Emissions Factors Toolkit v8.0

User Guide

November 2017

Change Log

Version	Date	Details of Changes Made
1	November 2017	Released with EFT 8.0

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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 8 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[1]. It is of particular interest for use in the assessment of 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[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 - PM_{10} and $PM_{2.5}$), for a specified year, road type, vehicle speed and vehicle fleet composition. Carbon dioxide (CO_2) 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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[1] http://www.legislation.gov.uk/ukpga/1995/25/contents

[2] 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](#)[3]. It provides emission rates for 2015 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 (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 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(or tonnes)/year from the total traffic for NO_x, PM_{10}, $PM_{2.5}$ and CO_2;

- Calculation of PM_{10} and $PM_{2.5}$ from tyre and brake wear and road abrasion emission sources;

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[3] https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html

[4] http://naei.beis.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 Vehicle Types	Alternative Vehicle Types[b]	
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.		
[b] 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_x, PM_{10} and $PM_{2.5}$; and

- Calculation of the fraction of primary NO_2 emissions (f-NO_2) 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 8)

> *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 lastest Version/Issue of the Tool.*

Defra and the Devolved Administrations have provided an updated Emissions Factors Toolkit (Version 8) 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 8 of the EFT, through close liaison with the NAEI and LAEI teams, Road Traffic Emission Projection assumptions for NO_x and PM have undergone technical peer review.

Version 8 incorporates:

1. Updated NO_x and PM speed emission coefficient equations, taken from the European Environment Agency (EEA) COPERT 5 emission calculation tool[6] (first released September 2016), including Euro 6 subcategories;

2. Ability for the user to define LGV petrol / diesel percentage split via the Euro Compositions advanced option;

3. 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;

4. New NO_x, PM_{10} and $PM_{2.5}$ 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;

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[6] http://emisia.com/products/copert/copert-5

> *Note 2: Data output by the new 'Annual Emissions Euro Split' option is also displayed graphically for ease of interpretation.*

5. New Advanced Option that allows the user to output the fraction of primary NO_2 emissions (f-NO_2) for the provided input data;

6. Basic fleet assumptions for 2015-2030 updated in line with DfT (2015) projections;

7. Euro class compositions for 2015-2030 updated in line with DfT (2015) projections and TfL data (inclusive of Euro 6 subcategories);

8. The 'Alternative Technologies' Advanced Option has been consolidated into the Traffic Format drop down menu on the Input Data sheet; and

9. Minor bug fixes based upon user feedback on previous version 7.0:

   - Improved Clear Input Data button reliability on the Input Data sheet;

   - Added additional checks to validate user inputs to ensure the tool is run correctly.

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
Version 8.0 **(Current Version)**	November 2017	See "Details of the EFT (Version 8)" page 5.
Version 7.0	July 2016	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;
		Streamlining of pollutants – removal of Hydrocarbons as an option in the EFT;
		CO_2 tailpipe emissions associated with alternative fuelled vehicles are included in emissions calculations, in addition to those from petrol and diesel vehicles. The applied CO_2 scaling factors for alternative technology vehicles are consistent with those applied in the LAEI[5]. The ability to output CO_2 when Alternative Technologies advanced user input option is selected has also been added;
		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;
		The ability to user define euro compositions individually for the Central, Inner, Outer and Motorway areas of London;
		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;
		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
		• CO_2 emissions for buses/coaches in London previously

EFT Version / Issue	Release Date	Reason for Release / Summary of Changes
		reported as zero.
Issue 6.0.2	November 2014	Minor bug fixes and/or enhancements: • 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: • Error in CO_2 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	NO_x emission coefficients for Euro 5 and 6 diesel cars were taken from the EEA COPERT 4v10 emission calculation tool. NO_x 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: • 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 information from TfL. Scaling factors updated to take into account the effects of changing fuel quality on emission factors, particularly the addition of small

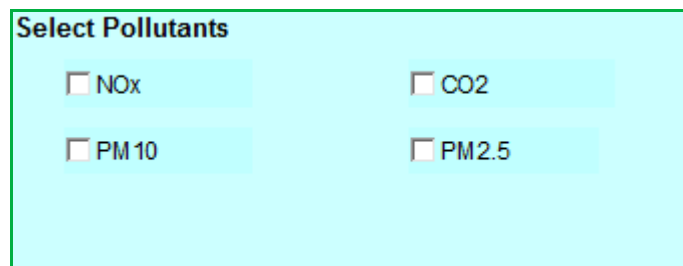| EFT Version / Issue	Release Date	Reason for Release / Summary of Changes
		amounts of biodiesel and bioethanol at up to 10% strength blends in commercial petrol and diesel fuels. The factors are based on evidence of the effect of biofuels on pollutant emissions reviewed by the NAEI. Bug Fix: • For 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	Updated NO_x emission factor and vehicle fleet information. 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.
Issue 4.2.2	November 2010	Bug Fix: • Bugs were related to PM_{10} 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	Bug Fix: • 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 29th 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 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 2010 this can be found under: DEVELOPER[7] > MACRO SECURITY > MACRO SETTINGS > ENABLE ALL MACROS[8]. For previous versions of Excel this can be found in: TOOLS > MACROS > SECURITY LEVEL > MEDIUM.
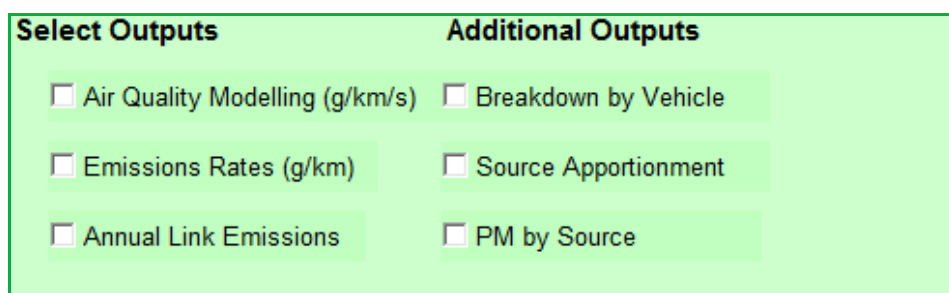
Basic Operation

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.

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

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[7] FILE>OPTIONS>CUSTOMIZE RIBBON>Tick DEVELOPER box on right hand side menu

[8] 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 2015 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	

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.
Alternative Technologies	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 and can only be entered when London is selected in Area Type.

*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" Advanced Option 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" Advanced Option.

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 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)](https://tfl.gov.uk/modes/driving/ultra-low-emission-zone)[9]. The ULEZ covers the same area as the Central London Congestion Charge Zone (CCZ) implemented in February 2003[10].
London – Inner	Use this option for roads in 'Inner London' as defined in the LAEI[11].
London – Outer	Use this option for roads in 'Outer London' as defined in the LAEI[12].
London – Motorway	Use this option for the M25 motorway only. Other motorways and fast dual carriageways in Greater London should be 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.*

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.
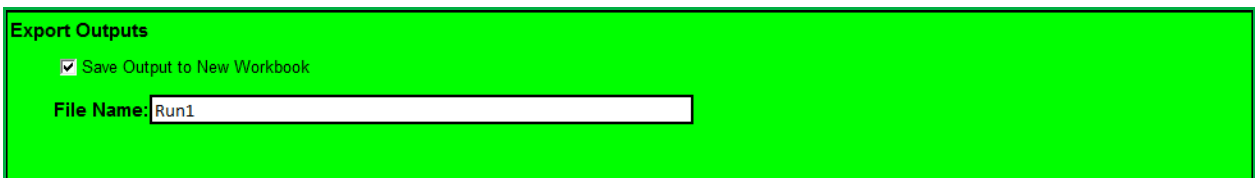
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[9] https://tfl.gov.uk/modes/driving/ultra-low-emission-zone

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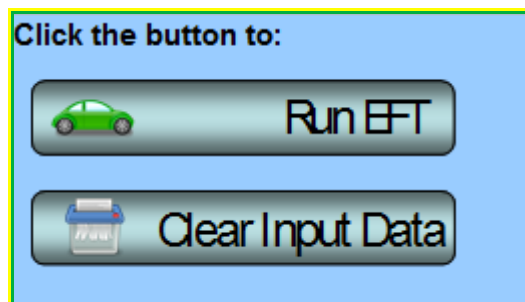
[11] Consists of some of the LAEI 1 km^2 grid squares in the London boroughs of Camden, Greenwich, Hackney, Hammersmith and Fulham, Haringey, Barnet, Islington, Kensington and Chelsea, Lambeth, Lewisham, Newham, Southwark, Tower Hamlets, Wandsworth, Westminster, Waltham Forest and Redbridge – see LAEI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

[12] Consists of some of the 1 km^2 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.

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[13].

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 either the **Annual Link Emissions** or **Annual Emissions Euro Split** (see Advanced Options on page 17) options have been selected.

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.
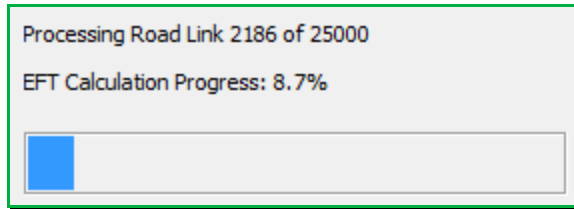

16. Click on **Run EFT** to run the calculations, or **Clear Input Data** to recommence data entry.

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[13] Please consult the Data Sources provided in Appendix C for more information.

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

Processing Road Link 2186 of 25000

EFT Calculation Progress: 8.7%

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 https://laqm.defra.gov.uk/helpdesks.html.

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)[14].

> *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.*

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[14] https://laqm.defra.gov.uk/action-planning/measures/low-emission-zones.html

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.

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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. Euro compositions for NO_x are entered on the left hand side of the sheet, whilst users should scroll across to the right to input Euro compositions for PM.
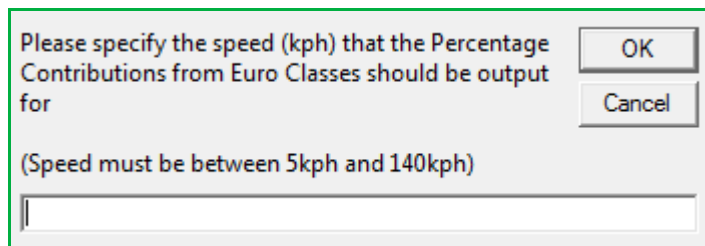

Note 10: *Emission reductions that can be achieved by retrofitting HGVs with Selective Catalytic Reduction (SCR) systems have not been confirmed at this stage. As a result, if any proportion information is input next to boxes ending in SCRRF, the standard emission factor for the Euro class of that HGV 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.*

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.

- *Primary NO$_2$ Fraction*

Selecting this option outputs the fraction of primary NO$_2$ emissions (f-NO$_2$) for the provided input traffic data. Results are output on the **Output_f-NO2** sheet, with f-NO$_2$ values provided at the individual link level and also as a weighted average according to the contribution each vehicle type makes to total NO$_x$ 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 Advanced Option.

Where users consider the EFT calculated f-NO$_2$ outputs to be representative of the study area, these values can be used in place of provided default values, e.g. in the [NO$_x$ to NO$_2$ calculator](#)[15].

The f-NO$_2$ values for each vehicle type that are employed as part of the calculation are consistent with those applied on the [NAEI](#)[16].

- *NO$_x$ / PM$_{10}$ / PM$_{2.5}$ Annual Emissions Euro Split*

Selecting these options provides annual link emissions (kg/yr) outputs for NO$_x$, PM$_{10}$ or PM$_{2.5}$ respectively, broken down by vehicle type and Euro emissions standard. This new 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 Advanced Option.

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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[15] https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc

[16] http://naei.beis.gov.uk/data/ef-transport

Road Type	Vehicle Category	Pre-Euro 0/I	Euro 1/I	Euro 2/II	Euro 3/III	Euro 4/IV	Euro 5/V	Euro 6/VI	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

Ouput results are also graphicaly 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.

Glossary and Definitions

Term	Definition
AADT	Annual Average Daily Traffic
AQAP	Air Quality Action Plan
CAZ	Clean Air Zone
CCZ	Congestion Charge Zone
CO_2	Carbon dioxide
DECC	Department for Energy and Climate Change
DfT	Department for Transport
EEA	European Environment Agency
EFT	Emissions Factors Toolkit
f-NO_2	Fraction of primary NO_2 emissions
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
LEZ	Low Emissions Zone
NAEI	National Atmospheric Emissions Inventory
NO_2	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)
PM_{10}	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

Vehicle Category	Full Description
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

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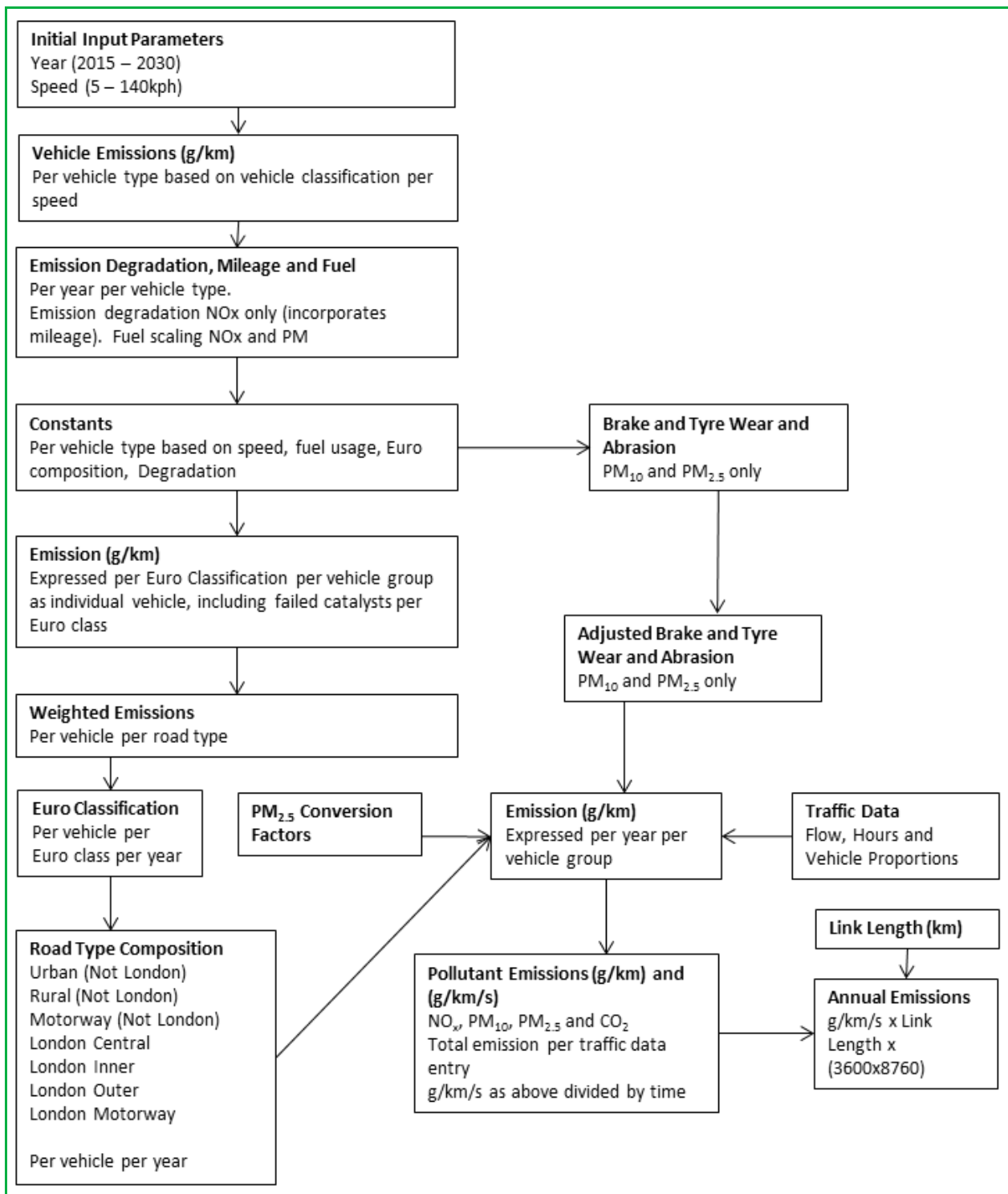
Contact details for the LAQM Helpdesk can be found at https://laqm.defra.gov.uk/helpdesks.html.

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).

NOx COPERT 5

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 5

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

CO_2 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 PM_{10} and $PM_{2.5}$ in g/km and g/km/s

PM_{10}

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 8 - Background Information*

Appendix B: EFT Process Map

Appendix C: Data Sources

Source	Data Set	Date
Ricardo-E&E[17]	UK (Outside London) Euro Compositions[18]	February 2017
	Fleet Compositions per Road Type (Outside London)[18]	February 2017
	Vehicle Size Proportions[18]	February 2017
	PM_{10} to $PM_{2.5}$ Conversion[19]	23/05/2010
	Brake, Tyre and Road Abrasion PM assumptions	30/10/2009
	HDV SCR / EGR Proportions[18]	February 2017
	Treatment of Failed Catalytic Convertors	13/02/2012
	Fuel Scaling[20]	03/10/2013
	Alternative Vehicle NO_x and PM Emissions Assumptions[21]	06/02/2013
	Primary NO_2 Emission Factors for Road Transport[16]	October 2017
EEA (COPERT 5)	NO_x vehicle emissions	September 2016
	PM vehicle emissions	September 2016
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[22]	June 2016

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[17] Formerly Ricardo-AEA / AEA Technology.

[18] Fleet projections based on fleet turnover model used in NAEI UK road transport emission projections (Base 2015) using vehicle projections provided by DfT (2015). The methodology used in the NAEI can be found at http://naei.beis.gov.uk/reports/reports?section_id=2

[19] Based on information from the EMEP/EEA Emissions Inventory Guidebook (2013), http://www.eea.europa.eu/publications/emep-eea-guidebook-2013

[20] 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/reports/cat15/0901151441_NAEI_Road_Transport_Biofuels_report_2008_v1.pdf

[21] http://naei.beis.gov.uk/resources/NAEI_Emisison_factors_for_alternative_vehicle_technologies_Final_Feb_13.pdf

[22] Factors are consistent with those applied in the LAEI 2013. However, in the absence of any clear evidence, CO_2 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.