



Department
for Environment
Food & Rural Affairs

Emissions Factors Toolkit v7.0

User Guide

July 2016



Department of
**Agriculture, Environment
and Rural Affairs**

www.daera-ni.gov.uk



Llywodraeth Cymru
Welsh Government



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Change Log

Version	Date	Details of Changes Made
1	July 2016	Released with EFT 7.0

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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.

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](#)¹. It is of particular interest and use in the assessment of policy interventions on road traffic emissions such as the Clean Air Zones (CAZs) that form part of the [UK national plan on compliance with EU Limit Values](#)². It is a tool that allows users to calculate road vehicle pollutant emission rates for oxides of nitrogen (NO_x) and Particulate Matter (PM - PM₁₀ and PM_{2.5}), for a specified year, road type, vehicle speed and vehicle fleet composition. Carbon dioxide (CO₂) 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.

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

² <https://www.gov.uk/government/collections/air-quality-plan-for-nitrogen-dioxide-no2-in-uk-2015>

The Emissions Factors Toolkit (EFT)

About the EFT

The latest EFT can be downloaded from the [LAQM website](#)³. It provides emission rates for 2013 through to 2030 and takes into consideration the following information available from the [National Atmospheric Emissions Inventory \(NAEI\)](#)⁴:

- 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;
- 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 the following London-specific information prepared by Transport for London (TfL) as part of the [London Atmospheric Emissions Inventory \(LAEI\)](#)⁵:

- 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/year or tonnes/year from the total traffic for NO_x, PM₁₀, PM_{2.5} and CO₂;
- calculation of PM₁₀ and PM_{2.5} from tyre and brake wear and road abrasion emission sources;

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

⁴ <http://naei.defra.gov.uk/>

⁵ <http://data.london.gov.uk/dataset/london-atmospheric-emissions-inventory-2013>

- 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 Vehicles Types		Alternative Vehicle Types	
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 (London only) ^a	Plug-In Hybrid Petrol LGV	Hybrid Bus	
	Battery EV LGV	FCEV Bus	
	FCEV LGV	B100 Coach	

^a Zero Emission Capable (ZEC) Taxis are included within this vehicle category.

All calculations are based on the average fleet composition for a given year and for a given road type (urban, rural, motorway) and whether the road is in London or outside London. However, advanced options are also available to 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 7)

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 Input Data are re-run using the latest Version/Issue.

Defra and the Devolved Administrations have provided an updated Emissions Factors Toolkit (Version 7) 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 7 of the EFT, through close liaison with the NAEI and LAEI teams, Road Traffic Emission Projection assumptions for NO_x and PM have recently undergone technical peer review.

Version 7 incorporates:

1. updated NO_x 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;
2. streamlining of pollutants – removal of Hydrocarbons as an option in the EFT;
3. CO₂ tailpipe emissions associated with alternative fuelled vehicles are included in emissions calculations, in addition to those from petrol and diesel vehicles. The applied CO₂ scaling factors for alternative technology vehicles are consistent with those applied in the LAEI⁵. The ability to output CO₂ when Alternative Technologies advanced user input option is selected has also been added;
4. 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;

Note 2: Users should be aware that the impact of the Ultra Low Emission Zone (ULEZ) is already taken into account within the default London fleet composition data.

5. the ability to user define euro compositions individually for the Central, Inner, Outer and Motorway areas of London;
6. the ability to enter up to 25,000 rows of input data;
7. bug fixes based upon user feedback on previous version 6.0.2:
 - cosmetic changes to improve user experience, including the addition of a status bar when running the EFT, indicating EFT calculation progress;
 - user defined London Taxi euro proportions previously being incorrectly processed in emissions calculations; and
 - CO₂ emissions for buses/coaches in London previously reported as zero.

Note 3: CO₂ emissions calculated by the EFT are those associated with tailpipe emissions from petrol and diesel vehicles only. While new alternative fuelled vehicles, such as hybrids, are now included within the national fleet, CO₂ emissions from these vehicles are not included as the EFT does not calculate the full impact of these technologies on CO₂, for example from electricity or hydrogen production, etc.

Tools are available for calculating Greenhouse Gas (GHG) emissions from a range of fuels and technologies, such as Defra/DECC GHG Conversion Factors at:

<https://www.gov.uk/government/publications/environmental-reporting-guidelines-including-mandatory-greenhouse-gas-emissions-reporting-guidance>

and

<https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting>

Details of Historic Versions of the EFT

EFT Version / Issue	Release Date	Reason for Release / Summary of Changes
Version 7.0 (Current Version)	July 2016	See “Details of the Current EFT” page 4.
Issue 6.0.2	November 2014	Minor bug fixes and/or enhancements: <ul style="list-style-type: none"> • Error related to 100% HDV runtime error; • Error related to Alternative Vehicles Output for g/km/s and Annual Emissions.
Issue 6.0.1	July 2014	Minor bug fixes and/or enhancements: <ul style="list-style-type: none"> • Error in CO₂ Output: Output now as Tonnes/Year (not Kg/Year); • Traffic Format Selection: Selection of Alternative Technologies Format only allowed when Advanced Option “Alternative Technologies” is selected; • 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.
Version 6.0	June 2014	NOx emission coefficients for Euro 5 and 6 diesel cars were taken from the EEA COPERT 4v10 emission calculation tool. NOx emission coefficients for Euro 5 and 6 LGVs (Vans) based on scaling of the diesel car emission factors. Hydrocarbon and PM speed emission equations for all vehicles updated using COPERT 4v10. Fleet composition updated, accounting for: <ul style="list-style-type: none"> • NAEI changes to uptake rates for newer vehicles and low emission vehicles based on information from DfT on projected sales of new cars and LGVs. • revised forecasts in the vehicle mix on different road types based on the January 2013 DfT traffic projections (RS2013); • revisions to traffic and fleet projections in London, based on

EFT Version / Issue	Release Date	Reason for Release / Summary of Changes
		<p>information from TfL.</p> <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"> 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.
Issue 5.2c	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.
Version 5.1.1	June 2012	<p>Updated NO_x emission factor and vehicle fleet information.</p> <p>NO_x 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>
Issue 4.2.2	November 2010	<p>Bug Fix:</p> <ul style="list-style-type: none"> Bugs were related to PM₁₀ and PM_{2.5} emissions due to brake and tyre wear and only affected emissions calculated using the 'Traffic Fleet' option.
Issue 4.2.1	October 2010	<p>Bug Fix:</p> <ul style="list-style-type: none"> Bug occurred when modelling specific vehicle classes (e.g. buses only).
Issue 4.2	June 2010	Updated version included advanced options for User Defined Traffic Fleet and Euro Composition information.
Version 4.1	February 2010	Updated vehicle exhaust emission factors based on DfT emissions factors published on 29 th June 2009. Also included brake and tyre wear for PM ₁₀ and PM _{2.5} .

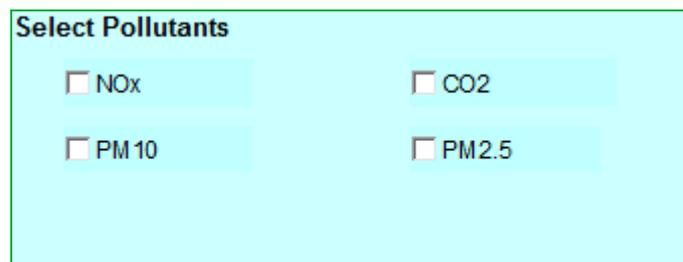
Local Authorities are not required to redo any work already carried out using previous versions but are advised to use the latest version for future work.

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 2010 this can be found under: DEVELOPER⁶ > MACRO SECURITY > MACRO SETTINGS > ENABLE ALL MACROS⁷. For previous versions of Excel 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

⁶ FILE>OPTIONS>CUSTOMIZE RIBBON>Tick DEVELOPER box on right hand side menu

⁷ Ensure this option is turned off after using the EFT as potentially dangerous code can run

Air Quality Modelling	Selecting this option provides outputs as total emissions as g/km/s for the pollutant(s) selected.
Emission Rates	Selecting this option provides outputs as total emissions as g/km for the pollutant(s) selected.
Annual Link Emissions	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 ₂ , 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:

PM by Source	Selecting this option generates a separate output sheet showing the proportion of particulate emissions from Exhaust, Brake, Tyre and Road Abrasion.
Source Apportionment	Selecting this option provides the relative percentage contribution from the specified vehicle types for the pollutant(s) selected.
Breakdown by Vehicle	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 Basic Split option, then the emissions are based entirely on the vehicle fleet composition embedded in the EFT.

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 2013 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	2013
Traffic Format	Basic Split
Select 'Basic Split' or 'Detailed Option 1 to 3' above	

Basic Split	Assumes standard fleet composition for the selected road type, with specified %HDV (HGV and buses/coaches).
Detailed Option 1	Allows fleet input by %Car, %Taxi, %LGV, %HGV, %Bus and Coach, %Motorcycle.
Detailed Option 2	Allows fleet input by %Car, %Taxi, %LGV, %Rigid HGV, %Articulated HGV, %Bus and Coach, %Motorcycle.
Detailed Option 3	Allows fleet input by %Petrol Car, %Diesel car, %Taxi, %LGV, %Rigid HGV, %Articulated HGV, %Bus and Coach, %Motorcycle.

Note 4: Taxi refers to Black Cabs and can only be entered when London is selected in Area Type.

8. Under the header **SourceID** enter a name for each of your roads (this can be anything you like). You can enter up to 25,000 road links. The 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:

Urban (Not London)	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).
Rural (Not London)	Use this option for roads that are not motorways or similarly fast flowing roads outside urban areas.
Motorway (Not London)	Use this option for motorways and fast dual carriageways.
London – Central	Use this option for roads in ‘Central London’ as defined in the LAEI, which corresponds to the Ultra Low Emission Zone (ULEZ) ⁸ . The ULEZ covers the same area as the Central London Congestion Charge Zone (CCZ) implemented in February 2003 ⁹ .
London – Inner	Use this option for roads in ‘Inner London’ as defined in the LAEI ¹⁰ .
London – Outer	Use this option for roads in ‘Outer London’ as defined in the LAEI ¹¹ .
London – Motorway	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 5: 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.

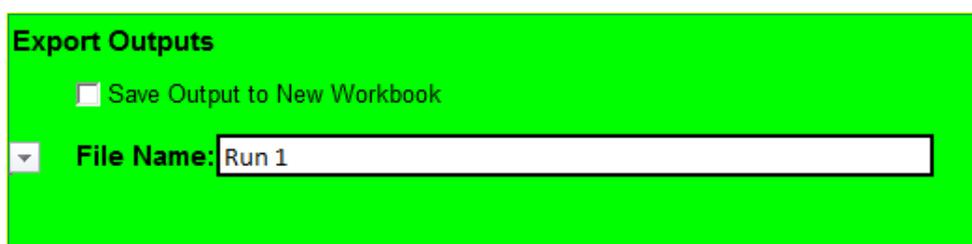
⁸ <https://tfl.gov.uk/modes/driving/ultra-low-emission-zone>

⁹ Consists of some of the LAEI 1 km² grid squares in the London boroughs of Camden, City of London, Islington, Lambeth, Southwark, Tower Hamlets, and Westminster – see LAEI documentation for full details.

¹⁰ Consists of some of the LAEI 1 km² 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.

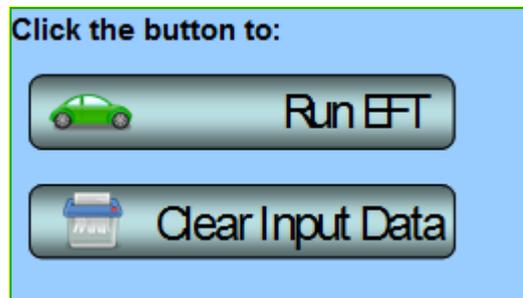
¹¹ Consists of some of the 1 km² grid squares in the London boroughs of Enfield, Barking and Dagenham, Barnet, Bexley, Brent, Bromley, Croydon, Ealing, Harrow, Havering, Hillingdon, Hounslow, Kingston-upon-Thames, Merton, Richmond-upon-Thames, Redbridge, Sutton and Waltham Forest – see LAEI documentation for full details.

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 assumed¹².
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).
14. Under the **Link Length (km)** enter the length of each road link. This is **only required** if the **Annual Link Emissions** option has been specified.
15. 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.

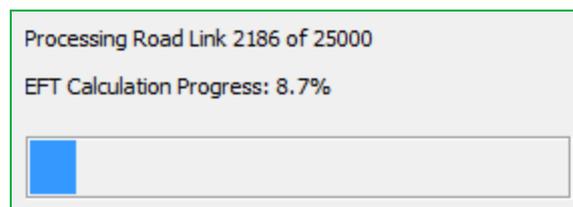


¹² Please consult the Data Sources provided in Appendix C for more information.

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



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



18. 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 <http://laqm.defra.gov.uk/helpdesks.html>.

Advanced Options	
<input type="checkbox"/>	Euro Compositions
<input type="checkbox"/>	Alternative Technologies
<input type="checkbox"/>	Output % Contributions from Euro Classes

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 \(LEZs\)](#)¹³.

Note 6: *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.*

¹³ <http://laqm.defra.gov.uk/action-planning/measurements/low-emission-zones.html>

The following procedure should be followed:

1. In the **Advanced Options** box of the **Input Data** sheet select **Euro Compositions**. 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.

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 User Defined Euro Proportions with Default Year and Area Euro Proportions**' 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.

IMPORTANT: 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.

5. The Euro compositions incorporated within the EFT are different for NO_x 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.

Note 7: *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.*

- *Alternative Technologies*

Should you wish to predict the impact on emissions of introducing vehicles with alternative technologies to the traffic fleet under consideration, then the following procedure should be followed:

1. In the **Advanced Options** box of the **Input Data** sheet select **Alternative Technologies**.
2. Select **Alternative Technologies** in the drop-down box adjacent to **Traffic Format**.

3. Under **Traffic Flow** header, enter the number of vehicles on each road. This will usually be vehicles per day (i.e. AADT flow) but can be any time period up to one day (24-hours).

4. Enter the percentage of the total traffic flow of each vehicle type in all categories. If a vehicle category has no vehicles – a “0” must be entered. The following additional vehicle categories are available:

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

5. Enter the **Speed (kph)**, **No of Hours** and **Link Length (km)** details as normal.

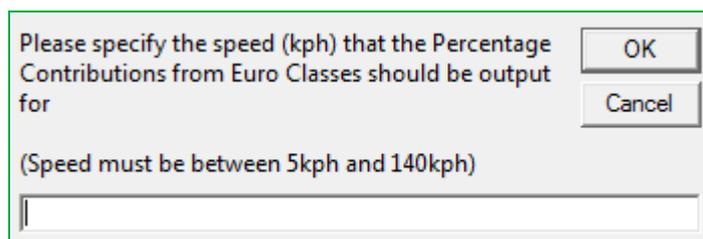
Note 8: When running the EFT with the Advanced Option for Alternative Technology Vehicles then the vehicle category **Bus and Coach** category only refers to conventional diesel vehicles (unlike the standard Traffic Formats (Basic, Options 1-3) whereby default fleet assumptions include some alternative 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” Advanced Option to alter the proportion of Buses and Coaches.

Note 9: If a user is running the EFT with the Advanced Options for Alternative Technology Vehicles with the London area then Note 8 also applies. Default assumptions used for standard Traffic Formats (Basic, Options 1 -3) for Bus and Coaches incorporate the detailed TfL bus fleet which includes hybrid buses. The Advanced Option allows users to overwrite these assumptions. The user can make further amendments to the conventional or hybrid fleet of London buses by also selecting the “Euro Compositions” Advanced Option.

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. 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.



Please specify the speed (kph) that the Percentage Contributions from Euro Classes should be output for

(Speed must be between 5kph and 140kph)

OK

Cancel

Input field for speed (kph)

Note 10: *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.*

Glossary

Term	Definition
AADT	Annual Average Daily Traffic
CAZ	Clean Air Zone
CCZ	Congestion Charge Zone
CO₂	Carbon dioxide
EEA	European Environment Agency
EFT	Emissions Factors Toolkit
DfT	Department for Transport
DECC	Department for Energy and Climate Change
HDV	Heavy Duty Vehicles. It encompasses Rigid and Artic Heavy Goods Vehicles and Buses/Coaches
HC	Hydrocarbons
LAEI	London Atmospheric Emissions Inventory
LAQM	Local Air Quality Management
LDV	Light Duty Vehicles. It encompasses cars, taxis (black cabs London), and vans
NAEI	National Atmospheric Emissions Inventory
NO₂	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 ₃), to nitrogen dioxide (NO ₂), which can be harmful to health
NO_x	NO ₂ and NO are both oxides of nitrogen and together are referred to as nitrogen oxides (NO _x)
PM₁₀	Particulate Matter less than 10µm in aerodynamic diameter
PM_{2.5}	Particulate Matter less than 2.5µm in aerodynamic diameter
TfL	Transport for London
TRL	Transport Research Laboratory
ULEZ	Ultra Low Emission Zone

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 Local Air Quality 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 Local Air Quality Management Helpdesk can be found at <http://laqm.defra.gov.uk/helpdesks.html>.

Appendices

Appendix A: Calculation Procedure

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).

NOx COPERT 4v11

Vehicle Type	x	Emissions	x	Constants	x	Degradation [‡]	x	Fuel	x	Euro Composition	x	Road Type	=	g/km
Vehicle Type	x	Emissions	x	Constants	x	Degradation [‡]	x	Fuel	x	Euro Composition	x	Road Type	/	(3600 x hours) = g/km/s
Vehicle Type	x	Emissions	x	Constants	x	Degradation [‡]	x	Fuel	x	Euro Composition	x	Road Type	/	(3600 x hours) x link length (km) x (3600x8760) / 1000 = kg/year

[‡]Degradation in emissions due to accumulated mileage only calculated for some petrol cars and petrol LGVs.

NOx and PM COPERT 4v11

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

CO₂ TRL/DFT

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

PM_{2.5}

PM ₁₀ g/km	x	0.95 = PM _{2.5} g/km
PM ₁₀ g/km/s	x	0.95 = PM _{2.5} g/km/s

The following documents the calculation procedure for generating the brake, tyre wear and road abrasion emissions for PM₁₀ and PM_{2.5} in g/km and g/km/s

PM₁₀

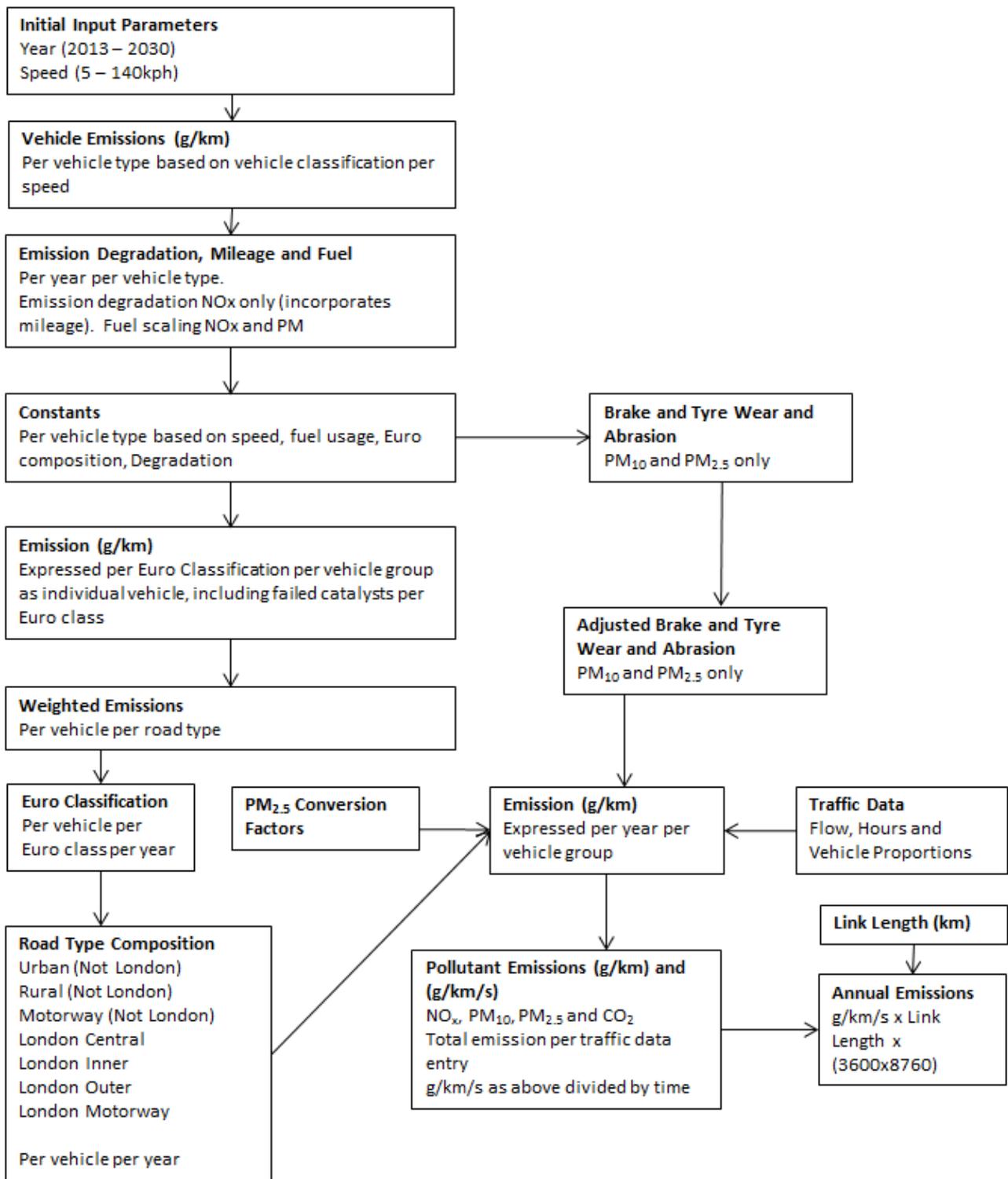
Vehicle Type	x	Brake Wear	Emissions	x	Constants	x	Euro Composition	x	Road Type	=	g/km
Vehicle Type	x	Tyre Wear	Emissions	x	Constants	x	Euro Composition	x	Road Type	=	g/km
Vehicle Type	x	Road Abrasion	Emissions	x	Constants	x	Euro Composition	x	Road Type	=	g/km
Vehicle Type	x	Brake Wear	Emissions	x	Constants	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

PM_{2.5}

PM ₁₀ Brake Wear	Emissions	x	0.4 = PM _{2.5} g/km
PM ₁₀ Tyre Emissions	Emissions	x	0.7 = PM _{2.5} g/km
PM ₁₀ Road Abrasion	Emissions	x	0.54 = PM _{2.5} g/km

Source: EFT Version 7 - Background Information

Appendix B: EFT Process Map



Appendix C: Data Sources

Source	Data Set	Date
Ricardo-E&E ¹⁴	UK (Outside London) Euro Compositions ¹⁵	03/10/2013
	Fleet Compositions per Road Type (Outside London) ¹²	03/10/2013
	Vehicle Size Proportions ¹¹	03/10/2013
	PM ₁₀ to PM _{2.5} Conversion ¹⁶	23/05/2010
	PM ₁₀ Assumptions	11/08/2009
	Brake, Tyre and Road Abrasion PM assumptions ¹³	30/10/2009
	HDV SCR/EGR Proportions ¹³	13/02/2012
	Treatment of Failed Catalytic Convertors ¹¹	13/02/2012
	Fuel Scaling ¹⁷	03/10/2013
	Alternative Vehicle NO _x and PM Emissions Assumptions ¹⁸	06/02/2013
EEA (COPERT 4v11)	NO _x vehicle emissions	July 2014
	PM vehicle emissions	July 2014
TRL	C vehicle emissions	07/08/2009
	Mileage Rates	07/08/2009
TfL	London Fleet Compositions	June 2016
	London Euro Compositions	June 2016
	Alternative Vehicle CO ₂ Scaling Factors ¹⁹	June 2016

¹⁴ Formerly Ricardo-AEA / AEA Technology. Data listed here are data developed for or by the 2011 version of the National Atmospheric Emissions Inventory and NAEI UK road transport emission projections (Base 2013 version). The methodology used in the NAEI can be found at http://naei.defra.gov.uk/reports/reports?section_id=2

¹⁵ Fleet projections based on fleet turnover model used in NAEI UK road transport emission projections (Base 2013 version) using vehicle sales projections provided by DfT (2013)

¹⁶ Assumptions used in the NAEI based on information from the EMEP/EEA Emissions Inventory Guidebook (2013), <http://www.eea.europa.eu/publications/emep-eea-guidebook-2013>

¹⁷ Factors used in NAEI UK road transport emission projections (Base 2013 version) derived from the effects of fuel quality on emission factors, including effect of low-strength biofuel blends. Biofuel effects report at http://uk-air.defra.gov.uk/reports/cat15/0901151441_NAEI_Road_Transport_Biofuels_report_2008_v1.pdf

¹⁸ http://naei.defra.gov.uk/resources/NAEI_Emission_factors_for_alternative_vehicle_technologies_Final_Feb_13.pdf

¹⁹ Factors are consistent with those applied in the LAEI 2013. However, in the absence of any clear evidence, CO₂ 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.