

## Notes for Users

The Detailed User Guide is published on the Defra Local Air Quality Management website:

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

### Macro Settings

EFT v10.1 uses macros to undertake the calculations. Please ensure that Macros are enabled.

When using Excel 2013, this can be found under: DEVELOPER > MACRO SECURITY > MACRO SETTINGS; for previous versions of Excel this can be found under: TOOLS > MACROS > SECURITY LEVEL > MEDIUM

Input Parameters	
<b>SourceID</b>	User defined name or reference for a road. Does not have to be unique, although if there are duplicate names and the data is to be used in detailed dispersion modelling, this may cause errors. Up to at least 25,000 road links can be entered, or up to 200,000 road links, dependent upon selected output options.
<b>Road Type</b>	<p>There are seven options to choose from.</p> <ol style="list-style-type: none"> <li>1. Urban (Not London)</li> <li>2. Rural (Not London)</li> <li>3. Motorway (Not London)</li> <li>4. London - Central</li> <li>5. London - Inner</li> <li>6. London - Outer</li> <li>7. London - Motorway</li> </ol> <p>The urban categorisation relates to the DfT definition of an urban area with a population of 10,000 or more.</p> <p>The London road types are consistent with the area categories defined in the London Atmospheric Emissions Inventory (LAEI). 'Central' corresponds to the Ultra Low Emission Zone (ULEZ) area, whilst 'Motorway' denotes the M25 - other motorways in London should be defined as 'London - Inner' or 'London - Outer' as appropriate.</p>
<b>Traffic Flow</b>	The total traffic flow along a particular road for the time period of interest (from 1 to 24 hours).
<b>%HDV</b>	<p>Percentage of Heavy Duty Vehicles.</p> <p>Heavy Duty Vehicles encompasses Rigid and Artic Heavy Goods Vehicles and Buses / Coaches.</p> <p>All other vehicles, cars, vans and motorcycles are consider to be Light Duty Vehicles (LDVs).</p>
<b>Speed (kph)</b>	<p>Speed in kilometres per hour for the specified traffic flow. This may be average or specific speed relating to driving scenario being considered.</p> <p>The range of speeds is between 5kph and 140kph. The tool will calculate appropriate emissions depending on the maximum speed for certain vehicle types.</p>
<b>No of Hours</b>	Number of hours corresponding to the duration of the flow defined by the Traffic Flow.
<b>Link Length (km)</b>	The length of the road link. Only required if annual emissions are being calculated.

Output Options	
<b>Air Quality Modelling</b>	<p>Selecting this option provides outputs as total emissions as g/km/s for the pollutant(s) selected.</p> <p>This data format is suitable for inclusion in most detailed air quality models.</p>
<b>Emission Rates</b>	Selecting this option provides outputs as total emissions as g/km for the pollutant(s) selected.
<b>Breakdown By Vehicle</b>	<p>Selecting this option provides outputs for each pollutant and vehicle type on the road link. Emissions will be output in either g/km/s, g/km, kg/yr or tonnes/yr dependent upon the pollutants and other output options selected.</p> <p>If the Basic Split option is specified, then the emissions are based entirely on the <u>vehicle fleet compositions embedded in the EFT</u>.</p>
<b>PM by Source</b>	Selecting this option generates a separate output sheet showing particulate emissions from Exhaust, Brake, Tyre and Abrasion.
<b>Annual Link Emissions</b>	<p>Selecting this option generates emissions of each pollutant per year for each road link in kg/yr for all pollutant with the exception of Carbon Dioxide, which is in tonnes/yr.</p> <p>This option requires the length of each link to be specified.</p>
<b>Source Apportionment</b>	Selecting this option provides the relative percentage contribution from the specified vehicle types for the pollutant(s) selected.

<b>% Gradient</b>	<p>The gradient of the road link. Only required if HDV emissions on links with gradients are being considered.</p> <p>The range of gradients is between 0% and 30%. If left blank, a 0% gradient will be assumed.</p> <p>The tool will calculate appropriate HDV emissions depending on the gradient and flow direction entered.</p>
<b>Flow Direction</b>	<p>The direction of flow on the road link. Only required if HDV emissions on links with gradients are being considered.</p> <p>The direction of flow should be Up Hill, Down Hill or Two Way Traffic. If left blank, Two Way Traffic will be assumed with an equal flow Up Hill and Down Hill.</p> <p>The tool will calculate appropriate HDV emissions depending on the gradient and flow direction entered.</p>
<b>% Load</b>	<p>The load of HDVs on the road link. Only required if emissions on links with variable HDV loads are being considered.</p> <p>The load should be 0%, 50% or 100%. If left blank, 50% load will be assumed.</p> <p>The tool will calculate appropriate HDV emissions depending on the load entered.</p>

<b>Traffic Flow Format</b>	
<b>Basic Split</b>	Assumes standard fleet composition for the selected road type. Only the % of HDVs is specified.
<b>Detailed Option 1</b>	Allows fleet input by %Car, %Taxi, %LGV, %HGV, %Bus and Coach, and %Motorcycle.
<b>Detailed Option 2</b>	Allows fleet input by %Car, %Taxi, %LGV, %Rigid HGV, %Articulated HGV, %Bus and Coach, and %Motorcycle.
<b>Detailed Option 3</b>	Allows fleet input by %Petrol Car, %Diesel Car, %Taxi, %LGV, %Rigid HGV, %Articulated HGV, %Bus and Coach, and %Motorcycle.
<b>Alternative Technologies</b>	Allows advanced users to input User Defined Alternative Technology proportions within the fleet. This data format is suitable for inclusion in most detailed air quality models.

<b>Advanced Options: Input</b>	
<b>Euro Compositions</b>	<p>Selecting this option allows Advanced Users to input User Defined Euro Classes and Size Distribution information.</p> <p>Available for all pollutants, i.e. NO<sub>x</sub>, PM<sub>10</sub>, PM<sub>2.5</sub> and CO<sub>2</sub>.</p> <p>This option is available for London and non-London areas.</p>
<b>Simple Entry Euro Compositions</b>	<p>Selecting this option allows Advanced Users to input User Defined Euro Classes in a simplified manner compared to the Euro Compositions Advanced option.</p> <p>The User Defined Euro Classes as entered are applied to all pollutants, i.e. NO<sub>x</sub>, PM<sub>10</sub>, PM<sub>2.5</sub> and CO<sub>2</sub>.</p> <p>Further changes to the User Defined Euro Classes and/or Size Distribution information can still be made prior to running through use of the Euro Compositions Advanced Option.</p> <p>This Advanced Option is presently unavailable for the London area.</p>

<b>Advanced Options: Output</b>	
<b>Output % Contributions from Euro Classes</b>	<p>Selecting this option provides outputs broken down into the percentage contribution from each Euro Class within each Vehicle Class, for the specified speed.</p> <p>Only available for pollutants NO<sub>x</sub>, PM<sub>10</sub> and PM<sub>2.5</sub>.</p>
<b>Primary NO<sub>2</sub> Fraction</b>	<p>Selecting this option 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>Values are provided at the individual link level and also as a weighted average according to the contribution each vehicle type makes to total NO<sub>x</sub> emissions from traffic associated with all links entered as input. Weighted averages are provided relative to the link lengths only if entered by the user for all links.</p>

<b>Fleet Projection Tool</b>	<p>Selecting this option allows Advanced Users to project their user defined Euro information for the Base Year (i.e. ANPR derived Euro fleet data) to a future Projection Year.</p> <p>The projection method assumes the future year Euro fleet composition has the same difference in Euro classes as observed between the default base year profile and the ANPR data.</p> <p>Once the Euro projection is complete, users can then transpose the projected fleet to the "SimpleUserEuro" sheet to be used as input for normal emissions calculations.</p> <p>This Advanced Option is presently unavailable for the London area.</p>
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<b>NO<sub>x</sub> Annual Emissions Euro Split</b>	<p>Selecting this option provides annual NO<sub>x</sub> emissions outputs aggregated for all links entered in the Input Data. Outputs are broken down into contributions from each Euro Class within each Vehicle Class, for each Road Type.</p> <p>Results are provided in tabular and graphical chart format.</p>
<b>PM<sub>10</sub> Annual Emissions Euro Split</b>	<p>Selecting this option provides annual PM<sub>10</sub> emissions outputs aggregated for all links entered in the Input Data. Outputs are broken down into contributions from each Euro Class within each Vehicle Class, for each Road Type.</p> <p>Results are provided in tabular and graphical chart format.</p>
<b>PM<sub>2.5</sub> Annual Emissions Euro Split</b>	<p>Selecting this option provides annual PM<sub>2.5</sub> emissions outputs aggregated for all links entered in the Input Data. Outputs are broken down into contributions from each Euro Class within each Vehicle Class, for each Road Type.</p> <p>Results are provided in tabular and graphical chart format.</p>

## Emissions Factors Toolkit (Version 10.1)

The EFT allows for the calculation of vehicle emissions factors for NO<sub>x</sub>, PM<sub>10</sub>, PM<sub>2.5</sub> and CO<sub>2</sub>. Version 10 incorporates vehicle exhaust emission factors and fleet compositions, with the inclusion of Euro 6 subcategories. NO<sub>x</sub> and PM Emissions Factors are taken from the European Monitoring and Evaluation Programme (EMEP) / European Environment Agency (EEA) Air Pollutant Emission Inventory Guidebook 2019 (Footnote 1), which is consistent with the EMISIA COPERT 5.3 emission calculation tool, released September 2019 (Footnote 2). Emissions Factors for CO<sub>2</sub> are those published by the Department for Transport on 29 June 2009 (Footnote 3). Emissions Factors have been combined with new information on Fleet Composition on different road types collected as part of the National Atmospheric Emissions Inventory (Footnote 4) and previous information from Transport for London prepared as part of the London Mayor's Transport Strategy (Footnote 5), to allow total emissions from a particular road link to be calculated. The QA sheet details all data sources used to produce the EFT.

In addition to the standard emissions outputs provided for Air Quality Modelling (g/km/s), Emissions Rates (g/km), or Annual Link Emissions (kg/yr or tonnes/yr), several 'Advanced Options' are available on the Input Data sheet. These allow Advanced Users to specify user defined Euro Compositions and fleet compositions for Alternative Technologies, and Output % Contributions from Euro Classes, plus the ability for users to output the fraction of primary NO<sub>2</sub> emissions (f-NO<sub>2</sub>) for the provided input data using the Primary NO<sub>2</sub> Fraction Advanced Option. There are also NO<sub>x</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> Annual Emissions Euro Split Advanced Options, which output emissions by kg/yr, broken down by vehicle type and Euro emission standard, with contributions from failed catalysts and Diesel Particulate Filters (DPFs) split out. 'Additional Outputs' are also available providing emissions Breakdown by Vehicle, Source Apportionment and PM by Source (Exhaust, Brake and Tyre Wear, and Road Abrasion).

Version 10 also allows users to input User Defined Euro Classes in a simplified manner through the Simple Entry Euro Compositions option, the User Defined Euro Classes of which are applied to all pollutants, i.e. NO<sub>x</sub>, PM<sub>10</sub>, PM<sub>2.5</sub> and CO<sub>2</sub>. Additionally, users can now project their user defined Euro information from a Base Year (i.e. ANPR derived Euro fleet data) to a future Projection Year, through the application of a revised projection methodology. Once the Euro projection is complete, users can then transpose the projected fleet to the 'SimpleUserEuro' sheet to be used as input for normal emissions calculations.

The following notes are provided to highlight some of the key assumptions and changes in EFT v10, however it is highly recommended that the user reads the EFT User Guide in entirety to ensure they are fully aware of all relevant details.

Version 10 includes the following changes:

- Adoption of COPERT 5.3 NO<sub>x</sub> and PM emissions factors.
- Outside of London, updated default fleet assumptions, vehicle size distributions and Euro class compositions for 2018-2030 in line with DfT and NAEI projections.
- Updated fleet projection methodology and refinement of the user interface for the Advanced Option 'Fleet Projection Tool' that allows users to project their user defined Euro fleet information from a Base Year (i.e. ANPR derived Euro fleet data) to a future Projection Year.

Footnote 1: <https://www.eea.europa.eu/publications/emep-eea-guidebook-2019>

Footnote 2: <https://www.emisia.com/news/copert-5-3-available-for-download/>

Footnote 3: <https://www.gov.uk/government/publications/road-vehicle-emission-factors-2009>

Footnote 4: <https://naei.beis.gov.uk>

Footnote 5: <https://www.london.gov.uk/what-we-do/transport/our-vision-transport/mayors-transport-strategy-2018?intcmp=46686>

A User Guide for the EFT is available at: <https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html>

If you require further information or support in using the EFT, then please contact the Local Air Quality Management Support Helpdesk:

Web: <https://laqm.defra.gov.uk>

Tel: +44 (0)800 032 7953

Email: [LAQMHelpdesk@bureauveritas.com](mailto:LAQMHelpdesk@bureauveritas.com)

The LAQM Support Helpdesk is operated by Bureau Veritas on behalf of Defra and the Devolved Administrations.

The EFT v10.1 has been developed on behalf of Defra and the Devolved Administrations by Bureau Veritas.

**EFT v10.1 released August 2020**

## Background Information

A user guide for the EFT v10.1 is available at: <https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html>

### 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 5.3

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.

#### NOx and PM COPERT 5.3

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<sub>2</sub> TRL/DIT

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.

#### PM<sub>10</sub>

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<sub>2.5</sub>

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

### Data Sources



			See User Guide	
<b>Ricardo-E&amp;E</b>	Fleet and Euro Compositions (non-London)	rtp_fleet_projection_NAEI_2017_Base_2019r_v1.1 (with PHEV).xlsx	Developed for NAEI (May 2019)	
	Fleet and Euro Compositions (London)	(new) rtp_fleet_projection_TfL_London_data_2018.xlsx	Developed for NAEI with TfL input (December 2018)	
	Constants (Size Distributions and EGR/SCR Ratios) (non-London)	rtp_fleet_projection_NAEI_2017_Base_2019r_v1.1 (with PHEV).xlsx	Developed for NAEI (May 2019)	
	Constants (Size Distributions and EGR/SCR Ratios) (London)	(new) rtp_fleet_projection_TfL_London_data_2018.xlsx	Developed for NAEI with TfL input (December 2018)	
	Treatment of Failed Catalytic Convertors (non-London)	rtp_fleet_projection_NAEI_2017_Base_2019r_v1.1 (with PHEV).xlsx	Developed for NAEI (May 2019)	
	Treatment of Failed Catalytic Convertors (London)	(new) rtp_fleet_projection_TfL_London_data_2018.xlsx	Developed for NAEI with TfL input (December 2018)	
	NO <sub>x</sub> Fuel Scaling Rates	NAEI_Fuel scaling factors_2014.xlsx	Developed for NAEI	
	PM Fuel Scaling Rates	Fuel scaling factors 2018.xlsx	Developed for NAEI	
	PM <sub>10</sub> to PM <sub>2.5</sub> Conversion	-	Assumptions used in NAEI	
	Assumption all PM emissions shown in EFT are PM <sub>10</sub>	-	Pers Comms	
	Alternative Technology assumptions	NAEI_Emission_factors_for_alternative_vehicle_technologies_Final_Feb_13.pdf	Developed for NAEI	
	Primary NO <sub>2</sub> Emission Factors for Road Transport	PrimaryNO2_factors_NAEIBase_2020_v2.xlsx	Developed for NAEI	
	<b>EMEP/EEA/EMISIA</b>	NO <sub>x</sub> and PM COPERT 5.3 speed emission factors equations	1.A.3.b.i-iv Road Transport Appendix 4 Emission Factors 2019.xlsx	Developed by EMISIA (September 2019)
	<b>TfL</b>	Alternative Vehicle CO <sub>2</sub> Scaling Factors	20160603_BV_Information.xlsx	Developed for LAEI (June 2016)
<b>TRL</b>	C vehicle emissions	regulated.xls	DfT Website 07/08/09	

Mileage Rates (used in degradation calculations)

fuelscaling.xls

DfT Website 07/08/09

Change Control	Date	Issue	Description of Change	<a href="#">See User Guide</a>
EFT 10.1	Released August 2020	1 Primary NO <sub>2</sub> Fraction 2 Primary NO <sub>2</sub> Fraction	Updated Primary NO <sub>2</sub> factors to match the latest factors published on the NAEI Bug fix on calculation of primary NO <sub>2</sub> fraction	
EFT 10.0	Released August 2020	1 Default Fleet Split (non-London) 2 Default Vehicle Size Distributions (non-London) 3 Default Euro Class Compositions (non-London) 4 NO <sub>x</sub> and PM Emissions Factors 5 Fleet Projection Tool 6 Primary NO <sub>2</sub> Fraction	Default fleet assumptions for 2018-2030 updated in line with DfT (2019) and NAEI projections Default vehicle size distributions for 2018-2030 updated in line with DfT (2019) and NAEI projections Default Euro class compositions for 2018-2030 updated in line with DfT (2019) and NAEI projections (inclusive of Euro 6 subcategories) Adoption of COPERT 5.3 emissions factors Updated fleet projection methodology and refinement of the user interface for the Advanced Option 'Fleet Projection Tool' Bug fix on calculation of primary NO <sub>2</sub> fraction	

<b>Select Pollutants</b> <input type="checkbox"/> NOx <input type="checkbox"/> CO2 <input type="checkbox"/> PM10 <input type="checkbox"/> PM2.5		<b>Select Outputs</b> <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		<b>Additional Outputs</b> <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		<b>Advanced Options</b> <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		<b>Click the button to:</b>  	
<b>Please Select from the Following Options:</b>		<b>Export Outputs</b> <input type="checkbox"/> Save Output to New Workbook <b>File Name:</b> <input type="text"/>							
<b>Area</b>	England (not London)								
<b>Year</b>	2018								
<b>Traffic Format</b>	Basic Split								
Select 'Basic Split' or 'Detailed Option 1 to 3' or 'Alternative Technologies' above									

SourceID	Road Type	Traffic Flow	% HDV	Speed(kph)	No of Hours	Link Length (km)	% Gradient	Flow Direction	% Load
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