INTERIM ADVICE NOTE 185/15

Updated traffic, air quality and noise advice on the assessment of link speeds and generation of vehicle data into 'speed-bands' for users of DMRB Volume 11, Section 3, Part 1 'Air Quality and Volume 11, Section 3. Part 7 Noise

Summary
This IAN provides supplementary advice to users of DMRB Volume 11, SECTION 3, PART 1 (HA207/07) and PART 7 (HD213/11). Advice is provided on the assessment of link speeds and generation of speed-band vehicle emissions

Instructions for Use
This guidance is supplementary to existing guidance given in DMRB Volume 11, Section 3, Part 1 (HA207/07) and Part 7 (HD213/11)

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1. Introduction

This IAN provides updated advice to support Highways Agency (HA) scheme assessments to:

- Analyse the performance of modelled traffic speeds on individual road links compared against observed speeds on the same road links
- Adjust, where required, modelled traffic speeds on individual road links to better reflect observed speeds; this is known as the “Speed Pivoting” approach
- Assign individual road links into a speed-band category and identify the corresponding NOx, PM_{10} and CO_2 emission rates
- Use of the speed-band categories within air quality and noise modelling and assessment

1.1 Relationship

This IAN provides updated air quality advice for users of DMRB Volume 11, Section 3, Part 1 ‘Air Quality’ (HA207/07) and Part 7 ‘Noise’ (HD213/11) and supports the preparation of traffic data for use in environmental assessments.

1.2 Implementation

This guidance should be used forthwith on relevant projects in England, where traffic and air quality assessments are undertaken and where such projects have yet to be submitted for statutory process, including Determination of the need for a statutory Environmental Impact Assessment.

2. Background Information

Historically traffic models have been developed with a focus on providing information to inform the scheme's economic assessment. Whilst the traffic flows have been used to inform environmental assessments and scheme design, the increased risks around air quality has presented challenges on the accuracy and suitability of traffic data required at the link level as opposed to more strategic flows.

Air quality and noise assessments require link based traffic flows (total flows and number of HDVs) and speeds provided by a traffic model (where one is available) to enable a calculation of the absolute pollutant concentrations at individual properties. Whilst there are validation criteria for modelled traffic flows at the link level, the criteria for journey times is based on discrete journeys through the model area and not at the individual link level. A review of journey times undertaken as part of scheme assessments has shown that the accuracy of journey times does not reflect speeds well on individual links.

As part of the analysis of journey times and also to support the aspirations of Smart motorways i.e. alleviating congestion, it was evident that it was not possible to describe the impacts of congested conditions within air quality and noise assessments.

The HA has been undertaking research into congestion, primarily on motorways, over the last few years. The research indicates that congestion tends to occur when speeds drop below 50mph (80kph). Above 50mph the motorway tends to be is a state of free flow driving. This research has identified that during periods of congestion on the motorway traffic emissions per vehicle increase comparative to free flow conditions.

Currently the vehicle emissions from Defra's Emission Factor Toolkit v6 suggest that emissions decrease as speed decreases from 70mph down to 50mph and emissions continue to decrease as speeds drop below 50mph. At speeds below 25mph, emissions start to increase rapidly as speed continues to decrease.

Previously the impacts and benefits associated with introducing or removing periods of congestion within the air quality assessment were not accurately represented. As the outcomes and decisions on the air quality impacts for a scheme are informed by the link level traffic data, any discrepancy in the traffic data and emissions could have significant ramifications for the overall judgement of the scheme's air quality impacts.

It is also recognised that significant emphasis is placed on the absolute traffic speed on an individual link and the consequent vehicle emissions. It is recognised that neither the traffic model nor vehicle emissions projections have this level of certainty. Consequently the development of the speed-band categories provides a pragmatic and robust approach to support air quality and noise assessments and is not unduly influenced by artificial precision.

3. Speed Pivoting Methodology

3.1 Introduction

The traffic model validation criteria are based on both link and screenline flows and route journey times (speeds). While traffic models may fulfil Department for Transport Web Transport Appraisal Guidance (WebTAG) Unit M3.1 'Highway Assignment Modelling' validation criteria for link flows and route journey times, it is quite likely that they do not validate well against individual link speeds. Work is ongoing by the HA to improve the validation of link speeds.

In the interim, work has been carried out to develop a cost effective method to better represent modelled speeds on individual links from the traffic model, by comparing them to observed traffic data.

A methodology has been developed which uses observed vehicle speeds from the base year. This allows for a comparison with the modelled base year speeds and provides an indication of the performance of the speeds from traffic model. This information can then be used to adjust the individual base year link speeds output from the traffic model, where required. As it is not possible to measure forecast traffic speeds, the adjustments applied to the base year model are applied to the opening and design year forecasts in the same way. The speed pivoting methodology should only be applied to those road links which are included in the Traffic Reliability Area (TRA)[1].

3.2 Data Collection

The following data sources provide information suitable to support the Speed Pivoting methodology.

Data Source	Motorway	Urban / Rural Roads	Available from
HA Journey Time Database	✓	×	https://www.hatris.co.uk/
GPS data from DfT	✓	✓	Make the request through the Overseeing Organisation
GPS data from other suppliers	✓	✓	Further details available from the Overseeing Organisation
Mobile phone data	✓	✓	Further details available from the Overseeing Organisation

This is not a definitive list and where alternative sources of data are suggested to support this approach, then this should be agreed with the Overseeing Organisation prior to commencing this work.

In addition to observed speed data outputs from the traffic model on a link-by-link basis and by direction are required. This information should be provided by period of the day i.e. AM Morning Peak period, Inter Peak (IP) period and Evening Peak (PM) period for at least the weekday. In some instances weekend traffic data may also be required to support scheme assessments and in these instances the Overseeing Organisation should be contacted to clarify the approach for weekend traffic modelling.

It is assumed for all roads, that overnight that the link is operating in free flow conditions and the speeds for a given link should reflect this, although this may not necessarily be the speed

[1] The TRA defines the sub-set of traffic data from the traffic model, that has been identified as suitable for informing the Environmental Assessment

limit for the road. Where evidence is available to suggest that overnight that a particular link is not operating at free flow speed then this should be recorded with a brief note setting out the reason and the appropriate speed.

Traffic data should be collected for either a neutral month (April, May (avoiding Bank Holidays), June, September, October and November (light permitting)) or corresponding to the data collection period used to inform the traffic model.

3.3 Speed Pivoting

The approach set out in Steps 1 to 4 describes how to undertake Speed Pivoting for individual road links and corresponding time periods. The method calculates the relative difference between the observed and modelled traffic speeds for each road link.

This relative difference can then be used to adjust i.e. 'pivot' the Base Year, Do-Minimum (DM) i.e. without scheme scenario and Do-Something (DS) i.e. with scheme scenario speeds for the relevant forecast year e.g. opening year and design year.

Step 1: Observed traffic speed along the road link in the base year ($SObs_{BY}$)
Where the observed speed used to support speed pivoting should be the average speed for the corresponding period e.g. for the AM period the average speed for the 3 hours covering the AM Peak period should be used.

Step 2: Modelled traffic speed along the corresponding road link in the base year ($SMod_{BY}$)

Step 3: Calculate the Speed Pivot adjustment factor (SP): $SObs_{BY} / SMod_{BY}$

Step 4: Applying the Speed Pivoting

For the base year and corresponding forecast years multiply the modelled speed by the Speed Pivoting Adjustment Factor

Base Year: $SP_{BY} = SMod_{BY} * SP$

Steps 1 to 4 should be repeated for each road included in the traffic model where observed speed data is available. For those road links and / or times of day when observed speeds are not available please see Section 3.6.

3.4. Assessing Performance of the Speed Pivoting

Once speed pivoting has been completed for all links with observed speed data then the performance of the adjustment should be evaluated. At the end of the analysis you should be able to:

1. Identify the number and percentage of links where the modelled speed are representative of observed speeds i.e. the modelled speeds are within 15% of observed.
2. Identify those road links that are within +/- 10mph (+/- 16kph) of the free flow and light congestion band for motorways and high speed and free flow on non-motorway roads (see Section 4 and Annex A). Particular attention should be provided to these road links to ensure that they are assigned to the appropriate speed band category
3. Identify location and type of links that need to be adjusted

In all instance professional judgement should be applied to the analysis and any adjustments made to the modelled traffic speeds must be reported.

3. 5. Speed Pivoting Forecast Traffic Speeds

Where the analysis of the Speed Pivoting (Section 3.3) indicates that either all modelled roads, or a subset of the modelled roads, need to adjusted then the following equations should be applied to the corresponding roads in the Do-Minimum and Do-Something for all forecast years.

Forecast Year DM: $SP_{DM} = SMod_{DM} * SP$

Forecast Year DS: $SP_{DS} = SMod_{DS} * SP$

Where: SMod = Modelled traffic speed
SP = Speed Pivot

Where a scheme would change the nature of the existing road e.g.a bypass, then professional judgement on the performance of the traffic model should be used to consider whether the modelled speed is reasonable. In these circumstances, a note should be provided to the Overseeing Organisation justifying the identified speed.

3.6. Infilling

It is recognised that observed speed data may not be available for every road link in the traffic model and consequently an 'infilling' process will be required to pivot the modelled traffic speeds on these road links.

The infilling process can be informed by considering for example:

- The speed pivoting performance on adjacent links
- The speed pivoting performance on roads with similar characteristics either in the local area or globally across the TRA if available e.g. motorways, urban centre roads, single carriageways, rural roads;
- When there is no observed speed data available or where it is difficult to relate complex observed data e.g. traffic master data in a proportionate and pragmatic way to the traffic model then the modelled speeds should be used.

As techniques develop to integrate observed traffic speeds with modelled speeds then the Overseeing Organisation may provide supplementary guidance on how to best relate complex observed traffic data to traffic models.

For each road link where infilling is required, then the source of infill data should be recorded along with a brief statements setting out the reasons.

4. Speed-Bands for Air Quality

4.1. Background

Over the last few years the HA has been investigating the impact of observed congestion and non-congested traffic conditions on measured levels of nitrogen dioxide (NO_2) concentrations. The purpose of this research is to help inform the corresponding emission information required to support air quality modelling; which is also informed by traffic data. There is little in the way of reported research in this area, other than the emission values developed by NPL [Dutch Roads Authority] which include a description of congested and free flow conditions on motorways and urban roads and corresponding emission rates.

The initial outcome of the HA research (to be published) indicates from the air quality monitoring and traffic data that there are different air quality responses to different driving states. These are split in to **3 categories for motorways** and **4 categories for urban roads** (Tables 3 and 4 respectively) and have been informed by the speed: emissions categories presented in the Dutch Concentrations reports[2] for urban roads and motorways.

4.2. Identifying and Selecting a Speed-Band Category

Following completion of the speed pivoting approach set out in Section 3, for each road link and period (AM, IP, PM and OP[3]), assign the road link to a corresponding speed-band as set out in Annex A. Separate speed-band categories are provided for motorways and non-motorway roads.

Descriptors of the speed ranges, general characteristics and example of the road traffic characteristics anticipated for each category are provided in Annex A, which are different for motorway and non-motorway roads.

Where the speed in a period for an individual link is on the cusp of two categories, i.e. within +/-10mph (+/-16kph) of the band and/or where a road link changes category between Do-Minimum and Do-Something scenarios, then the traffic data should be reviewed to clarify which speed-band it resides within, with a supporting brief statement justifying the reason for the category selected or the rationale for the change respectively.

A percentage variation in speed statistic is included in the Motorway Table in Annex A. This is not a key determinant for identifying the relevant speed-band category as there is only observed data available for the base year, and it is not possible to model the variance in future speed. However, the statistic can be used as supporting evidence to help clarify which speed-band category a road link may be in.

4.3. Allocating an Emission Rate to a Speed-Band

Annex C1, C2 and C3 contains a list of emission rates for NOx, PM_{10} and CO_2 respectively. The emissions are split by LDV and HDV for 2011 to 2030 inclusive, for each of the speed band categories for motorways and non-motorway links. These categories are further split for emissions for different road types e.g. free flow motorway, light congestion motorway, heavy congestion urban, high speed rural. Speed-Bands are also provided for London Inner, Outer, Central and London motorway, split again by different driving conditions.

Once the correct speed-band category and assessment year has been identified, the corresponding vehicle emission factors for a single LDV and single HDV can be obtained

[2] Rijksinstituut voor Volksgezondheid en Milieu (RIVM), Grootschalige concentratie- en depositiekaarten Nederland Rapportage 2009, 2010, 2011, 2012, 2013

[3] AM – Morning Peak 7-10; IP – Inter Peak 10-16; PM- Evening Peak 16-19; OP- Off Peak 19-7

from the tables in Annex C. This emission rate in conjunction with the traffic flow for each individual link can then be used to calculate the total emission for the various periods or daily conditions for that road link.

Where only AADT or AAWT traffic information is available it is recommended to select the free flow speed band, unless advice is provided to the contrary for any given link. In these instances notes should be recorded justifying the reason for this selection.

Outcomes of the HA's congestion research (available on request from the HA) identified very limited occurrence of heavy congestion traffic conditions. Whilst the HA has been able to derive an emission value for heavy congestions, it is clear from our analysis that periods of heavy congestion are limited in locations around the network and the likelihood of their occurrence is also limited.

Where motorway links are identified as being in the Heavy Congestion speed-band category then contact the overseeing organisation for further advice.

4.4. Junctions

Driving styles close to junctions are associated with increased periods of acceleration associated with traffic starting and clearing the junction. To account for this increase in engine load it is recommended that within a 100m radius of the centre of the junction in all directions that at least the light congestion emissions, and in some instances heavy congestion emissions should be used depending on the driving conditions during that period of the day.

4.5. Air Quality Modelling

Annex B presents a worked example of determining the speed-band category and subsequent emissions calculations for use in the air quality assessment.

The published version of the DMRB air quality spreadsheet model (v1.03c) cannot be used to calculate emissions and concentrations in congested conditions.

The updated version of the DMRB air quality spreadsheet model in development already contains all the emissions information for different speed-bands and calculates the emissions for total LDV and HDV, based on the inputted traffic data

5. Speed-Bands for Noise

5.1. Background

A change in traffic characteristics is not as influential for noise as it is for changes in vehicle emissions and the consequent changes in air quality. Changes in speed begin to become significant for noise with changes of around 10 kph or more. However, it is recognised that there is a need to minimise the influence of artificially precise speeds from the traffic model, and ensure a consistency of approach as set out for the air quality assessments.

5.2. Identifying and Selecting a Speed-band Category

Following completion of the speed pivoting approach set out in Section 3, for each road link and period (AM, IP, PM and OP[4]), assign the road link to a corresponding noise speed-band as set out in Annex A.

For example, if the pivoted speed from the traffic model for the AM peak period is identified as residing within the light congestion on the motorway, then the corresponding speed would be 55kph.

Speed-band categories are provided for motorways and non-motorway roads. The descriptors provided in Annex A can also be used to inform which noise speed-band to assign an individual link.

Where the speed in a period for an individual link is on the cusp of two categories i.e. within +/-10mph (+/-16kph) of the band and/or where a road link changes category between Do-Minimum and Do-Something scenarios, then the traffic data should be reviewed to clarify which speed-band it resides within, with supporting brief statement justifying the reason for the category selected or the rationale for the change respectively.

5.3. Calculating the 18 hour Annual Average Weekday Traffic Speed

Once the speed-band has been assigned for each one hour period, then the 18 hour Annual Average Weekday Traffic speed needs to be calculated. The speed is based on the weighted average of the different periods over the course of the day and is to be calculated as follows:

$$\text{18hr AAWT speed} = \frac{(\text{AM period speed} \times 3) + (\text{IP period speed} \times 6) + (\text{PM period speed} \times 3) + (\text{OP period speed} \times 6)}{18}$$

Based on this calculated value an overall speed-band is then assigned to the road link for use in the noise assessment.

5.4. Noise Consideration of Alleviating Congestion

There is a potential where a scheme alleviates periods of congestion and the traffic moves into free flow conditions that noise levels could increase by approximately 3dB(A) during individual peak periods. Professional judgement of the noise specialist should consider whether the impact of noise during these periods needs to be assessed separately and if necessary any mitigation measures are required.

[4] AM – Morning Peak 7-10; IP – Inter Peak 10-16; PM- Evening Peak 16-19; OP- Off Peak 19-7

5.5. Junctions

Driving styles close to junctions are associated with increased periods of acceleration associated with traffic starting and clearing the junction. To account for this increase in engine load it is recommended that within a 100m radius of the centre of the junction in all directions, at least the speeds set out in Annex A for light congestion, and in some instances heavy congestion depending on the driving conditions during that period of the day are used.

6. Withdrawal Conditions

This IAN will be withdrawn when an updated Volume 11, Section 3, Part 1 'Air Quality' and Part 7 'Noise' have been published and / or if Defra's advice is changed.

7. Contacts

Any queries regarding this IAN should be addressed to either:

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8. References

Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1, Air Quality (HA207/07) May 2007

Design Manual for Roads and Bridges, Volume 11, Section 3, Part 7, Noise (HD213/11)

Department for Transport (2014) WebTAG M3.1 Highway Assignment Modelling https://www.gov.uk/government/publications/webtag-tag-unit-m3-1-highway-assignment-modelling

9. Additional Reading

Department for Environment, Food and Rural Affairs, Local Air Quality Management, Technical Guidance (LAQM.TG09), February 2009 [as updated by Defra] http://laqm.defra.gov.uk/review-and-assessment/tools/modelling.html#ProjectingNO2Note

Rijksinstituut voor Volksgezondheid en Milieu (RIVM), Grootschalige concentratie- en depositiekaarten Nederland Rapportage 2009, 2010, 2011, 2012, 2013

Further information on the Journey Time Database (JTDB) can be found at: https://www.hatris.co.uk/

Annex A

Motorway Speed-Band Descriptors

Category	Speed Range	General Description	Examples of Possible Characteristics	Noise Speed-band (kph)
Heavy Congestion	<30kph(#)	Traffic with a high degree of congestion and stop: start driving behaviour	• Junction merges and diverges during morning and evening rush hours • Slip roads with queuing traffic • High variation in traffic speeds (represented by a standard deviation in speed of >32 kph)* (>20mph)	20
Light Congestion	30(#)-80kph (50mph)	Traffic with some degree of flow breakdown,	• Normally experience during the morning or evening peak periods. • Typically volume/capacity (V/C) would be >80%. • Normal operating regime for all slip roads • Medium variation in traffic speeds (represented by a standard deviation in speed of 15 kph -32kph)* (10-20mph)	55
High Speed	≥80kph (50mph)	Motorway with free flow driving conditions with no flow breakdown.	• V/C <80% • Low variation in traffic speeds (represented by a standard deviation in speed on < 15 kph)* (<10mph)	97
(#) Represents the current uncertainty associated with the speed threshold between light and heavy congestion * Currently, this can only be applied for the base year where the data is available. Further work is required to see how it can be applied to forecast speeds and whether the observed traffic data requires a different standard deviation in speed for heavy and light congestion				

Urban / Rural (Non-Motorway) Roads Speed-Band Descriptors

Category	Speed Range	General Description	Examples of Possible Characteristics	Noise Speed-band (kph)
Heavy Congestion	<20kph (12mph)	Traffic with a high degree of congestion. Within a 100m radius of road junction with a high degree of congestion.	• Typically 10 stops per km* • RFC of (to be agreed)	20
Light Congestion	20-45kph (12-27mph)	Typical urban traffic with a reasonable degree of congestion. Within a 100m radius of road junction.	• On average of 1.5 to 2 stops per km*. • Travelling to and from work during the morning and evening rush hours.	33
Free Flow	45-80kph (27-50mph)	Typical urban traffic with limited or no congestion.	• Possibly experiencing 1 stop per km*	63
High Speed Urban Road	>80kph (50mph)	High speed urban single or dual carriageway	• Low likelihood of any stops per km. • RFC of (to be agreed)	97
* The number of stops per km is taken from the Dutch work and the HA are keeping this under review to whether this metric is appropriate to the GB network or whether a metric based on, say, RFC is more appropriate.				

Annex B

Worked Example

Traffic, air quality and noise modelling is being undertaken in support of a proposed scheme. The example focuses on one road in the base year (2012) to help illustrate the methodology described in this IAN.

A section of motorway has the following characteristics (Table C1) for the morning peak period (7-10am):

Table C1

	Northbound		Southbound	
	Modelled (SMod)	Observed (SObs)	Modelled (SMod)	Observed (SObs)
Flow	10,214		9,832	
%HDV	17		14	
Speed (kph)	87	62	91	102

Speed Pivoting

1. Calculate the Speed Pivot adjustment factor (**SP**) by dividing $SObs_{BY}$ by the link's modelled vehicle speed from the base year model ($SMod_{BY}$);

   Northbound SP = 62 ÷ 87 = 0.71
   Southbound SP = 102 ÷ 91 = 1.12

2. Apply the northbound and southbound SP adjustment factor respectively to adjust the speeds in the base year traffic model.

3. The northbound and southbound SP adjustment factors can then be used to adjust speeds in the future year forecast to derive the link's average AM vehicle speed for use in the road scheme's various forecast scenarios as such:

   Forecast Speed = Modelled speed x SP

4. For example, if a traffic model identified that the particular link's average vehicle speed was 101km/h in a future scenario for the northbound direction, the SP adjustment factor (0.71) can be applied to that speed, resulting in a pivoted speed of 71kph (101 x 0.71).

Assigning a Speed Band

5. Once the speeds have been adjusted for all links in the traffic model, the speed can then be used to determine which speed-band they are assigned to. The northbound and southbound speeds are presented in Table C2, with the associated speed bands and corresponding NOx emissions and equivalent speed for use in the air quality and noise modelling respectively.

Table C2

	SP Speed (kph)	Speed Band	Air Quality (NOx Emission g/km)	Noise (Speed kph)
Northbound	62	Light Congestion	LDV: 0.64 HDV: 4.02	55
Southbound	102	Free Flow	LDV: 0.47 HDV: 2.96	97

Annex C1 NOx Emissions (g/km per vehicle) 2011 to 2020

		2011	2011	2012	2012	2013	2013	2014	2014	2015	2015	2016	2016	2017	2017	2018	2018	2019	2019	2020	2020
		LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV
Motorway	Heavy Congestion	0.71	5.24	0.71	4.50	0.72	3.70	0.74	2.88	0.72	2.22	0.67	1.67	0.61	1.25	0.57	0.93	0.53	0.70	0.49	0.54
Motorway	Light Congestion	0.63	4.69	0.64	4.02	0.65	3.31	0.66	2.58	0.64	1.98	0.60	1.49	0.55	1.11	0.51	0.83	0.47	0.63	0.44	0.48
Motorway	Free Flow	0.47	3.46	0.47	2.96	0.48	2.44	0.49	1.90	0.47	1.46	0.44	1.10	0.40	0.82	0.37	0.61	0.35	0.46	0.32	0.36
Urban	Heavy Congestion	0.59	12.09	0.60	11.86	0.61	11.14	0.63	9.89	0.61	8.68	0.57	7.58	0.52	6.60	0.48	5.69	0.45	4.93	0.42	4.30
Urban	Light Congestion	0.44	6.45	0.44	6.22	0.44	5.73	0.45	4.99	0.44	4.29	0.41	3.65	0.38	3.08	0.35	2.57	0.32	2.14	0.30	1.79
Urban	Free Flow	0.35	4.12	0.35	3.81	0.35	3.40	0.35	2.89	0.34	2.42	0.31	2.01	0.28	1.65	0.26	1.33	0.24	1.07	0.22	0.86
Urban	High Speed	0.42	3.47	0.42	3.13	0.42	2.74	0.42	2.30	0.41	1.90	0.37	1.55	0.34	1.26	0.32	1.00	0.29	0.79	0.27	0.62
Rural	Heavy Congestion	0.63	11.97	0.64	11.83	0.65	10.95	0.67	9.37	0.65	7.97	0.61	6.74	0.56	5.67	0.52	4.79	0.48	4.10	0.45	3.58
Rural	Light Congestion	0.46	6.54	0.46	6.25	0.47	5.63	0.48	4.70	0.47	3.88	0.44	3.17	0.40	2.56	0.37	2.06	0.34	1.67	0.32	1.37
Rural	Free Flow	0.37	4.11	0.37	3.71	0.37	3.20	0.37	2.61	0.36	2.10	0.33	1.66	0.30	1.30	0.28	1.01	0.26	0.79	0.24	0.62
Rural	High Speed	0.43	3.39	0.44	2.96	0.44	2.49	0.45	2.00	0.43	1.59	0.40	1.24	0.37	0.95	0.34	0.72	0.31	0.55	0.29	0.42
London Centre	Heavy Congestion	0.68	11.08	0.68	10.52	0.69	9.63	0.70	8.33	0.69	7.35	0.65	6.64	0.61	6.03	0.57	5.44	0.53	4.92	0.50	4.49
London Centre	Light Congestion	0.50	5.88	0.50	5.46	0.50	4.94	0.51	4.23	0.50	3.68	0.47	3.25	0.44	2.88	0.41	2.53	0.39	2.23	0.36	1.97
London Centre	Free Flow	0.40	3.77	0.40	3.32	0.40	2.90	0.40	2.40	0.39	2.02	0.37	1.73	0.34	1.49	0.32	1.27	0.30	1.08	0.28	0.91
London Centre	High Speed	0.49	3.18	0.49	2.72	0.49	2.33	0.49	1.90	0.47	1.57	0.45	1.33	0.42	1.12	0.39	0.95	0.37	0.80	0.34	0.65
London Inner	Heavy Congestion	0.60	10.61	0.61	10.22	0.62	9.59	0.63	8.57	0.61	7.70	0.58	6.90	0.54	6.22	0.50	5.54	0.47	4.95	0.44	4.47
London Inner	Light Congestion	0.44	5.75	0.44	5.41	0.45	4.99	0.46	4.39	0.44	3.87	0.42	3.39	0.39	2.98	0.36	2.58	0.34	2.24	0.31	1.95
London Inner	Free Flow	0.36	3.73	0.35	3.31	0.35	2.94	0.35	2.49	0.34	2.12	0.32	1.81	0.29	1.54	0.27	1.29	0.25	1.09	0.24	0.90
London Inner	High Speed	0.43	3.15	0.42	2.71	0.42	2.34	0.43	1.95	0.41	1.62	0.38	1.35	0.36	1.13	0.33	0.94	0.31	0.78	0.29	0.62
London Outer	Heavy Congestion	0.58	10.47	0.59	10.11	0.60	9.53	0.61	8.55	0.59	7.70	0.56	6.89	0.52	6.20	0.48	5.52	0.45	4.92	0.42	4.43
London Outer	Light Congestion	0.42	5.71	0.43	5.37	0.43	4.98	0.44	4.39	0.42	3.88	0.40	3.39	0.37	2.97	0.34	2.57	0.32	2.22	0.30	1.93
London Outer	Free Flow	0.34	3.72	0.34	3.30	0.34	2.93	0.34	2.50	0.32	2.13	0.30	1.81	0.28	1.53	0.26	1.29	0.24	1.08	0.22	0.89
London Outer	High Speed	0.41	3.14	0.40	2.69	0.40	2.33	0.41	1.95	0.39	1.62	0.36	1.35	0.34	1.13	0.31	0.93	0.29	0.77	0.27	0.61
London Motorway	Heavy Congestion	0.70	5.21	0.70	4.50	0.71	3.72	0.73	2.90	0.70	2.23	0.66	1.68	0.61	1.26	0.56	0.94	0.53	0.71	0.49	0.54
London Motorway	Light Congestion	0.63	4.66	0.63	4.02	0.64	3.33	0.65	2.59	0.63	1.99	0.59	1.50	0.54	1.12	0.50	0.84	0.47	0.63	0.44	0.49
London Motorway	Free Flow	0.46	3.43	0.46	2.97	0.47	2.45	0.48	1.91	0.46	1.47	0.43	1.11	0.40	0.83	0.37	0.62	0.35	0.47	0.32	0.36

Annex C1 (continue) NOx Emissions (g/km per vehicle) 2021 to 2030

		2021	2021	2022	2022	2023	2023	2024	2024	2025	2025	2026	2026	2027	2027	2028	2028	2029	2029	2030	2030
		LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV
Motorway	Heavy Congestion	0.46	0.43	0.43	0.36	0.40	0.31	0.38	0.29	0.36	0.27	0.34	0.26	0.33	0.25	0.32	0.25	0.31	0.25	0.30	0.25
Motorway	Light Congestion	0.41	0.38	0.39	0.32	0.36	0.28	0.34	0.26	0.32	0.24	0.31	0.23	0.29	0.23	0.28	0.22	0.28	0.22	0.27	0.22
Motorway	Free Flow	0.30	0.28	0.28	0.23	0.27	0.20	0.25	0.19	0.24	0.18	0.23	0.17	0.22	0.17	0.21	0.16	0.20	0.16	0.20	0.16
Urban	Heavy Congestion	0.39	3.78	0.37	3.37	0.34	3.05	0.32	2.80	0.30	2.60	0.29	2.47	0.28	2.37	0.27	2.31	0.26	2.27	0.25	2.24
Urban	Light Congestion	0.28	1.50	0.26	1.27	0.25	1.10	0.23	0.97	0.22	0.87	0.21	0.80	0.20	0.74	0.19	0.71	0.19	0.69	0.18	0.67
Urban	Free Flow	0.21	0.69	0.20	0.57	0.18	0.47	0.17	0.40	0.16	0.35	0.16	0.31	0.15	0.28	0.14	0.26	0.14	0.25	0.14	0.25
Urban	High Speed	0.26	0.49	0.24	0.39	0.22	0.32	0.21	0.27	0.20	0.23	0.19	0.20	0.18	0.18	0.18	0.16	0.17	0.15	0.17	0.15
Rural	Heavy Congestion	0.42	3.19	0.39	2.91	0.37	2.71	0.35	2.57	0.33	2.46	0.31	2.39	0.30	2.34	0.29	2.31	0.28	2.30	0.28	2.29
Rural	Light Congestion	0.30	1.15	0.28	1.00	0.27	0.89	0.25	0.81	0.24	0.76	0.23	0.72	0.22	0.69	0.21	0.68	0.21	0.67	0.20	0.67
Rural	Free Flow	0.22	0.49	0.21	0.41	0.20	0.35	0.19	0.31	0.18	0.29	0.17	0.27	0.16	0.26	0.16	0.25	0.15	0.24	0.15	0.24
Rural	High Speed	0.27	0.33	0.26	0.26	0.24	0.22	0.23	0.20	0.22	0.18	0.21	0.17	0.20	0.16	0.19	0.15	0.19	0.15	0.19	0.15
London Centre	Heavy Congestion	0.47	4.05	0.44	3.65	0.41	3.20	0.38	2.76	0.36	2.20	0.34	1.85	0.33	1.76	0.31	1.72	0.30	1.67	0.29	1.64
London Centre	Light Congestion	0.34	1.72	0.32	1.51	0.30	1.27	0.28	1.05	0.26	0.77	0.25	0.60	0.24	0.55	0.23	0.53	0.22	0.51	0.21	0.50
London Centre	Free Flow	0.26	0.77	0.24	0.65	0.23	0.54	0.21	0.44	0.20	0.31	0.19	0.23	0.18	0.21	0.17	0.20	0.17	0.19	0.16	0.18
London Centre	High Speed	0.32	0.54	0.30	0.46	0.28	0.38	0.26	0.30	0.25	0.21	0.24	0.14	0.23	0.13	0.21	0.12	0.21	0.11	0.20	0.11
London Inner	Heavy Congestion	0.41	4.02	0.38	3.60	0.35	3.17	0.33	2.78	0.31	2.33	0.30	2.05	0.28	1.96	0.27	1.92	0.26	1.88	0.25	1.85
London Inner	Light Congestion	0.29	1.69	0.27	1.46	0.25	1.23	0.24	1.03	0.23	0.80	0.21	0.65	0.20	0.61	0.20	0.59	0.19	0.57	0.18	0.56
London Inner	Free Flow	0.22	0.75	0.21	0.62	0.19	0.51	0.18	0.42	0.17	0.32	0.16	0.25	0.15	0.23	0.15	0.22	0.14	0.20	0.14	0.20
London Inner	High Speed	0.27	0.50	0.25	0.41	0.23	0.34	0.22	0.27	0.21	0.20	0.20	0.15	0.19	0.14	0.18	0.13	0.17	0.12	0.17	0.12
London Outer	Heavy Congestion	0.39	3.98	0.36	3.57	0.34	3.14	0.32	2.77	0.30	2.34	0.28	2.06	0.27	1.98	0.26	1.94	0.25	1.90	0.24	1.88
London Outer	Light Congestion	0.28	1.66	0.26	1.44	0.24	1.21	0.23	1.02	0.22	0.80	0.20	0.66	0.19	0.62	0.19	0.60	0.18	0.58	0.17	0.57
London Outer	Free Flow	0.21	0.74	0.19	0.61	0.18	0.50	0.17	0.41	0.16	0.31	0.15	0.25	0.15	0.23	0.14	0.22	0.14	0.21	0.13	0.20
London Outer	High Speed	0.25	0.49	0.24	0.40	0.22	0.33	0.21	0.27	0.20	0.19	0.19	0.15	0.18	0.13	0.17	0.13	0.16	0.12	0.16	0.12
London Motorway	Heavy Congestion	0.46	0.43	0.43	0.36	0.41	0.31	0.38	0.28	0.36	0.26	0.34	0.25	0.33	0.24	0.31	0.24	0.30	0.24	0.30	0.24
London Motorway	Light Congestion	0.41	0.38	0.39	0.32	0.36	0.27	0.34	0.25	0.32	0.24	0.30	0.23	0.29	0.22	0.28	0.21	0.27	0.21	0.26	0.21
London Motorway	Free Flow	0.30	0.28	0.29	0.23	0.27	0.20	0.25	0.19	0.24	0.17	0.22	0.17	0.21	0.16	0.21	0.16	0.20	0.16	0.20	0.16

Annex C2 PM_{10} Emissions (g/km per vehicle) 2011 to 2020

		2011	2011	2012	2012	2013	2013	2014	2014	2015	2015	2016	2016	2017	2017	2018	2018	2019	2019	2020	2020
		LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV
Motorway	Heavy Congestion	0.05	0.19	0.04	0.18	0.04	0.17	0.04	0.15	0.04	0.14	0.03	0.13	0.03	0.13	0.03	0.12	0.03	0.12	0.03	0.11
Motorway	Light Congestion	0.04	0.17	0.04	0.16	0.04	0.15	0.03	0.14	0.03	0.13	0.03	0.12	0.03	0.11	0.03	0.11	0.03	0.10	0.02	0.10
Motorway	Free Flow	0.03	0.13	0.03	0.12	0.03	0.11	0.03	0.10	0.02	0.09	0.02	0.09	0.02	0.08	0.02	0.08	0.02	0.08	0.02	0.08
Urban	Heavy Congestion	0.05	0.30	0.04	0.28	0.04	0.26	0.04	0.23	0.04	0.21	0.04	0.19	0.04	0.18	0.03	0.16	0.03	0.15	0.03	0.14
Urban	Light Congestion	0.04	0.21	0.04	0.20	0.04	0.19	0.04	0.18	0.04	0.17	0.03	0.16	0.03	0.15	0.03	0.14	0.03	0.13	0.03	0.13
Urban	Free Flow	0.04	0.18	0.04	0.17	0.04	0.16	0.04	0.16	0.03	0.15	0.03	0.14	0.03	0.14	0.03	0.13	0.03	0.13	0.03	0.12
Urban	High Speed	0.04	0.17	0.04	0.17	0.04	0.16	0.04	0.15	0.04	0.14	0.03	0.14	0.03	0.13	0.03	0.13	0.03	0.13	0.03	0.12
Rural	Heavy Congestion	0.04	0.27	0.04	0.25	0.03	0.22	0.03	0.20	0.03	0.17	0.03	0.15	0.03	0.14	0.03	0.13	0.03	0.12	0.02	0.11
Rural	Light Congestion	0.03	0.18	0.03	0.17	0.03	0.16	0.03	0.14	0.03	0.13	0.03	0.12	0.03	0.11	0.02	0.11	0.02	0.10	0.02	0.10
Rural	Free Flow	0.03	0.15	0.03	0.14	0.03	0.13	0.03	0.13	0.03	0.12	0.03	0.11	0.02	0.11	0.02	0.10	0.02	0.10	0.02	0.10
Rural	High Speed	0.04	0.14	0.03	0.14	0.03	0.13	0.03	0.12	0.03	0.11	0.03	0.11	0.03	0.10	0.02	0.10	0.02	0.10	0.02	0.10
London Centre	Heavy Congestion	0.06	0.19	0.06	0.18	0.06	0.17	0.05	0.16	0.05	0.15	0.05	0.14	0.05	0.13	0.04	0.13	0.04	0.12	0.04	0.12
London Centre	Light Congestion	0.04	0.16	0.04	0.15	0.04	0.14	0.04	0.13	0.04	0.12	0.04	0.12	0.04	0.11	0.03	0.11	0.03	0.11	0.03	0.11
London Centre	Free Flow	0.04	0.14	0.04	0.13	0.04	0.13	0.04	0.12	0.04	0.11	0.04	0.11	0.03	0.11	0.03	0.10	0.03	0.10	0.03	0.10
London Centre	High Speed	0.05	0.14	0.05	0.13	0.04	0.12	0.04	0.12	0.04	0.11	0.04	0.11	0.04	0.11	0.04	0.10	0.03	0.10	0.03	0.10
London Inner	Heavy Congestion	0.05	0.21	0.05	0.19	0.05	0.18	0.04	0.17	0.04	0.16	0.04	0.15	0.04	0.14	0.04	0.14	0.04	0.13	0.03	0.12
London Inner	Light Congestion	0.04	0.16	0.04	0.15	0.04	0.15	0.04	0.14	0.04	0.13	0.03	0.13	0.03	0.12	0.03	0.12	0.03	0.12	0.03	0.11
London Inner	Free Flow	0.04	0.15	0.04	0.14	0.04	0.13	0.04	0.13	0.03	0.12	0.03	0.12	0.03	0.11	0.03	0.11	0.03	0.11	0.03	0.11
London Inner	High Speed	0.04	0.14	0.04	0.13	0.04	0.13	0.04	0.12	0.04	0.12	0.04	0.12	0.03	0.11	0.03	0.11	0.03	0.11	0.03	0.11
London Outer	Heavy Congestion	0.05	0.21	0.04	0.19	0.04	0.18	0.04	0.17	0.04	0.16	0.04	0.15	0.04	0.14	0.03	0.14	0.03	0.13	0.03	0.13
London Outer	Light Congestion	0.04	0.16	0.04	0.15	0.04	0.15	0.04	0.14	0.04	0.13	0.03	0.13	0.03	0.12	0.03	0.12	0.03	0.12	0.03	0.11
London Outer	Free Flow	0.04	0.15	0.04	0.14	0.04	0.13	0.04	0.13	0.03	0.12	0.03	0.12	0.03	0.12	0.03	0.11	0.03	0.11	0.03	0.11
London Outer	High Speed	0.04	0.14	0.04	0.13	0.04	0.13	0.04	0.12	0.04	0.12	0.03	0.12	0.03	0.11	0.03	0.11	0.03	0.11	0.03	0.11
London Motorway	Heavy Congestion	0.05	0.19	0.04	0.18	0.04	0.16	0.04	0.15	0.04	0.14	0.03	0.13	0.03	0.12	0.03	0.12	0.03	0.11	0.03	0.11
London Motorway	Light Congestion	0.04	0.17	0.04	0.16	0.04	0.15	0.03	0.13	0.03	0.12	0.03	0.12	0.03	0.11	0.03	0.11	0.03	0.10	0.02	0.10
London Motorway	Free Flow	0.03	0.12	0.03	0.12	0.03	0.11	0.03	0.10	0.02	0.09	0.02	0.09	0.02	0.08	0.02	0.08	0.02	0.08	0.02	0.07

Annex C2 (continue) PM_{10} Emissions (g/km per vehicle) 2021 to 2030

		2021	2021	2022	2022	2023	2023	2024	2024	2025	2025	2026	2026	2027	2027	2028	2028	2029	2029	2030	2030
		LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV
Motorway	Heavy Congestion	0.03	0.11	0.03	0.11	0.03	0.11	0.03	0.11	0.03	0.11	0.03	0.11	0.03	0.11	0.03	0.11	0.03	0.11	0.03	0.11
Motorway	Light Congestion	0.02	0.10	0.02	0.10	0.02	0.10	0.02	0.10	0.02	0.10	0.02	0.10	0.02	0.10	0.02	0.10	0.02	0.10	0.02	0.10
Motorway	Free Flow	0.02	0.07	0.02	0.07	0.02	0.07	0.02	0.07	0.02	0.07	0.02	0.07	0.02	0.07	0.02	0.07	0.02	0.07	0.02	0.07
Urban	Heavy Congestion	0.03	0.14	0.03	0.13	0.03	0.13	0.03	0.13	0.03	0.13	0.03	0.12	0.03	0.12	0.03	0.12	0.03	0.12	0.03	0.12
Urban	Light Congestion	0.03	0.13	0.03	0.12	0.03	0.12	0.03	0.12	0.03	0.12	0.03	0.12	0.03	0.12	0.03	0.12	0.03	0.12	0.03	0.12
Urban	Free Flow	0.03	0.12	0.03	0.12	0.03	0.12	0.03	0.12	0.03	0.12	0.03	0.12	0.03	0.12	0.03	0.12	0.03	0.12	0.03	0.12
Urban	High Speed	0.03	0.12	0.03	0.12	0.03	0.12	0.03	0.12	0.03	0.12	0.03	0.12	0.03	0.12	0.03	0.12	0.03	0.12	0.03	0.12
Rural	Heavy Congestion	0.02	0.10	0.02	0.10	0.02	0.10	0.02	0.10	0.02	0.10	0.02	0.10	0.02	0.10	0.02	0.10	0.02	0.10	0.02	0.10
Rural	Light Congestion	0.02	0.10	0.02	0.10	0.02	0.10	0.02	0.09	0.02	0.09	0.02	0.09	0.02	0.09	0.02	0.09	0.02	0.09	0.02	0.09
Rural	Free Flow	0.02	0.09	0.02	0.09	0.02	0.09	0.02	0.09	0.02	0.09	0.02	0.09	0.02	0.09	0.02	0.09	0.02	0.09	0.02	0.09
Rural	High Speed	0.02	0.09	0.02	0.09	0.02	0.09	0.02	0.09	0.02	0.09	0.02	0.09	0.02	0.09	0.02	0.09	0.02	0.09	0.02	0.09
London Centre	Heavy Congestion	0.04	0.11	0.04	0.11	0.03	0.11	0.03	0.10	0.03	0.10	0.03	0.09	0.03	0.09	0.03	0.09	0.03	0.09	0.03	0.09
London Centre	Light Congestion	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.09	0.03	0.09	0.03	0.09	0.03	0.09	0.03	0.09	0.03	0.09
London Centre	Free Flow	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.09	0.03	0.09	0.03	0.09	0.03	0.09	0.03	0.09	0.03	0.09	0.03	0.09
London Centre	High Speed	0.03	0.10	0.03	0.10	0.03	0.09	0.03	0.09	0.03	0.09	0.03	0.09	0.03	0.09	0.03	0.09	0.03	0.09	0.03	0.09
London Inner	Heavy Congestion	0.03	0.12	0.03	0.12	0.03	0.11	0.03	0.11	0.03	0.11	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10
London Inner	Light Congestion	0.03	0.11	0.03	0.11	0.03	0.11	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10
London Inner	Free Flow	0.03	0.11	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10
London Inner	High Speed	0.03	0.11	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10
London Outer	Heavy Congestion	0.03	0.12	0.03	0.12	0.03	0.11	0.03	0.11	0.03	0.11	0.03	0.11	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10
London Outer	Light Congestion	0.03	0.11	0.03	0.11	0.03	0.11	0.03	0.11	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10
London Outer	Free Flow	0.03	0.11	0.03	0.11	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10
London Outer	High Speed	0.03	0.11	0.03	0.11	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	0.10
London Motorway	Heavy Congestion	0.03	0.11	0.03	0.11	0.03	0.11	0.03	0.11	0.03	0.11	0.02	0.11	0.02	0.11	0.02	0.11	0.02	0.11	0.02	0.11
London Motorway	Light Congestion	0.02	0.10	0.02	0.10	0.02	0.10	0.02	0.10	0.02	0.10	0.02	0.10	0.02	0.10	0.02	0.10	0.02	0.10	0.02	0.10
London Motorway	Free Flow	0.02	0.07	0.02	0.07	0.02	0.07	0.02	0.07	0.02	0.07	0.02	0.07	0.02	0.07	0.02	0.07	0.02	0.07	0.02	0.07

Annex C3 CO_2 Emissions (g/km per vehicle) 2011 to 2020

		2011	2011	2012	2012	2013	2013	2014	2014	2015	2015	2016	2016	2017	2017	2018	2018	2019	2019	2020	2020
		LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV
Motorway	Heavy Congestion	249.44	1262.58	244.74	1247.99	240.47	1234.14	236.31	1220.96	230.54	1208.28	224.73	1207.82	219.51	1207.76	214.89	1207.89	210.75	1208.20	206.74	1208.65
Motorway	Light Congestion	222.97	1128.59	218.77	1115.54	214.95	1103.16	211.23	1091.38	206.08	1080.04	200.88	1079.63	196.22	1079.58	192.08	1079.70	188.38	1079.97	184.79	1080.38
Motorway	Free Flow	164.43	832.29	161.33	822.67	158.52	813.54	155.77	804.85	151.97	796.49	148.14	796.19	144.70	796.15	141.65	796.24	138.92	796.44	136.28	796.74
Urban	Heavy Congestion	402.14	1731.60	396.53	1725.83	391.40	1718.11	386.14	1711.75	379.78	1706.36	373.59	1707.13	367.78	1707.93	362.29	1708.17	356.93	1708.85	351.28	1710.20
Urban	Light Congestion	180.09	843.43	176.93	839.69	174.01	835.20	171.11	831.76	167.09	829.19	162.99	828.89	159.15	828.76	155.56	828.67	152.17	828.80	148.75	829.18
Urban	Free Flow	150.65	636.77	147.53	633.76	144.61	630.20	141.73	627.48	137.75	625.42	133.74	624.86	130.02	624.51	126.61	624.23	123.47	624.17	120.41	624.35
Urban	High Speed	165.56	663.24	162.45	660.27	159.47	656.74	156.51	654.04	152.44	652.02	148.42	651.39	144.69	651.01	141.26	650.70	138.10	650.64	134.98	650.83
Rural	Heavy Congestion	404.42	1730.22	399.08	1712.71	393.76	1695.56	388.62	1679.29	382.49	1663.70	376.68	1665.76	371.39	1667.62	366.54	1669.23	362.00	1670.89	357.35	1672.71
Rural	Light Congestion	180.90	957.38	177.88	942.96	174.96	929.12	172.18	916.17	168.34	903.98	164.47	904.42	160.89	905.01	157.62	905.70	154.60	906.51	151.62	907.47
Rural	Free Flow	151.13	721.50	148.51	711.05	145.64	701.08	142.87	691.83	139.05	683.18	135.24	683.14	131.77	683.31	128.64	683.59	125.83	684.02	123.14	684.58
Rural	High Speed	165.25	753.23	164.34	742.75	161.49	732.76	158.65	723.52	154.77	714.89	150.99	714.76	147.54	714.86	144.43	715.09	141.65	715.49	138.97	716.03
London Centre	Heavy Congestion	412.03	636.20	407.56	640.53	403.38	655.47	399.10	674.64	392.02	692.35	379.64	704.93	365.80	710.24	353.64	715.49	342.35	720.80	330.86	726.44
London Centre	Light Congestion	181.49	357.31	178.97	358.11	176.56	366.10	174.17	376.50	170.14	386.09	163.95	392.73	157.29	395.41	151.38	398.07	145.94	400.84	140.48	403.87
London Centre	Free Flow	154.52	277.74	152.03	278.08	149.62	284.15	147.24	292.10	143.33	299.42	137.51	304.45	131.33	306.45	125.88	308.44	120.93	310.54	116.04	312.84
London Centre	High Speed	176.46	295.10	173.97	295.43	171.52	301.85	169.09	310.26	164.93	318.00	158.31	323.33	151.14	325.43	144.85	327.53	139.12	329.75	133.46	332.18
London Inner	Heavy Congestion	398.37	888.30	393.15	892.13	388.22	906.93	383.18	925.34	375.35	942.09	362.60	953.70	348.60	958.65	336.21	963.44	324.66	968.26	312.87	973.43
London Inner	Light Congestion	178.89	500.23	175.94	500.20	173.12	507.99	170.31	517.88	165.77	526.85	159.21	532.86	152.27	535.26	146.08	537.60	140.35	540.06	134.60	542.81
London Inner	Free Flow	149.87	387.36	146.94	386.95	144.12	392.78	141.34	400.26	136.91	407.03	130.70	411.53	124.22	413.27	118.48	414.99	113.25	416.82	108.10	418.88
London Inner	High Speed	165.36	410.74	162.41	410.27	159.54	416.41	156.69	424.30	152.01	431.44	145.04	436.17	137.63	438.00	131.10	439.80	125.14	441.73	119.25	443.90
London Outer	Heavy Congestion	395.01	937.55	389.50	941.14	384.28	955.31	378.95	972.85	370.94	988.71	358.45	999.91	344.89	1004.77	332.84	1009.47	321.57	1014.19	310.05	1019.26
London Outer	Light Congestion	178.46	528.07	175.35	527.79	172.37	535.18	169.41	544.54	164.72	552.97	158.18	558.74	151.33	561.09	145.20	563.37	139.51	565.78	133.80	568.49
London Outer	Free Flow	148.70	408.79	145.61	408.17	142.63	413.71	139.70	420.79	135.11	427.16	128.90	431.45	122.48	433.14	116.78	434.80	111.58	436.58	106.46	438.58
London Outer	High Speed	162.05	433.41	158.93	432.71	155.89	438.55	152.88	446.02	148.06	452.75	141.15	457.26	133.87	459.01	127.44	460.74	121.57	462.61	115.77	464.71
London Motorway	Heavy Congestion	246.01	1146.05	241.15	1142.84	236.57	1142.95	232.17	1144.44	226.17	1146.23	220.03	1146.45	214.48	1145.95	209.54	1145.68	205.11	1145.57	200.81	1145.60
London Motorway	Light Congestion	219.90	1024.42	215.55	1021.55	211.46	1021.65	207.53	1022.98	202.17	1024.58	196.67	1024.77	191.72	1024.33	187.30	1024.09	183.34	1023.99	179.50	1024.02
London Motorway	Free Flow	162.17	755.47	158.96	753.35	155.95	753.43	153.05	754.41	149.09	755.59	145.04	755.73	141.39	755.41	138.13	755.23	135.21	755.15	132.37	755.18

Annex C3 (continue) CO_2 Emissions (g/km per vehicle) 2021 to 2030

		2021	2021	2022	2022	2023	2023	2024	2024	2025	2025	2026	2026	2027	2027	2028	2028	2029	2029	2030	2030
		LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV	LDV	HDV
Motorway	Heavy Congestion	203.36	1209.72	200.44	1210.96	197.89	1212.15	195.68	1213.28	193.72	1214.39	191.70	1213.98	190.26	1213.57	188.95	1213.17	187.76	1212.77	186.64	1212.38
Motorway	Light Congestion	181.78	1081.33	179.16	1082.44	176.89	1083.51	174.91	1084.51	173.16	1085.51	171.36	1085.14	170.07	1084.77	168.90	1084.42	167.84	1084.06	166.83	1083.71
Motorway	Free Flow	134.06	797.44	132.13	798.26	130.45	799.05	128.99	799.79	127.70	800.52	126.37	800.25	125.42	799.98	124.55	799.72	123.77	799.46	123.03	799.19
Urban	Heavy Congestion	345.98	1710.04	341.26	1709.71	336.82	1708.97	332.62	1708.06	328.68	1707.23	323.90	1706.05	320.09	1704.93	316.29	1704.02	312.54	1702.92	308.70	1701.59
Urban	Light Congestion	145.67	829.64	142.94	830.26	140.43	830.86	138.12	831.41	136.00	831.98	133.59	832.21	131.67	832.44	129.84	832.68	128.08	832.88	126.35	833.01
Urban	Free Flow	117.68	624.65	115.29	625.12	113.12	625.58	111.17	626.02	109.39	626.47	107.44	626.70	105.90	626.94	104.44	627.20	103.05	627.42	101.68	627.59
Urban	High Speed	132.20	651.17	129.74	651.70	127.52	652.22	125.50	652.72	123.66	653.23	121.64	653.53	120.04	653.83	118.51	654.15	117.03	654.43	115.56	654.67
Rural	Heavy Congestion	353.14	1674.86	349.48	1676.98	346.22	1678.89	343.26	1680.64	340.55	1682.39	337.32	1681.87	334.99	1681.38	332.71	1680.95	330.50	1680.48	328.26	1679.94
Rural	Light Congestion	149.00	908.95	146.71	910.58	144.67	912.16	142.86	913.66	141.22	915.14	139.41	915.19	138.05	915.23	136.79	915.28	135.62	915.32	134.49	915.33
Rural	Free Flow	120.80	685.54	118.77	686.65	117.00	687.72	115.45	688.75	114.08	689.76	112.63	689.82	111.57	689.88	110.60	689.95	109.72	690.00	108.88	690.05
Rural	High Speed	136.62	716.97	134.60	718.07	132.83	719.14	131.28	720.16	129.91	721.17	128.50	721.26	127.49	721.34	126.56	721.43	125.72	721.51	124.92	721.58
London Centre	Heavy Congestion	321.24	732.12	313.52	737.29	306.10	742.39	300.26	747.85	295.37	752.89	290.01	758.36	285.79	764.11	281.87	769.95	278.37	775.88	275.20	781.91
London Centre	Light Congestion	135.91	406.96	132.19	409.82	128.67	412.65	125.86	415.69	123.48	418.49	120.96	421.53	118.98	424.73	117.17	427.98	115.57	431.27	114.15	434.62
London Centre	Free Flow	111.98	315.19	108.69	317.39	105.60	319.57	103.16	321.92	101.13	324.09	99.03	326.45	97.38	328.92	95.90	331.44	94.60	333.99	93.46	336.58
London Centre	High Speed	128.77	334.67	125.01	336.99	121.45	339.31	118.70	341.81	116.42	344.11	114.08	346.61	112.23	349.24	110.58	351.91	109.14	354.62	107.89	357.37
London Inner	Heavy Congestion	302.90	978.56	294.81	983.19	287.07	987.65	280.84	992.38	275.55	996.72	269.62	1001.43	264.98	1006.36	260.64	1011.34	256.71	1016.37	253.10	1021.44
London Inner	Light Congestion	129.75	545.58	125.76	548.14	122.01	550.63	118.95	553.27	116.33	555.68	113.51	558.31	111.30	561.06	109.27	563.83	107.47	566.64	105.84	569.47
London Inner	Free Flow	103.79	420.98	100.26	422.93	96.97	424.83	94.32	426.87	92.09	428.73	89.75	430.76	87.92	432.88	86.27	435.02	84.81	437.18	83.52	439.37
London Inner	High Speed	114.35	446.10	110.37	448.16	106.64	450.18	103.68	452.34	101.21	454.31	98.63	456.46	96.61	458.71	94.78	460.98	93.18	463.27	91.77	465.58
London Outer	Heavy Congestion	300.25	1024.26	292.24	1028.78	284.58	1033.12	278.34	1037.68	272.99	1041.88	266.93	1046.45	262.19	1051.22	257.75	1056.03	253.70	1060.89	249.94	1065.79
London Outer	Light Congestion	128.96	571.20	124.96	573.71	121.19	576.13	118.09	578.69	115.41	581.04	112.51	583.60	110.24	586.27	108.16	588.97	106.29	591.70	104.59	594.45
London Outer	Free Flow	102.16	440.62	98.61	442.51	95.32	444.36	92.64	446.32	90.36	448.13	87.96	450.09	86.09	452.14	84.39	454.20	82.88	456.29	81.53	458.39
London Outer	High Speed	110.91	466.84	106.95	468.84	103.24	470.79	100.27	472.86	97.77	474.76	95.13	476.83	93.07	479.00	91.21	481.18	89.56	483.38	88.10	485.60
London Motorway	Heavy Congestion	197.18	1145.90	194.01	1146.33	191.22	1146.74	188.79	1147.16	186.61	1147.52	184.25	1147.75	182.47	1148.01	180.83	1148.28	179.33	1148.55	177.89	1148.83
London Motorway	Light Congestion	176.25	1024.28	173.42	1024.67	170.93	1025.04	168.75	1025.41	166.80	1025.73	164.69	1025.94	163.10	1026.17	161.64	1026.41	160.30	1026.65	159.01	1026.90
London Motorway	Free Flow	129.98	755.37	127.89	755.65	126.05	755.93	124.45	756.20	123.01	756.44	121.46	756.59	120.28	756.76	119.21	756.94	118.21	757.12	117.27	757.30