> <p>Better representation of failure rates of both catalysts and Diesel Particulate Filters (DPFs). The input tables for the Euro Compositions Advanced Option no longer assume failure rates within the presented proportions (default failure rates are subsequently assumed as part of the calculation procedure). Also, when using the Output % Contributions from Euro Classes Advanced Option, the proportion of total emissions attributable to failed catalysts and DPFs is now presented separately within brackets alongside the emissions for each Euro category;</p> <p>New NO<sub>x</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> Annual Emissions Euro Split Advanced Options added, giving emissions by kg/yr, broken down by vehicle type and Euro emission standard, with contributions from failed catalysts and DPFs again split out;</p> <p>New Advanced Option that allows the user to output the fraction of primary NO<sub>2</sub> emissions (f-NO<sub>2</sub>) for the provided input data;</p> <p>Basic fleet assumptions for 2015-2030 updated in line with DfT (2015) projections;</p> <p>Euro class compositions for 2015-2030 updated in line with DfT</p>

EFT Version / Issue	Release Date	Reason for Release / Summary of Changes
		<p>(2015) projections and TfL data (inclusive of Euro 6 subcategories);</p> <p>The 'Alternative Technologies' Advanced Option has been consolidated into the Traffic Format drop down menu on the Input Data sheet; and</p> <p>Minor bug fixes based upon user feedback on previous version 7.0:</p> <ul style="list-style-type: none"> <li>• Improved Clear Input Data button reliability on the Input Data sheet;</li> <li>• Added additional checks to validate user inputs to ensure the tool is run correctly.</li> </ul>
<b>Version 7.0</b>	July 2016	<p>Updated NO<sub>x</sub> and PM speed emission coefficient equations for Euro 5 and 6 vehicles, taken from the European Environment Agency (EEA) COPERT 4v11 emission calculation tool, reflecting more recent evidence on the real-world emission performance of these vehicles;</p> <p>Streamlining of pollutants – removal of Hydrocarbons as an option in the EFT;</p> <p>CO<sub>2</sub> tailpipe emissions associated with alternative fuelled vehicles are included in emissions calculations, in addition to those from petrol and diesel vehicles. The applied CO<sub>2</sub> scaling factors for alternative technology vehicles are consistent with those applied in the <a href="#">LAEI</a><sup>6</sup>. The ability to output CO<sub>2</sub> when Alternative Technologies advanced user input option is selected has also been added;</p> <p>Updated fleet composition data, accounting for updates to traffic and fleet projections in London, based on information from TfL. This includes varying fleet data specific to the Central, Inner, Outer and Motorway areas of London;</p> <p>The ability to user define euro compositions individually for the Central, Inner, Outer and Motorway areas of London;</p> <p>The ability to enter up to at least 25,000 rows of input data, or up to 200,000 rows of input data, dependent upon selected output options;</p>

<sup>6</sup> <https://data.london.gov.uk/dataset/london-atmospheric-emissions-inventory-2013>

EFT Version / Issue	Release Date	Reason for Release / Summary of Changes
		<p>Bug fixes based upon user feedback on previous version 6.0.2:</p> <ul style="list-style-type: none"> <li>• Cosmetic changes to improve user experience, including the addition of a status bar when running the EFT, indicating EFT calculation progress;</li> <li>• User defined London Taxi euro proportions previously being incorrectly processed in emissions calculations; and</li> <li>• CO<sub>2</sub> emissions for buses/coaches in London previously reported as zero.</li> </ul>
<b>Issue 6.0.2</b>	November 2014	<p>Minor bug fixes and/or enhancements:</p> <ul style="list-style-type: none"> <li>• Error related to 100% HDV runtime error;</li> <li>• Error related to Alternative Vehicles Output for g/km/s and Annual Emissions.</li> </ul>
<b>Issue 6.0.1</b>	July 2014	<p>Minor bug fixes and/or enhancements:</p> <ul style="list-style-type: none"> <li>• Error in CO<sub>2</sub> Output: Output now as Tonnes/Year (not Kg/Year);</li> <li>• Traffic Format Selection: Selection of Alternative Technologies Format only allowed when Advanced Option “Alternative Technologies” is selected;</li> <li>• Header Cells for User Defined Proportions/User Size Distributions are now ‘fixed’ in the UserEuro sheet when ‘Populated With Defaults’ and do not change based on Input Data Area/Year.</li> </ul>
<b>Version 6.0</b>	June 2014	<p>NO<sub>x</sub> emission coefficients for Euro 5 and 6 diesel cars were taken from the EEA COPERT 4v10 emission calculation tool.</p> <p>NO<sub>x</sub> emission coefficients for Euro 5 and 6 LGVs (Vans) based on scaling of the diesel car emission factors.</p> <p>Hydrocarbon and PM speed emission equations for all vehicles updated using COPERT 4v10.</p> <p>Fleet composition updated, accounting for:</p> <ul style="list-style-type: none"> <li>• NAEI changes to uptake rates for newer vehicles and low emission vehicles based on information from DfT on</li> </ul>

EFT Version / Issue	Release Date	Reason for Release / Summary of Changes
		<p>projected sales of new cars and LGVs.</p> <ul style="list-style-type: none"> <li>Revised forecasts in the vehicle mix on different road types based on the January 2013 DfT traffic projections (RS2013);</li> <li>Revisions to traffic and fleet projections in London, based on information from TfL.</li> </ul> <p>Scaling factors updated to take into account the effects of changing fuel quality on emission factors, particularly the addition of small amounts of biodiesel and bioethanol at up to 10% strength blends in commercial petrol and diesel fuels. The factors are based on evidence of the effect of biofuels on pollutant emissions reviewed by the NAEI.</p> <p>Bug Fix:</p> <ul style="list-style-type: none"> <li>For the "Detailed Option 3" traffic format, corrected the functionality allowing users to specify the petrol/diesel split when the alternative technologies box is ticked.</li> </ul>
<b>Issue 5.2c</b>	January 2013	Added 'Advanced Options' to the Input Data worksheet allowing Advanced Users to provide a User Defined Euro Compositions and Alternative Technologies, and output relative percentage contributions from Euro Classes.
<b>Version 5.1.1</b>	June 2012	<p>Updated NO<sub>x</sub> emission factor and vehicle fleet information.</p> <p>NO<sub>x</sub> Emission Factors were taken from the EEA COPERT 4v8.1 emission calculation tool. Emission Factors for other pollutants were those published by the DfT on 29 June 2009.</p>
<b>Issue 4.2.2</b>	November 2010	<p>Bug Fix:</p> <ul style="list-style-type: none"> <li>Bugs were related to PM<sub>10</sub> and PM<sub>2.5</sub> emissions due to brake and tyre wear and only affected emissions calculated using the 'Traffic Fleet' option.</li> </ul>
<b>Issue 4.2.1</b>	October 2010	<p>Bug Fix:</p> <ul style="list-style-type: none"> <li>Bug occurred when modelling specific vehicle classes (e.g. buses only).</li> </ul>

<b>EFT Version / Issue</b>	<b>Release Date</b>	<b>Reason for Release / Summary of Changes</b>
<b>Issue 4.2</b>	June 2010	Updated version included advanced options for User Defined Traffic Fleet and Euro Composition information.
<b>Version 4.1</b>	February 2010	Updated vehicle exhaust emission factors based on DfT emissions factors published on 29 <sup>th</sup> June 2009. Also included brake and tyre wear for PM <sub>10</sub> and PM <sub>2.5</sub> .

Local Authorities are not required to redo any work already carried out using previous versions but are advised to use the latest version for all future work.

# Using the EFT

In order to use the EFT you must enable macros in your MS Excel security settings before opening the spreadsheet. When using Excel 2013 this can be found under: DEVELOPER<sup>7</sup> > MACRO SECURITY > MACRO SETTINGS > ENABLE ALL MACROS<sup>8</sup>. For versions of Excel prior to 2010, this can be found in: TOOLS > MACROS > SECURITY LEVEL > MEDIUM.

## Basic Operation

1. Go to the **Input Data** sheet using the tabs at the bottom of the workbook.
2. In the **Select Pollutants** box, select the pollutants for which you require emissions information.

Select Pollutants	
<input type="checkbox"/> NOx	<input type="checkbox"/> CO2
<input type="checkbox"/> PM10	<input type="checkbox"/> PM2.5

3. In the **Select Outputs** box, select your required output from the following categories:

Select Outputs	Additional Outputs
<input type="checkbox"/> Air Quality Modelling (g/km/s)	<input type="checkbox"/> Breakdown by Vehicle
<input type="checkbox"/> Emissions Rates (g/km)	<input type="checkbox"/> Source Apportionment
<input type="checkbox"/> Annual Link Emissions	<input type="checkbox"/> PM by Source

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<sup>7</sup> FILE>OPTIONS>CUSTOMIZE RIBBON>Tick DEVELOPER box on right hand side menu

<sup>8</sup> Ensure this option is turned off after using the EFT as potentially dangerous code can run



<b>Air Quality Modelling</b>	Selecting this option provides outputs as total emissions as g/km/s for the pollutant(s) selected.
<b>Emission Rates</b>	Selecting this option provides outputs as total emissions as g/km for the pollutant(s) selected.
<b>Annual Link Emissions</b>	Selecting this option generates emissions of each pollutant per year for each road link in kg/yr for all pollutants with the exception of CO <sub>2</sub> , which is in tonnes/yr. This option requires the length of each link to be specified.

4. In the **Additional Outputs** box, select your required output from the following categories:

<b>Breakdown by Vehicle</b>	All output options above are provided for each vehicle type on the road link for the possible 31 vehicle categories within the EFT, which include conventional and alternative vehicles types. If you specify the <b>Basic Split</b> option, then the emissions are based entirely on the vehicle fleet composition embedded in the EFT.
<b>Source Apportionment</b>	Selecting this option provides the relative percentage contribution from the specified vehicle types for the pollutant(s) selected.
<b>PM by Source</b>	Selecting this option generates a separate output sheet showing the proportion of particulate emissions from Exhaust, Brake, Tyre and Road Abrasion.

5. Enter **Area** using drop-down box. This incorporates area specific information from detailed traffic surveys on fleet composition. The areas available are:

- a. England (Not London);
- b. London;
- c. Northern Ireland;
- d. Scotland; and
- e. Wales.

6. Enter the **Year** for which you wish to predict emissions. Years 2017 to 2030 can be selected.

7. Select one of the following **Traffic Formats** which matches your available data, using the drop-down box:

Please Select from the Following Options:	
Area	England (not London)
Year	2017
Traffic Format	Detailed Option 2
Select 'Basic Split' or 'Detailed Option 1 to 3' or 'Alternative Technologies' above	

<b>Basic Split</b>	Assumes standard fleet composition for the selected road type, with specified %HDV (HGV and buses/coaches).
<b>Detailed Option 1</b>	Allows fleet input by %Car, %Taxi, %LGV, %HGV, %Bus and Coach, %Motorcycle.
<b>Detailed Option 2</b>	Allows fleet input by %Car, %Taxi, %LGV, %Rigid HGV, %Articulated HGV, %Bus and Coach, %Motorcycle.
<b>Detailed Option 3</b>	Allows fleet input by %Petrol Car, %Diesel Car, %Taxi, %LGV, %Rigid HGV, %Articulated HGV, %Bus and Coach, %Motorcycle.
<b>Alternative Technologies</b>	Allows fleet input by %Petrol Car, %Diesel car, %Taxi, %LGV, %Rigid HGV, %Articulated HGV, %Bus and Coach, %Motorcycle, %Full Hybrid Petrol Cars, %Plug-In Hybrid Petrol Cars, %Full Hybrid Diesel Cars, %Battery EV Cars, %FCEV Cars, %E85 Bioethanol Cars, %LPG Cars, %Full Hybrid Petrol LGV, %Plug-In Hybrid Petrol LGV, %Battery EV LGV, %FCEV LGV, %E85 Bioethanol LGV, %LPG LGV%, %B100 Rigid HGV, %B100 Artic HGV, %B100 Bus, %CNG Bus, %Biomethane Bus, %Biogas Bus, %Hybrid Bus, %FCEV Bus, %B100 Coach. A full description of each alternative technology type is available in the Glossary and Definitions table.

**Note 4:** *Taxi refers to Black Cabs or 'Hackney Cabs'. Following update to Version 9.0 of the EFT, fleet information for Taxis can be entered for any selected Area Type, i.e. not just for when London is selected, as was previously the case. The following considerations/key assumptions should be borne in mind when including Taxis in the EFT:*

- *This option should not be used to represent Minicabs or Uber vehicles. These vehicles should be included within the Car vehicle proportion;*
- *When using the EFT in basic split mode, a proportion of Taxis will be included within the vehicle fleet for the different areas of London. In areas outside of London, the NAEI vehicle fleet data does not include a proportion assigned to Taxis, therefore the user has to specify a proportion of Taxis within the fleet, otherwise Taxi emissions will not be output in basic split mode;*
- *Outside of London, Zero Emission Capable (ZEC) vehicles are not included within the Taxi Euro category fleet in any future years. It is possible, however, for a user to assign a proportion of the Taxi Euro category fleet to ZEC vehicles using the Euro compositions or Simple Entry Euro Compositions 'Advanced Options'. This may be helpful, e.g. if a user wishes to test policies which promote the uptake of ZEC Taxis;*
- *Emissions for Diesel LGV N1(III) have been used to represent vehicles assigned as Taxis both inside and outside of London, and emissions for Euro 6 Petrol LGV N1 (III) has been used to represent vehicles assigned as ZEC Taxis both inside and outside of London.*
- *In areas outside of London, the NAEI vehicle fleet data does not include Taxis, therefore outside of London the Taxi fleet information split by Euro category has been based on the Diesel LGV fleet;*
- *There is no engine failure rate available for Taxis. It is assumed that no proportion of any Taxis will emit at a higher rate than the assigned Euro class. Due to policies governing upkeep and vehicle age of licensed Taxis engine failure is less likely, therefore engine failure for Taxis is not accounted for within the EFT.*

**Note 5:** *When running the EFT with the Alternative Technologies Traffic Format then the vehicle category **Bus and Coach** category only refers to conventional diesel vehicles (unlike the standard Traffic Formats (i.e. Basic Split and Detailed Options 1-3) whereby default fleet assumptions include a proportion of alternative vehicles). There is no need to apply any correction to allow for alternative buses such as hybrids. For example, if your fleet is 100% buses, and 10% are hybrids, then you would enter 90 under “**Bus and Coach**” and 10 under “**Hybrid Bus**”. Users may also use the “Euro Compositions” or “Simple Entry Euro Compositions” Advanced Options to alter the proportion of Buses and Coaches.*

**Note 6:** If a user is running the EFT with the Alternative Technologies Traffic Format with Input Data in the London area then Note 5 also applies. Default assumptions used for standard Traffic Formats (i.e. Basic Split and Detailed Options 1-3) for Bus and Coaches incorporate the detailed TfL bus fleet which includes hybrid buses. The Advanced Option allows users to override these assumptions. The user can make further amendments to the conventional or hybrid fleet of London buses by also selecting the “Euro Compositions” or “Simple Entry Euro Compositions” Advanced Options.

8. Under the header **SourceID** enter a name for each of your roads (this can be anything you like). You can enter up to at least 25,000 road links, or up to 200,000 road links, dependent upon selected output options. The input SourceID doesn't have to be unique, although if there are duplicate names and the data are to be used in detailed dispersion modelling, this may cause errors.

9. Under the **Road Type** header, select a road type from the following list:

<b>Urban (Not London)</b>	Use this option for roads that are not motorways or similarly fast flowing roads in urban areas (by the DfT definition of an urban area with a population of 10,000 or more).
<b>Rural (Not London)</b>	Use this option for roads that are not motorways or similarly fast flowing roads outside urban areas.
<b>Motorway (Not London)</b>	Use this option for motorways and fast dual carriageways.
<b>London – Central</b>	Use this option for roads in 'Central London' as defined in the LAEI, which corresponds to the ULEZ <sup>5</sup> . The ULEZ covers the same area as the Central London Congestion Charge Zone (CCZ) implemented in February 2003 <sup>9</sup> .
<b>London – Inner</b>	Use this option for roads in 'Inner London' as defined in the LAEI <sup>10</sup> .

<sup>9</sup> Consists of some of the LAEI 1 km<sup>2</sup> grid squares in the London boroughs of Camden, City of London, Islington, Lambeth, Southwark, Tower Hamlets, and Westminster – see LAEI documentation for full details.

<sup>10</sup> Consists of some of the LAEI 1 km<sup>2</sup> grid squares in the London boroughs of Camden, Greenwich, Hackney, Hammersmith and Fulham, Haringey, Barnet, Islington, Kensington and Chelsea, Lambeth, Lewisham, Newham, Southwark, Tower Hamlets, Wandsworth, Westminster, Waltham Forest and Redbridge – see LAEI documentation for full details.

<b>London – Outer</b>	Use this option for roads in ‘Outer London’ as defined in the LAEI <sup>11</sup> .
<b>London – Motorway</b>	Use this option for the M25 motorway only. Other motorways and fast dual carriageways in Greater London should be defined as either ‘London – Inner’ or ‘London – Outer’ as appropriate.

**Note 7:** *The urban categorisation relates to the DfT definition of an urban area with a population of 10,000 or more. The London road types use the area categories defined in the LAEI<sup>6</sup>.*

10. Under **Traffic Flow** header, enter the number of vehicles on each road. This will usually be vehicles per day (i.e. AADT (Annual Average Daily Traffic) flow) but can be any time period up to one day (24-hours).
11. Enter the percentage of the total traffic flow of each vehicle type in the categories depending on the **Traffic Format** selected. If a vehicle category has no vehicles – a “0” must be entered. The sum of all categories must be equal to 100 for the EFT to run.
12. Under the **Speed (kph)** header, enter the average traffic speed on each road (this should relate to the same time period as the Traffic Flow). This can be between 5kph and 140kph. Where the maximum possible speed for a vehicle defined within emissions functions is below the specified speed, the emissions for the maximum speed in the range designated for that vehicle’s emission factors will be used. Similarly, where the speed entered is below the minimum speed allowed for that vehicle type, the minimum will be assumed<sup>12</sup>.
13. Under the **No of Hours** header, enter the time period used for the Traffic Flow (for example, if you entered the number of vehicles per day, this will be 24; but if you entered the number of vehicles per hour, this will be 1).

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<sup>11</sup> Consists of some of the 1 km<sup>2</sup> grid squares in the London boroughs of Enfield, Barking and Dagenham, Barnet, Bexley, Brent, Bromley, Croydon, Ealing, Harrow, Havering, Hillingdon, Hounslow, Kingston-upon-Thames, Merton, Richmond-upon-Thames, Redbridge, Sutton and Waltham Forest – see LAEI documentation for full details.

<sup>12</sup> Please consult the Data Sources provided in Appendix C for more information.

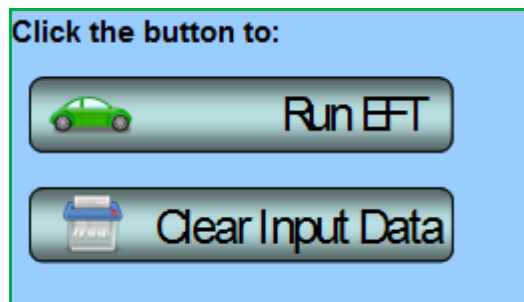
14. Under the **Link Length (km)** header enter the length of each road link. This is only required if either the **Annual Link Emissions** or **Annual Emissions Euro Split** (see Advanced Options on page 20) options have been selected.
15. Under the **Gradient** header a positive gradient between 0.1% and 30% can be entered, e.g. for a 3.5% gradient a value of 3.5 should be entered. It should be noted that whilst users can enter gradient values up to 30%, the impact on emissions is capped at a 6% gradient, i.e. if the user enters a gradient above 6%, the output emission will be equivalent to a 6% gradient. A gradient should only be entered if HDV emissions on links with variable road gradients are being considered. If the gradient field is left blank, the EFT will assume that the road link has a gradient equal to 0%, i.e. no gradient – consistent with previous versions of the EFT.
16. If a gradient value has been entered, then under the **Flow Direction** header a selection of either Up Hill, Down Hill or Two Way Traffic should be made in accordance with the road link entered. Where Two Way Traffic is selected, the EFT will assume 50% of the vehicle flow as inputted for that road link is travelling Up Hill, and 50% is travelling Down Hill. If assuming no gradient, i.e. a gradient value of 0%, there is no need to enter a value under the Flow Direction header; however, if one is entered, this will not affect the output emission.
17. Under the **Load** header a percentage load weighting of either 0%, 50% or 100% for HDV vehicles can be entered. A load weighting percentage should only be entered if calculating HDV emissions on links with variable loads. If the load field is left blank, the EFT will assume a load equal to 50% – consistent with previous versions of the EFT.
18. If you require the output to be saved in a new workbook, tick the box, and specify a file name next to **File Name**. The file will be generated in the directory where you have saved the EFT.

**Export Outputs**

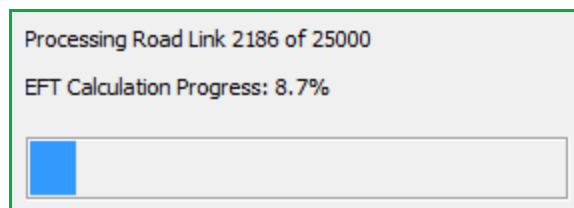
☒ Save Output to New Workbook

File Name:

19. Click on **Run EFT** to run the calculations, or **Clear Input Data** to recommence data entry.



20. Upon running the EFT, a status bar will be displayed indicating EFT calculation progress.



21. When calculations are complete, you will automatically be taken to the **Output** sheet of the workbook, where the requested emission information for each source name and pollutant will be displayed.

## Advanced Options

The following Advanced Options have been added to the EFT to provide greater choice in input options so that a user can more accurately represent the situation in their locality or test the impact of proposed intervention measures. It is recommended that these features are only used by experienced air quality modellers. If you are unfamiliar with using vehicle emissions factors and are not comfortable with the underlying methodology and limitations of these features, their use is not recommended as results may be misinterpreted. Further information can be obtained from the LAQM Helpdesk at <https://laqm.defra.gov.uk/helpdesks.html>.

Advanced Options	
<input type="checkbox"/> Euro Compositions	<input type="checkbox"/> NOx Annual Emissions Euro Split
<input type="checkbox"/> Simple Entry Euro Compositions	<input type="checkbox"/> PM10 Annual Emissions Euro Split
<input type="checkbox"/> Output % Contributions from Euro Classes	<input type="checkbox"/> PM2.5 Annual Emissions Euro Split
<input type="checkbox"/> Primary NO2 Fraction	<input type="checkbox"/> Fleet Projection Tool

### Advanced Options: Input

- *Euro Compositions*

This option allows users to specify the Euro classification of the fleet used in the emission calculations to more accurately reflect local conditions or test intervention measures under consideration. This may, for example, include testing the impact of implementing [Low Emissions Zone \(LEZs\)](https://laqm.defra.gov.uk/action-planning/measures/low-emission-zones.html)<sup>13</sup>.

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<sup>13</sup> <https://laqm.defra.gov.uk/action-planning/measures/low-emission-zones.html>



**Note 8:** By way of example, if a LEZ is proposed to restrict Heavy Duty Vehicles to Euro VI emissions standards, then the User Euro Proportions contained within the 'UserEuro' sheet of the EFT should be populated for the Rigid HGV, Artic HGV, Buses and Coaches categories accordingly. Any EFT outputs generated will then be representative of the modified emissions associated with the LEZ scenario.

The following procedure should be followed:

1. In the **Advanced Options** box of the **Input Data** sheet select **Euro Compositions**, and then click 'OK' on the pop-up notification.

If undertaking user defined emissions calculations for non-London areas, go to the **UserEuro** sheet that is generated. Alternatively, if undertaking user defined emissions calculations for London, go to the **UserEuro London** sheet that is generated. These display all of the Euro class splits that will be used in the calculation of emission factors. The boxes with headings in blue display the default proportions built into the toolkit based on the selected **Road Type**, **Area** and **Year**. Using the **Euro Compositions** option allows users to define the following information:

- a. The Euro proportions for the conventional fleet;
- b. Euro proportions for alternative technologies;
- c. Vehicle size distribution for the conventional fleet; and
- d. Vehicle size distribution for alternative technologies.

This is accomplished by manually populating the relevant User Defined orange boxes (boxes with headings in orange).

2. The boxes with headings in orange will be used in the calculations if the **Euro Compositions** option has been selected. The proportions in each box should always add up to 1 (100%). The text adjacent to each box confirms whether the proportions add up to 1. For London, there are further sub-divisions for each road type (Central, Inner, Outer, Motorway), and corresponding flags if the proportions in each road type do not equal one.

An error message will be shown if proportions in all orange boxes do not add up to 1 and the EFT will not run.

3. Users must populate the orange boxes with the default Euro class and size information first by clicking the '**Populate With Defaults for chosen Year and Area**' button before manually editing the orange boxes for those vehicle types they wish to alter.

Upon running the EFT, a message will be shown if the orange boxes were not first pre-populated with the default Euro class and size information asking if the user wishes to continue with the run.

4. Users must remember to enter the traffic fleet information for each road link on the **Input Data** sheet in order to run the model.

**Note 9:** Unlike Fleet Data entered into the Input Data worksheet which refer to vehicle mix by main vehicle type based on automatic or manual traffic count data, the Euro Class proportions entered into the UserEuro and UserEuro London worksheets must be based on more detailed information on the age mix of vehicles seen on the road, e.g. from Automatic Number Plate Recognition activity data, or based upon future Euro fleet projections.

5. The Euro compositions incorporated within the EFT are different for NO<sub>x</sub> and PM (and other pollutants) as in some cases the standards that apply differ. Therefore, your entered fleet data should be added in both sets of tables where necessary. Euro compositions for NO<sub>x</sub> are entered on the left hand side of the sheet, whilst users should scroll across to the right to input Euro compositions for PM.

**Note 10:** *Emission reductions that can be achieved by retrofitting HGVs with Selective Catalytic Reduction (SCR) systems have not been confirmed at this stage. As a result, if any proportion information is input next to boxes ending in SCRRF, the standard emission factor for the Euro class of that HGV will be used. It is intended that the EFT will be updated as and when further data becomes available on the likely effectiveness of such systems.*

**Note 11:** *Users are no longer required to consider failure rates when defining Euro compositions information in the Euro Compositions data input tables. Default consideration of catalyst and DPF failure rates is subsequently applied during the emissions calculation stage when running the EFT.*

- *Simple Entry Euro Compositions*

This option presents a more simplified input interface compared to the Euro Composition option, allowing users to specify the Euro classification of the fleet used in the emission calculations. The simple entry option is not available for the London area.

The following procedure should be followed:

1. In the **Advanced Options** box of the **Input Data** sheet select **Simple Entry Euro Compositions**, and then click 'OK' on the pop-up notification.
2. The boxes with headings in blue display the default proportions built into the toolkit based on the selected **Road Type**, **Area** and **Year**. As per the **Euro Compositions** option, the **Simple Entry Euro Composition** option allows users to define the following information:
  - a. The Euro proportions for the conventional fleet; and
  - b. Euro proportions for a simplified alternative technology fleet.

This is accomplished by manually populating the relevant User Defined orange boxes (boxes with headings in orange).

It is not possible to user define the vehicle size distributions using the **Simple Entry Euro Composition** option.

3. The boxes with headings in orange will be used in the calculations if the **Simple Entry Euro Compositions** option has been selected. The proportions in each box should always add up to 1 (100%). The text adjacent to each box confirms whether the proportions add up to 1.

An error message will be shown if proportions in all orange boxes do not add up to 1 and the EFT will not run.

4. Users must populate the orange boxes with the default Euro class and size information first by clicking the **Populate With Defaults** button before manually editing the orange boxes for those vehicle types they wish to alter.

Upon running the EFT, a message will be shown if the orange boxes were not first pre-populated with the default Euro class information asking if the user wishes to continue with the run.

5. Users must remember to enter the traffic fleet information for each road link on the **Input Data** sheet in order to run the model.

Notes 9, 10 and 11 - as detailed above - similarly apply to the **Simple Entry Euro Composition** option.

- *Fleet Projection Tool*

This option allows users to project their user defined Euro fleet information from a Base Year (e.g. a local Euro fleet derived from ANPR surveys) to a future Projection Year. This option is only available outside of London.

When using the Fleet Projection Tool, the following procedure should be followed:

1. In the **Advanced Options** box of the **Input Data** sheet select **Fleet Projection Tool**, and then click 'OK' on the pop-up notification.
2. Within the **Fleet Projection** sheet, users must first populate the red boxes with the default Euro class information for the selected Base Year (i.e. the year of the observed local Euro fleet data) using the **Pre-populate with Base Year Fleet** button, e.g. for a base year of 2019, first select 2019 from the Base Year drop down:

Base Year (Year of observed fleet data)	2019
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Then click the **Pre-populate with Base Year Fleet** button:

**Pre-populate with Base  
Year Fleet**

3. Proceed to then update the red boxes with user defined Euro information for the Base Year (i.e. ANPR derived Euro fleet data).
4. The **Projection Year** will automatically align to the Year as defined on the **Input Data** sheet, e.g. for a projection year of 2022:

<b>Projection Year</b>	<b>2022</b>
------------------------	-------------

5. Two options are available for projecting the local base year Euro fleet to the selected projection year – Option 1 and Option 2. Users should select the most appropriate projection method:

**Note 12:** Whilst both projection methods take into account the local baseline Euro fleet and the national fleet projections, there are differences between the two projection options:

- Option 1 assumes that the local fleet will follow the same profile as the national fleet, and that the difference between the two fleets is due to the local fleet being either “ahead” or “behind” the national fleet in terms of Euro class uptake. Therefore, the assumption is that the “gap” observed (in terms of number of years ahead or behind) between local and national fleets in the baseline year will remain the same in the Projection Year – i.e. if ANPR data show that the local fleet composition is currently cleaner than the national fleet composition (i.e. a higher proportion of newer Euro class vehicles in the fleet), the EFT will assume that this will remain the case in the Projection Year; and that the local fleet will remain “ahead” of the national fleet.
- Option 2 assumes that the local fleet composition will gradually shift and converge towards the national fleet composition and mirror it at a specific point in time (referred to as the “Convergence Year” hereafter) – assuming the convergence will occur a number of years after the Projection Year, and no later than 2030 (the latest year of assessment currently available in the EFT). Whilst similar to Option 1 in terms of first determining the gap between local and national fleets, the EFT then considers that this gap will eventually close towards the Convergence Year.

☒ Option 1

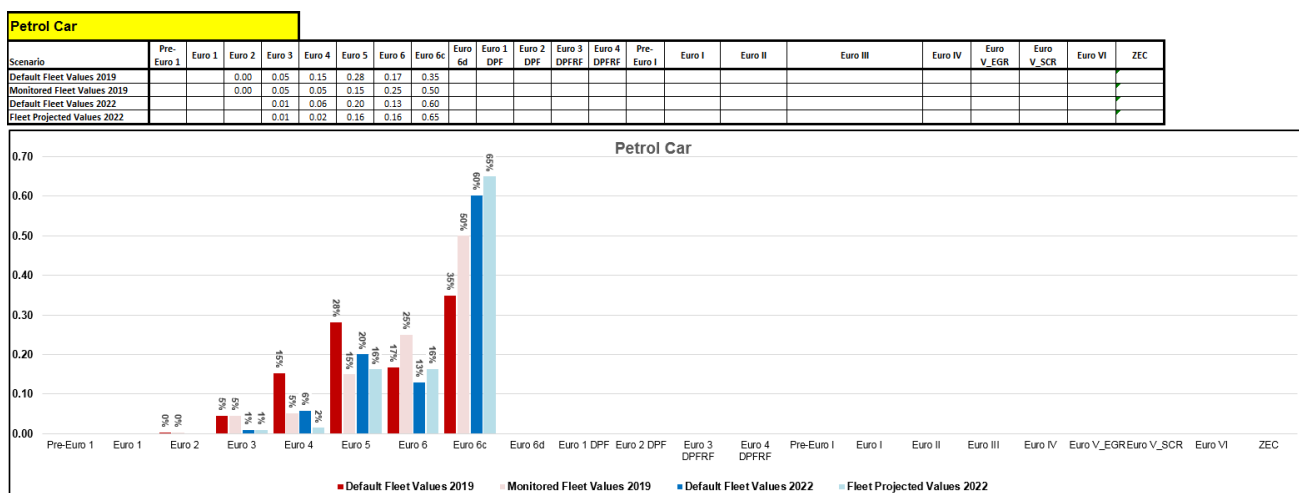
☐ Option 2

6. If using Option 2 it is necessary to select a Convergence Year. It is possible to select a convergence year for any year after the Projection Year, up to and including 2030, e.g. for a convergence year of 2030:

Convergence Year

2030

7. Projection will occur automatically based upon the information provided in Steps 1-6, with outputs provided in the corresponding **purple boxes**.
8. Users should confirm that the fleet projected values are acceptable using the selected projection method. To assist with this evaluation, a graphical representation of the default fleet and monitored local fleet proportions, for the user entered Base Year and Projection Year, is output within the EFT, e.g. for petrol cars:



**Note 13:** The vehicle type presented within the graph can be changed using the drop-down menu in the yellow box to the top left of the Scenario table. Once a vehicle type has been selected the corresponding data will be updated within the Scenario table and the graph.

9. To run the EFT with the projected fleet data (i.e. the Fleet Projected Values as output to the purple boxes), select the **Transpose Projected Fleet to SimpleUserEuro** button and click 'OK' on the pop-up notification. The **SimpleUserEuro** sheet will

become visible and the User Euro Proportions orange boxes within the **SimpleUserEuro** sheet will update with the Euro composition values as per the **Fleet Projection** boxes, with the orange boxes turning purple as a visual confirmation that the projected fleet has been copied across successfully:

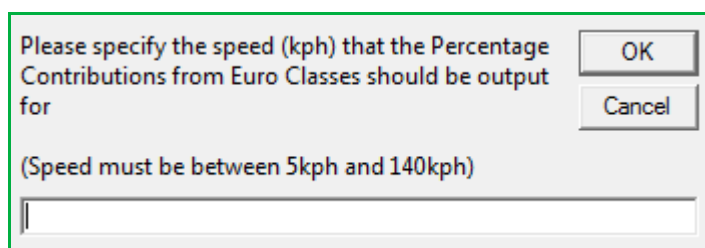
**Transpose Fleet Projected Values to  
SimpleUserEuro**

10. The EFT can then be run as normal, with the user able to first make additional changes as required on either the **SimpleUserEuro** and/or **UserEuro** sheets.

### Advanced Options: Output

- *Output % Contributions from Euro Classes*

Selecting this option provides outputs broken down into the percentage contribution from each Euro Class within each Vehicle Category. Results are output on the **Output\_Euro** sheet. Unlike other EFT outputs that are calculated based upon the speed information entered on the Input Data sheet, Output % Contributions from Euro Classes are only output for a single vehicle speed. The user will be prompted to enter this upon running the EFT – a speed between 5kph and 140kph must be entered.



**Note 14:** *If a user is running the EFT with the Output % Contributions from Euro Classes Advanced Option, all other EFT outputs selected for the model run will be based upon the speeds entered on the Input Data sheet on a link-by-link basis.*

**Note 15:** *Users are reminded that when using the Output % Contributions from Euro Classes Advanced Option, the output tables now separately report the proportion of total emissions attributable to failed catalysts and DPFs (within brackets), alongside the proportion of total emissions for each Euro category.*

- *Primary NO<sub>2</sub> Fraction*

Selecting this option outputs the fraction of primary NO<sub>2</sub> emissions (f-NO<sub>2</sub>) for the provided input traffic data. Results are output on the **Output\_f-NO2** sheet, with f-NO<sub>2</sub> values provided at the individual link level and also as an average weighted or not weighted by link length according to the contribution each vehicle type makes to total NO<sub>x</sub> emissions from traffic associated with all links entered as input. The output results are representative of the full set of road links as entered on the **Input Data** sheet, inclusive of any user defined information as entered using the **Euro Compositions or Simple Entry Euro Compositions Advanced Options**.

Where users consider the EFT calculated f-NO<sub>2</sub> outputs to be representative of the study area, these values can be used in place of provided default values, e.g. in the [NO<sub>x</sub> to NO<sub>2</sub> calculator](#)<sup>14</sup>.

The f-NO<sub>2</sub> values for each vehicle type that are employed as part of the calculation are consistent with those applied on the [NAEI](#)<sup>15</sup>.

- *NO<sub>x</sub> / PM<sub>10</sub> / PM<sub>2.5</sub> Annual Emissions Euro Split*

Selecting these options provides annual link emissions (kg/yr) outputs for NO<sub>x</sub>, PM<sub>10</sub> or PM<sub>2.5</sub> respectively, broken down by vehicle type and Euro emissions standard. This option allows for the rapid appraisal of intervention measures, e.g. CAZ implementation or Air Quality Action Plan (AQAP) measures, at the emissions level.

The output results are representative of the full set of road links as entered on the **Input Data** sheet, inclusive of any user defined information as entered using the **Euro Compositions or Simple Entry Euro Compositions Advanced Options**.

A detailed breakdown of emissions is provided on the **Output\_NOxEuroSplit**, **Output\_PM10EuroSplit** and **Output\_PM2.5EuroSplit** sheets for each Vehicle Type, further disaggregated by Road Type, Euro Emission Standard and corresponding Failed Catalysts or DPFs.

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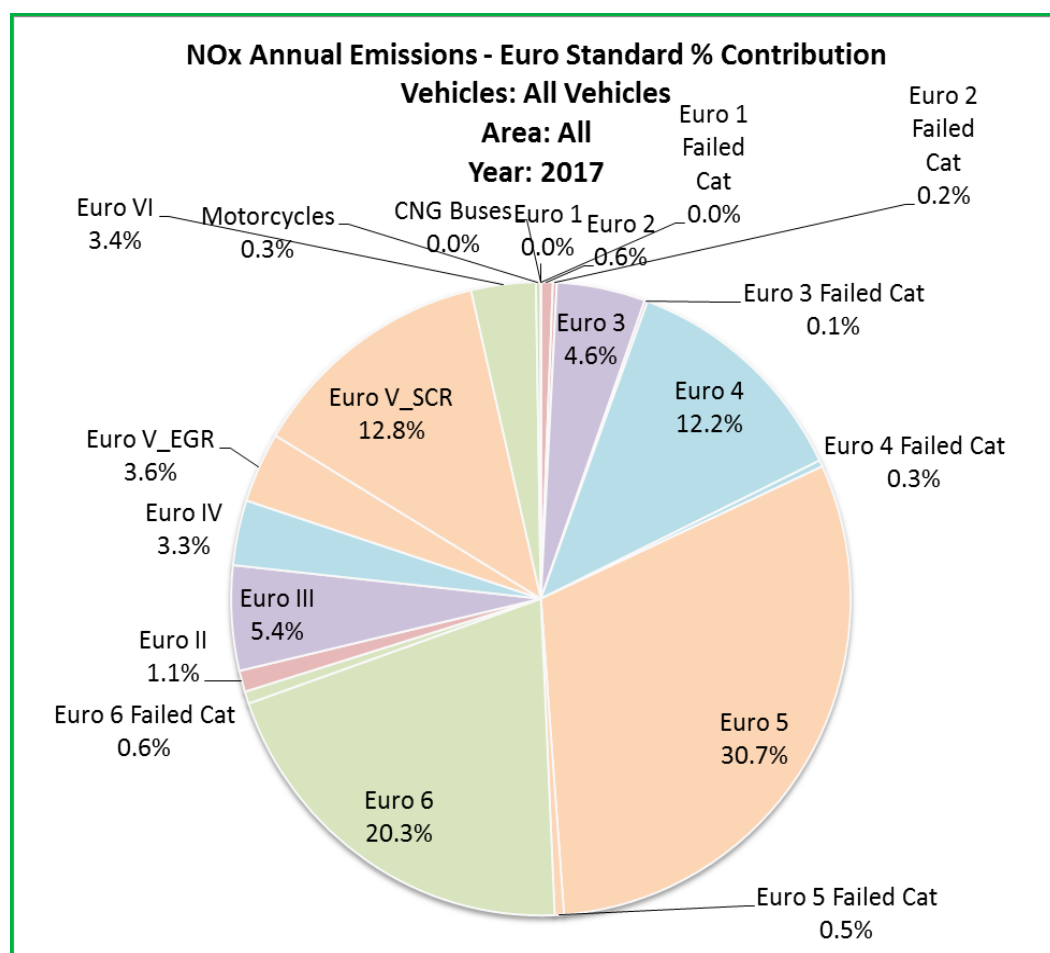
<sup>14</sup> <https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc>

<sup>15</sup> <http://naei.beis.gov.uk/data/ef-transport>



Road Type	Vehicle Category	Pre-Euro VI	Euro VI	Euro 2III	Euro 3III	Euro 4IV	Euro 5V	Euro 6VI	ZEC (Taxis)	Total
All	Motorcycles	-	-	-	-	-	-	-	-	-
All	Taxis	-	-	-	-	-	-	-	-	-
All	Cars	-	-	-	15.12	103.58	468.11	882.48	-	1,469.29
All	LGVs	-	-	-	0.46	2.54	12.50	21.20	-	36.70
All	HGVs	-	-	-	17.61	13.17	169.86	249.95	-	450.59
All	Buses and Coaches	-	-	-	-	-	-	-	-	-
All	All Vehicles	-	-	-	33.20	119.28	650.46	1,153.63	-	1,956.58

Output results are also graphically displayed in pie chart format for ease of interpretation.



The displayed information can be edited using the Vehicle Category and Road Type drop down menus located above the pie chart.

Vehicle Category	Area/Region
All Vehicles	All

# Glossary and Definitions

Term	Definition
<b>AADT</b>	Annual Average Daily Traffic
<b>AQAP</b>	Air Quality Action Plan
<b>CAZ</b>	Clean Air Zone
<b>CCZ</b>	Congestion Charge Zone
<b>CO<sub>2</sub></b>	Carbon dioxide
<b>DECC</b>	Department for Energy and Climate Change
<b>DfT</b>	Department for Transport
<b>EEA</b>	European Environment Agency
<b>EFT</b>	Emissions Factors Toolkit
<b>f-NO<sub>2</sub></b>	Fraction of primary NO <sub>2</sub> emissions
<b>HDV</b>	Heavy Duty Vehicles. It encompasses Rigid and Artic Heavy Goods Vehicles and Buses/Coaches
<b>HC</b>	Hydrocarbons
<b>LAEI</b>	London Atmospheric Emissions Inventory
<b>LAQM</b>	Local Air Quality Management
<b>LDV</b>	Light Duty Vehicles. It encompasses cars, taxis (black cabs London), and vans
<b>LEZ</b>	Low Emissions Zone
<b>NAEI</b>	National Atmospheric Emissions Inventory
<b>NO<sub>2</sub></b>	Nitric oxide (NO) is mainly derived from road transport emissions and other combustion processes such as the electricity supply industry. NO is not considered to be harmful to health. However, once released to the atmosphere, NO is usually very rapidly oxidized, mainly by ozone (O <sub>3</sub> ), to nitrogen dioxide (NO <sub>2</sub> ), which can be harmful to health
<b>NO<sub>x</sub></b>	NO <sub>2</sub> and NO are both oxides of nitrogen and together are referred to as nitrogen oxides (NO <sub>x</sub> )
<b>PM<sub>10</sub></b>	Particulate Matter less than 10µm in aerodynamic diameter
<b>PM<sub>2.5</sub></b>	Particulate Matter less than 2.5µm in aerodynamic diameter
<b>TfL</b>	Transport for London
<b>TRL</b>	Transport Research Laboratory
<b>ULEZ</b>	Ultra Low Emission Zone
<b>ZEC</b>	Zero Emission Capable

Vehicle Category	Full Description
<b>Full Hybrid Petrol Cars</b>	Petrol Hybrid Electric Vehicle Cars
<b>Plug-In Hybrid Petrol Cars</b>	Petrol Plug-in Hybrid Electric Vehicle Cars
<b>Full Hybrid Diesel Cars</b>	Diesel Hybrid Electric Vehicle Cars
<b>Battery EV Cars</b>	Battery Electric Vehicle Cars
<b>FCEV Cars</b>	Fuel Cell Electric Vehicle Cars
<b>E85 Bioethanol Cars</b>	Bioethanol Cars
<b>LPG Cars</b>	Liquefied Petroleum Gas Cars
<b>Full Hybrid Petrol LGV</b>	Petrol Hybrid Electric Vehicle LGVs
<b>Plug-In Hybrid Petrol LGV</b>	Petrol Plug-in Hybrid Electric Vehicle LGVs
<b>Battery EV LGV</b>	Battery Electric Vehicle LGVs
<b>FCEV LGV</b>	Fuel Cell Electric Vehicle LGVs
<b>E85 Bioethanol LGV</b>	Bioethanol LGVs
<b>LPG LGV</b>	Liquefied Petroleum Gas LGVs
<b>B100 Rigid HGV</b>	B100 Biodiesel Rigid HGVs
<b>B100 Artic HGV</b>	B100 Biodiesel Articulated HGVs
<b>B100 Bus</b>	B100 Biodiesel Buses
<b>CNG Bus</b>	Compressed Natural Gas Buses
<b>Biomethane Bus</b>	Biomethane Buses
<b>Biogas Bus</b>	Biogas Buses
<b>Hybrid Bus</b>	Hybrid Buses
<b>FCEV Bus</b>	Fuel Cell Electric Vehicle Buses
<b>B100 Coach</b>	B100 Biodiesel Coaches

# Local Air Quality Management Helpdesk

This Helpdesk has been set up on behalf of Defra and the Devolved Administrations to offer assistance to local authorities in managing air pollution in their area. The Helpdesk provides:

- Answers to local authorities' questions on air quality monitoring, modelling and emissions inventories;
- Information and guidance to assist local authorities in carrying out the LAQM Review and Assessment process required under Part IV of the Environment Act 1995; and
- Information and guidance to assist local authorities in preparing and implementing Air Quality Action Plans for improvement of local air quality.

Contact details for the LAQM Helpdesk can be found at <https://laqm.defra.gov.uk/helpdesks.html>.

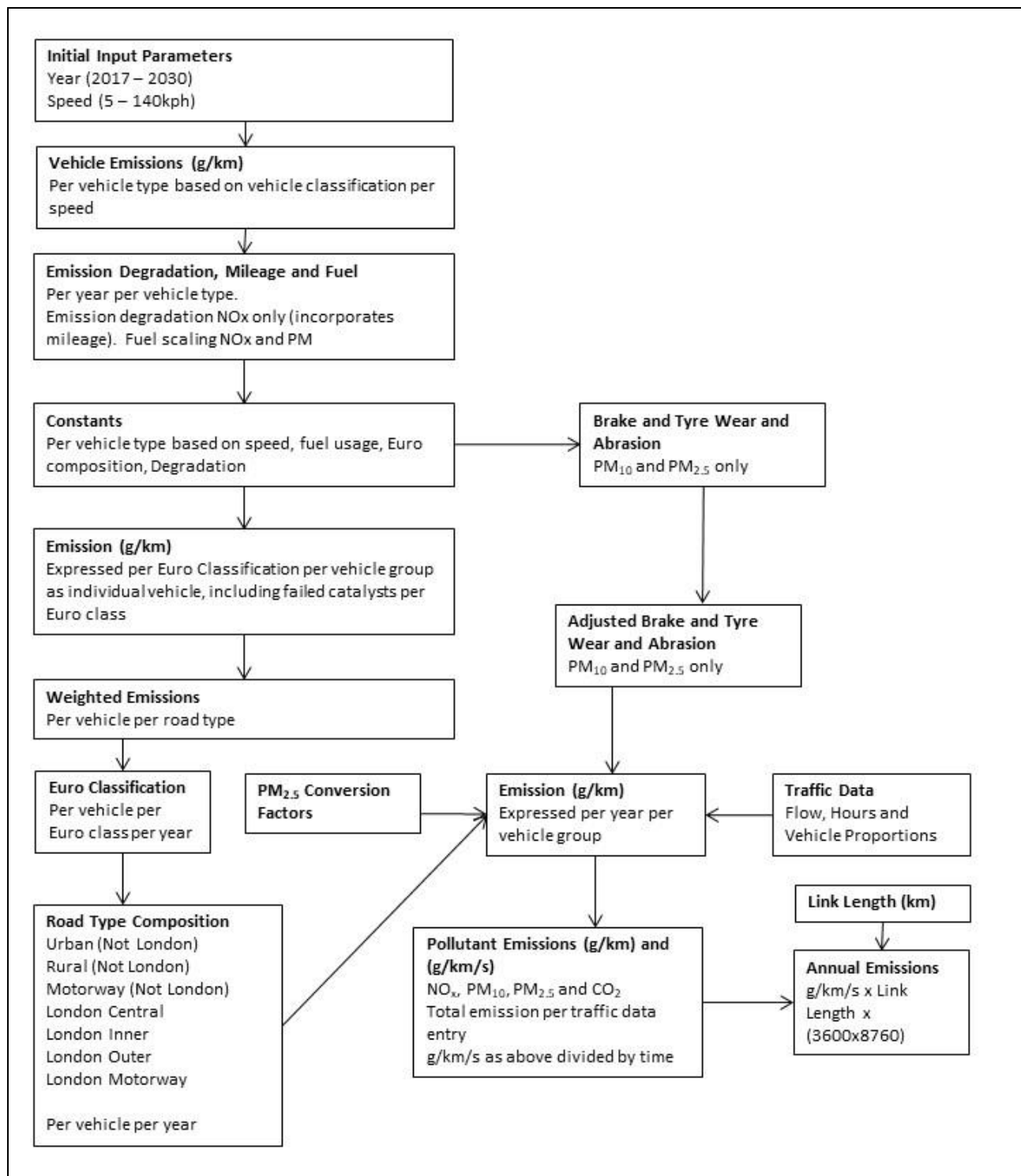
# Appendices

## Appendix A: Calculation Procedure

Emissions Generation										
The following documents the calculation procedure for generating the vehicle emissions in g/km, g/km/s and kg/year or tonnes/year (please see the User Guide for more information).										
<b>NOx COPERT 5</b>										
Vehicle Type	x	Emissions	x	Constants	x	Degradation <sup>#</sup>	x	Fuel	x	Euro Composition x Road Type = g/km
Vehicle Type	x	Emissions	x	Constants	x	Degradation <sup>#</sup>	x	Fuel	x	Euro Composition x Road Type / (3600 x hours) = g/km/s
Vehicle Type	x	Emissions	x	Constants	x	Degradation <sup>#</sup>	x	Fuel	x	Euro Composition x Road Type / (3600 x hours) x link length (km) x (3600x8760) / 1000 = kg/year
<sup>#</sup> Degradation in emissions due to accumulated mileage only calculated for some petrol cars and petrol LGVs.										
<b>NOx and PM COPERT 5</b>										
Vehicle Type	x	Emissions	x	Constants	x	Fuel	x	Euro Composition	x	Road Type = g/km
Vehicle Type	x	Emissions	x	Constants	x	Fuel	x	Euro Composition	x	Road Type / (3600 x hours) = g/km/s
Vehicle Type	x	Emissions	x	Constants	x	Fuel	x	Euro Composition	x	Road Type / (3600 x hours) x link length (km) x (3600x8760) / 1000 = kg/year
<b>CO<sub>2</sub> TRL/DFT</b>										
Vehicle Type	x	Emissions	x	Constants	x	Fuel	x	Euro Composition	x	Road Type = g/km
Vehicle Type	x	Emissions	x	Constants	x	Fuel	x	Euro Composition	x	Road Type / (3600 x hours) = g/km/s
Vehicle Type	x	Emissions	x	Constants	x	Fuel	x	Euro Composition	x	Road Type / (3600 x hours) x link length (km) x (3600x8760) / 1,000,000 = tonnes/year
The following documents the calculation procedure for generating the brake, tyre wear and road abrasion emissions for PM <sub>10</sub> and PM <sub>2.5</sub> in g/km and g/km/s.										
<b>PM<sub>10</sub></b>										
Vehicle Type	x	Brake Wear	Emissions	x	Constants	x	Euro Composition	x	Road Type	= g/km
Vehicle Type	x	Tyre Wear	Emissions	x	Constants	x	Euro Composition	x	Road Type	= g/km
Vehicle Type	x	Road Abrasion	Emissions	x	Constants	x	Euro Composition	x	Road Type	= g/km
Vehicle Type	x	Brake Wear	Emissions	x	Constants	x	Euro Composition	x	Road Type	/ (3600 x hours) = g/km/s
Vehicle Type	x	Tyre Wear	Emissions	x	Constants	x	Euro Composition	x	Road Type	/ (3600 x hours) = g/km/s
Vehicle Type	x	Road Abrasion	Emissions	x	Constants	x	Euro Composition	x	Road Type	/ (3600 x hours) = g/km/s
Vehicle Type	x	Brake Wear	Emissions	x	Constants	x	Euro Composition	x	Road Type	/ (3600 x hours) x link length (km) x (3600x8760) / 1000 = kg/year
Vehicle Type	x	Tyre Wear	Emissions	x	Constants	x	Euro Composition	x	Road Type	/ (3600 x hours) x link length (km) x (3600x8760) / 1000 = kg/year
Vehicle Type	x	Road Abrasion	Emissions	x	Constants	x	Euro Composition	x	Road Type	/ (3600 x hours) x link length (km) x (3600x8760) / 1000 = kg/year
<b>PM<sub>2.5</sub></b>										
PM <sub>10</sub> Exhaust	Emissions	x	1 = PM <sub>2.5</sub>	g/km						
PM <sub>10</sub> Brake Wear	Emissions	x	0.4 = PM <sub>2.5</sub>	g/km						
PM <sub>10</sub> Tyre Emissions	Emissions	x	0.7 = PM <sub>2.5</sub>	g/km						
PM <sub>10</sub> Road Abrasion	Emissions	x	0.54 = PM <sub>2.5</sub>	g/km						

Source: EFT Version 9 - Background Information

## Appendix B: EFT Process Map



## Appendix C: Data Sources

Source	Data Set	Date
<b>Ricardo-E&amp;E<sup>16</sup></b>	UK (Outside London) Fleet Compositions <sup>17</sup>	December 2018
	UK (Outside London) Euro Compositions <sup>17</sup>	December 2018
	UK (Outside London) Vehicle Size Proportions <sup>17</sup>	December 2018
	PM <sub>10</sub> to PM <sub>2.5</sub> Conversion <sup>18</sup>	July 2018
	Brake, Tyre and Road Abrasion PM assumptions	30/10/2009
	HDV SCR / EGR Proportions <sup>17</sup>	February 2017
	Treatment of Failed Catalytic Convertors	13/02/2012
	NO <sub>x</sub> Fuel Scaling <sup>19</sup>	03/10/2013
	PM Fuel Scaling <sup>19</sup>	13/12/2018
	Alternative Vehicle NO <sub>x</sub> and PM Emissions Assumptions <sup>20</sup>	06/02/2013
	Primary NO <sub>2</sub> Emission Factors for Road Transport <sup>15</sup>	March 2018
<b>EEA (COPERT 5)</b>	NO <sub>x</sub> vehicle emissions	September 2016
	PM vehicle emissions	September 2016
<b>TRL</b>	C vehicle emissions	07/08/2009
	Mileage Rates	07/08/2009
<b>TfL</b>	London Fleet Compositions <sup>21</sup>	December 2018
	London Euro Compositions <sup>21</sup>	December 2018
	London Vehicle Size Proportions <sup>21</sup>	December 2018

<sup>16</sup> Formerly Ricardo-AEA / AEA Technology.

<sup>17</sup> UK (outside of London) fleet projections and vehicle size proportions based on a set of traffic activity projections from the DfT (2015), rebased to 2016 NAEI. The methodology used in the NAEI can be found at [http://naei.beis.gov.uk/reports/reports?section\\_id=2](http://naei.beis.gov.uk/reports/reports?section_id=2), whilst the NAEI UK fleet projection dataset can be found at <http://naei.beis.gov.uk/data/ef-transport>

<sup>18</sup> Based on information from the EMEP/EEA Emissions Inventory Guidebook (2016), <https://www.eea.europa.eu/publications/emep-eea-guidebook-2016>

<sup>19</sup> Factors used in NAEI UK road transport emission projections derived from the effects of fuel quality on emission factors, including effect of low-strength biofuel blends. Biofuel effects report at [https://uk-air.defra.gov.uk/assets/documents/reports/cat15/0901151441\\_NAEI\\_Road\\_Transport\\_Biofuels\\_report\\_2008\\_v1.pdf](https://uk-air.defra.gov.uk/assets/documents/reports/cat15/0901151441_NAEI_Road_Transport_Biofuels_report_2008_v1.pdf)

<sup>20</sup> [http://naei.beis.gov.uk/resources/NAEI\\_Emission\\_factors\\_for\\_alternative\\_vehicle\\_technologies\\_Final\\_Feb\\_13.pdf](http://naei.beis.gov.uk/resources/NAEI_Emission_factors_for_alternative_vehicle_technologies_Final_Feb_13.pdf)

<sup>21</sup> London fleet projections and vehicle size proportions based on information provided by TfL. The NAEI London fleet projection dataset can be found at <http://naei.beis.gov.uk/data/ef-transport>

Source	Data Set	Date
	Alternative Vehicle CO <sub>2</sub> Scaling Factors <sup>22</sup>	June 2016

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<sup>22</sup> Factors are consistent with those applied in the LAEI 2013. However, in the absence of any clear evidence, CO<sub>2</sub> scaling factors for the Biomethane Bus and Biogas Bus categories are assumed to be equal to those for CNG Buses. Also, LAEI factors Biodiesel have been applied to B100 categories within the EFT.