

CO₂ g/km exhaust emissions from UK passenger cars.

A preliminary analysis of published DfT / DVSA Vehicle Market Surveillance Unit RDE 'on road' exhaust emissions data (2019 – 2023).

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Disclaimer

The analysis described in this research note is furnished "as is". Whilst reasonable efforts have been made to ensure accuracy, no warranty is provided whatsoever. The author will not be held responsible for any loss, damage or inconvenience caused as a result of any inaccuracy or error.

1. Introduction

The UK Department for Transport (DfT) and its agency the Driver and Vehicle Standards Agency (DVSA) has a market surveillance unit, which inspects vehicles to make sure they meet safety and environmental standards. Since 2017, the Vehicle Market Surveillance Unit (VMSU) has carried out exhaust emissions tests (laboratory, test track, and on-road) annually on a representative selection of the most popular vehicle types used on UK roads.

<https://www.gov.uk/government/collections/dvsa-vehicle-market-surveillance-unit>

The DVSA test vehicles to make sure they conform to European emission standards (as adopted in GB legislation). While the published VMSU annual reports document emission results for pollutants with legislated limit values (such as NO_x, CO, and particle number per km), CO₂ g/km results over the RDE (real driving emissions) 'on road' drive cycle are not systematically reported. In European legislation, CO₂ g/km emissions limits are specified in terms of annual specific emission targets for each manufacturer based on EU fleet-wide targets, taking into account the mix of its registered new vehicles. Since 2021, these specific CO₂ emission targets are based on the Worldwide Harmonised Light Vehicle Test Procedure (WLTP) laboratory test cycle. The CO₂ g/km values published for each new passenger car are WLTP values.

However, the RDE 'on road' CO₂ g/km values are of potential value to the research community to help inform analysis of 'real world' carbon emissions (encompassing factors such as variation in ambient temperature, highway gradient, road type and traffic conditions).

This analysis utilises the RDE 'on road' exhaust emissions data from the datasets published by DVSA on their website. The analysis in this research note has been limited to petrol and diesel passenger cars of Euro class 6d-temp and Euro class 6d. The analysis excludes passenger cars identified by DVSA as either plug-in hybrid electric vehicles (PHEV) or self-charging hybrid vehicles.

The analysis provides insights into the 'on road' CO₂ emissions performance of the vehicles tested, and facilitates comparison between RDE 'on road' emission rates, published WLTP values, and emission rate assumptions in tools such as DEFRA's Emissions Factors Toolkit.

2. Data processing

The RDE 'on road' data published by DVSA were collected using Portable Emissions Measuring System (PEMS) equipment. Each test measures exhaust emissions while the vehicle is being driven on public roads for between 1.5 and 2 hours over a specified test route. The routes included urban, rural and motorway driving, and tests were carried out during daytime in normal traffic conditions. The routes utilised by DVSA in years 2019 to 2023 are illustrated in Appendix A.

Most of the RDE 'on road' data published by DVSA is at 1Hz frequency, although some data files were found to be at 10Hz frequency. 10Hz data were aggregated to 1Hz prior to analysis.

This analysis utilised the EMROAD version 6 utility developed by the European Commission Joint Research Centre (JRC). The mass of the exhaust gas component (in this case CO₂) is calculated using:

$$m_{gas,i} = U_{gas} \cdot C_{gas,i} \cdot Q_{mew,i}$$

where:

$m_{gas,i}$ is the mass of the exhaust component “gas” [g/s]

U_{gas} is the ratio of the density of the exhaust component “gas” and the overall density of the exhaust

$C_{gas,i}$ is the measured concentration of the exhaust component “gas” in the exhaust [ppm]

$Q_{mew,i}$ is the measured exhaust mass flow rate [kg/s]

gas is the respective component

i is the number of the measurement.

Table 1 presents the list of diesel passenger cars included in the analysis (29 vehicles, 34 tests), documenting relevant parameters such as Euro class, engine capacity, maximum power output, and the mean ambient temperature of the RDE ‘on road’ test. Table 2 presents the list of petrol passenger cars (41 vehicles, 43 tests).

Figures 1 and 2 illustrate the RDE ‘on road’ and WLTP drive cycles respectively, for information.

Table 1: Diesel passenger cars included in DfT/DVSA RDE ‘on road’ PEMS tests (Euro 6d-temp & Euro 6d only)

DVSA test year	Manufacturer	Model	Fuel type	Engine cc	Euro class	kW	Ambient Temp °C
2021	BMW	3 Series 320d (2020MY) auto	Diesel	1995	6d-temp	140	13
2022	Ford	Focus (2020MY) manual	Diesel	1995	6d-temp	110	15
2022	Hyundai	Tucson (2020MY) manual	Diesel	1598	6d-temp	85	13
2021	Jaguar	F Pace (2020MY) auto	Diesel	1999	6d-temp	177	11
2022	Jeep	Wrangler (2019MY) auto	Diesel	2143	6d-temp	147	4
2021	Mercedes-Benz	A Class (2020MY) auto	Diesel	1461	6d-temp	85	7
2021	Mercedes-Benz	E Class E220 D AMG (2019MY)	Diesel	1950	6d-temp	143	11
2021	Peugeot	3008 (2020MY) auto	Diesel	1499	6d-temp		14
2021	Skoda	Octavia (2020MY) manual	Diesel	1598	6d-temp	85	9
2021	Vauxhall	Insignia (2019MY) manual	Diesel	1956	6d-temp	125	16
2021	Volvo	V90 (2020MY) auto	Diesel	1969	6d-temp		25
2020	Ford	Kuga (2019MY) manual (Run 1)	Diesel	1997	6d-temp	132	24
2020	Ford	Kuga (2019MY) manual (Run 2)	Diesel	1997	6d-temp	132	20
2019	Honda	Civic EX i-Dtec (2018MY) man. (Run 1)	Diesel	1597	6d-temp	88	14
2019	Honda	Civic EX i-Dtec (2018MY) man. (Run 2)	Diesel	1597	6d-temp	88	21
2020	Kia	Sportage (2018MY) manual	Diesel	1598	6d-temp	100	16
2019	Land Rover	Discovery SD4 (2018MY) auto (Run 1)	Diesel	1999	6d-temp	177	4
2019	Land Rover	Discovery SD4 (2018MY) auto (Run 2)	Diesel	1999	6d-temp	177	19
2019	Nissan	Qashqai (2018MY) manual	Diesel	1461	6d-temp		10
2019	Range Rover	Velar (2018MY) auto (Run 1)	Diesel	2993	6d-temp	221	6
2019	Range Rover	Velar (2018MY) auto (Run 2)	Diesel	2993	6d-temp	221	20
2020	Renault	Kadjar (2019MY) manual	Diesel	1461	6d-temp	85	12
2020	Toyota	Land Cruiser (2019MY) auto	Diesel	2755	6d-temp	130	22
2020	Vauxhall	Astra Sri VX Line CDTi (2018MY) man	Diesel	1598	6d-temp	100	16
2020	Vauxhall	Grandland X (2019MY) manual	Diesel	1499	6d-temp	96	17
2020	Volvo	XC60 (2019MY) auto	Diesel	1969	6d-temp	173	17
2023	Audi	Q5 (2021MY) auto	Diesel	1968	6d	100	10
2022	BMW	X5 (2021MY) auto	Diesel	2993	6d	210	9
2022	Ford	Galaxy (2021MY) auto (Run 1)	Diesel	1995	6d	110	23
2022	Ford	Galaxy (2021MY) auto (Run 2)	Diesel	1995	6d	110	17
2023	Ford	Tourneo Custom (2022MY) auto	Diesel	1995	6d	125	9
2022	Mercedes-Benz	GLC (2019MY) auto	Diesel	1950	6d	143	12
2022	Volkswagen	Passat (2021MY) auto	Diesel	1968	6d	110	14
2023	Volkswagen	Tiguan (2021MY) auto	Diesel	1968	6d	110	8

Table 2: Petrol passenger cars included in DfT/DVSA RDE 'on road' PEMS tests (Euro 6d-temp & Euro 6d only)

DVSA test year	Manufacturer	Model	Fuel type	Engine cc	Euro class	kW	Ambient Temp °C
2021	Ford	Fiesta (2019MY) manual	Petrol	998	6d-temp	92	12
2021	Ford	Focus (2020MY) auto	Petrol	999	6d-temp	92	10
2021	Kia	Sportage (2020MY) auto	Petrol	1591	6d-temp		20
2021	Mini	Countryman Cooper S(2019MY) man.	Petrol	1998	6d-temp	141	14
2021	Mitsubishi	Eclipse Cross (2019MY) manual	Petrol	1499	6d-temp		14
2022	Nissan	Juke (2020MY) auto	Petrol	999	6d-temp	86	13
2021	Nissan	Qashqai (2020MY) auto	Petrol	1332	6d-temp	117	14
2022	Range Rover	Sport SVR (2020MY) auto	Petrol	4999	6d-temp	432	13
2021	Renault	Captur (2020MY) manual	Petrol	1332	6d-temp		15
2021	Renault	Clio (2020MY) manual	Petrol	999	6d-temp		7
2022	Subaru	Outback (2019MY) auto	Petrol	2498	6d-temp	114	9
2021	Vauxhall	Mokka (2018MY) auto	Petrol	1364	6d-temp		26
2021	Volkswagen	Golf Life TSI (2020MY) manual	Petrol	1498	6d-temp	96	15
2022	Volkswagen	Polo (2019MY) manual	Petrol	999	6d-temp	59	12
2019	BMW	118i Sport (2018MY) manual	Petrol	1499	6d-temp	100	11
2020	Hyundai	i20 (2019MY) auto	Petrol	1248	6d-temp	61.8	14
2020	Jaguar	XE R-Sport (2019MY) auto	Petrol	1997	6d-temp	147	7
2020	Kia	XCeed (2019MY) manual	Petrol	998	6d-temp	88.3	17
2020	Mazda	CX5 (2019MY) manual	Petrol	1998	6d-temp	121	13
2020	Mercedes-Benz	A180 Sport (2019MY) auto	Petrol	1332	6d-temp	100	9
2020	Peugeot	2008 auto	Petrol	1191	6d-temp		27
2019	Volvo	V40 manual	Petrol	1969	6d-temp		12
2023	Aston Martin	DB11 (2022MY) auto	Petrol	3982	6d	393.5	3
2023	Audi	A1 (2022MY) auto	Petrol	999	6d	81	5
2022	Citroen	C5 (2020MY) auto	Petrol	1199	6d	96	13
2023	CUPRA	Ateca (2022MY) auto	Petrol	1984	6d	221	7
2022	Dacia	Sandero (2021MY) manual	Petrol	999	6d	74	12
2022	Fiat	500 (2021MY) manual	Petrol	999	6d	51.5	25
2023	Ford	Puma MEHV (2020MY) manual	Petrol	999	6d	91.9	8
2022	Honda	Civic (2021MY) manual	Petrol	998	6d	93	15
2023	Hyundai	Tucson (2021MY) manual (Run 1)	Petrol	1598	6d	110	18
2023	Hyundai	Tucson (2021MY) manual (Run 2)	Petrol	1598	6d	110	15
2023	Maserati	Levante (2022MY) auto	Petrol	1995	6d	243	2
2022	Mazda	3 (2020MY) manual (Run 1)	Petrol	1998	6d	132	13
2022	Mazda	3 (2020MY) manual (Run 2)	Petrol	1998	6d	132	10
2023	Mercedes Benz	A Class (2022MY) auto	Petrol	1332	6d	120	9
2023	Mini	Cooper (2022MY) manual	Petrol	1499	6d	100	9
2023	Porsche	Macan (2022MY) auto	Petrol	1984	6d	195	11
2021	Suzuki	Vitara (2020MY) manual	Petrol	1373	6d	95	15
2021	Toyota	Aygo (2019MY) manual	Petrol	998	6d	53	8
2021	Vauxhall	Corsa (2020MY) manual	Petrol	1199	6d	74	10
2022	Volkswagen	Tiguan (2021MY) auto	Petrol	1498	6d	110	8
2023	Volvo	XC40 MEHV (2021MY) auto	Petrol	1969	6d	145	3

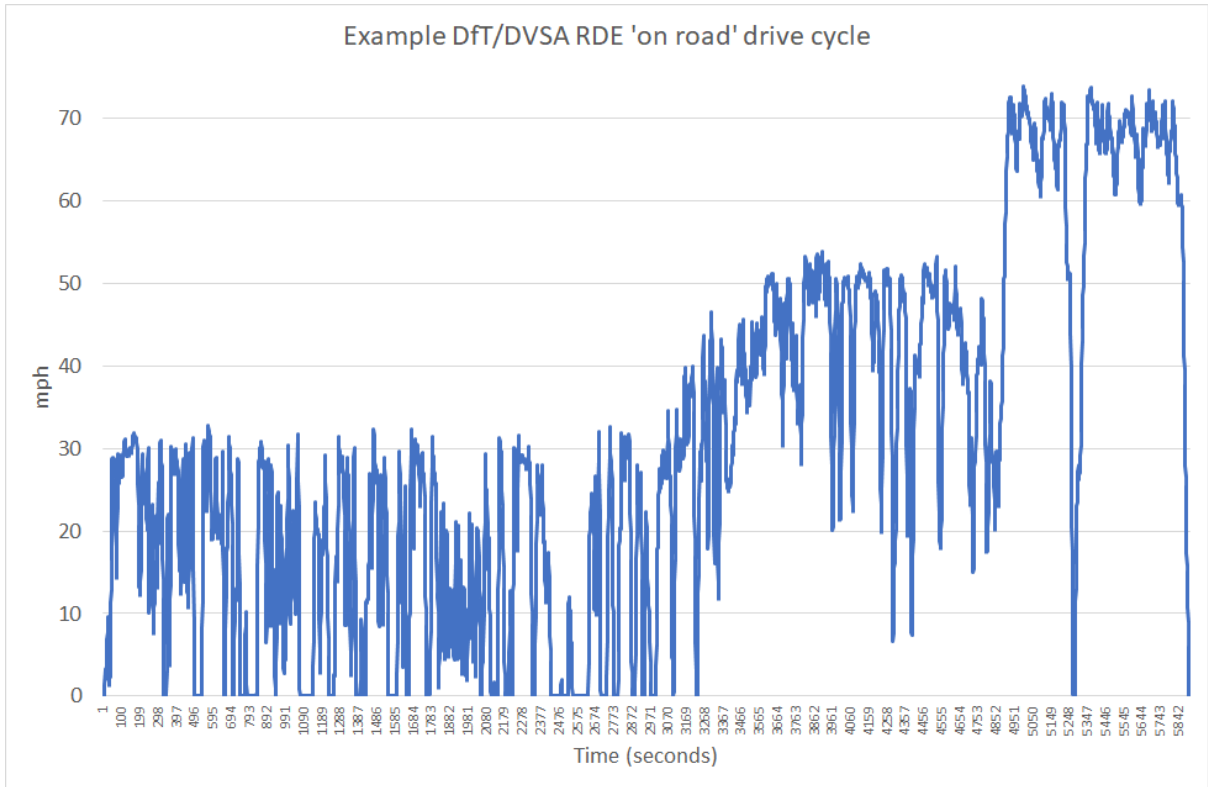


Figure 1: Example DfT/DVSA RDE 'on road' drive cycle

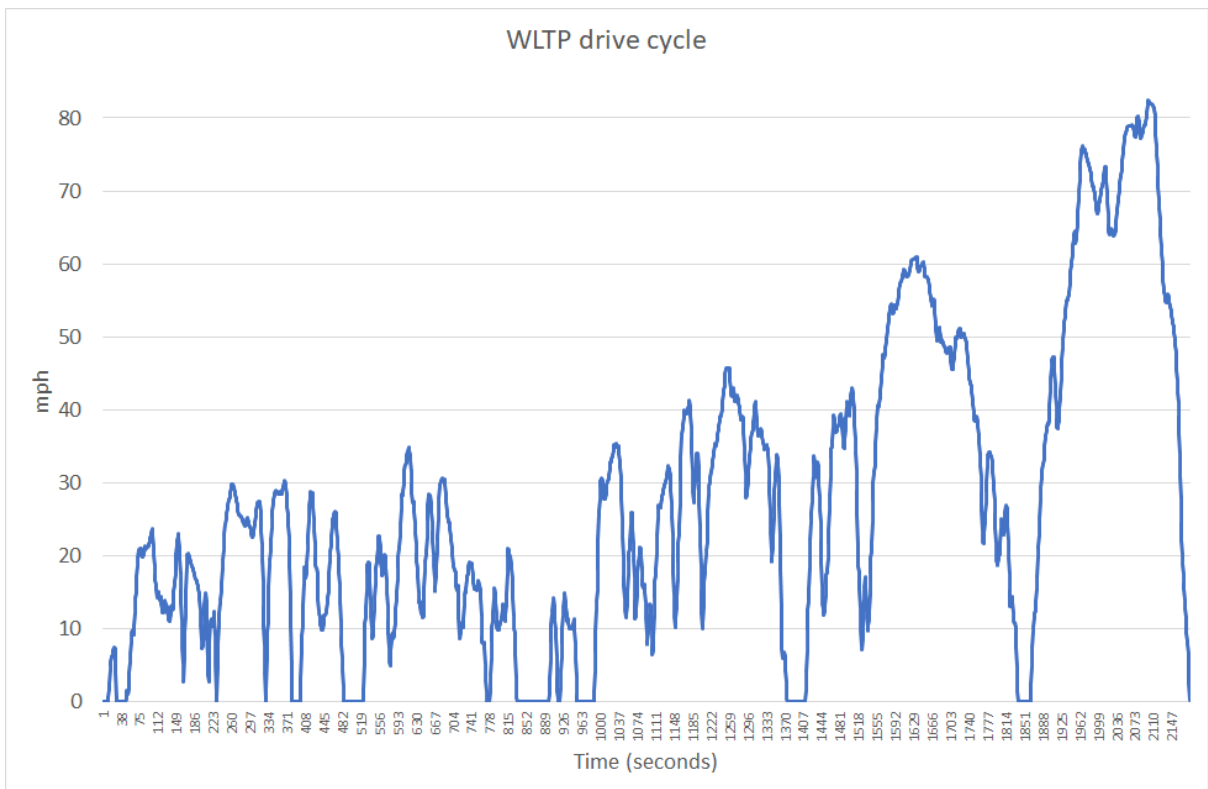


Figure 2: WLTP drive cycle

3. Results

3.1 RDE 'on road' CO₂ g/km values – Diesel cars Euro 6d-temp

Table 3: RDE 'on road' PEMS test CO₂ g/km – Diesel cars (Euro 6d-temp)

Vehicle	Complete test	Urban	Rural	Motorway
Land Rover Discovery SD4 auto 177kW Run 1	249	308	238	188
Range Rover Velar 2993cc auto 221kW Run 1	238	298	211	201
Land Rover Discovery SD4 auto 177kW Run 2	234	299	205	191
Jeep Wrangler 2143cc auto 147kW	221	258	182	217
Toyota Land Cruiser 2755cc auto 130kW	221	292	189	198
Range Rover Velar 2993cc auto 221kW Run 2	212	287	182	168
Jaguar F Pace 1999cc auto 177kW	196	262	171	162
Volvo XC60 1969cc auto 173kW	181	242	166	155
Mercedes E class 1950cc auto 143kW	180	222	167	149
Ford Kuga 1997cc manual 132Kw Run 2	177	224	164	154
Ford Kuga 1997cc manual 132Kw Run 1	168	203	159	152
BMW 3 series 1995cc auto 140kW	158	227	136	113
Volvo V90 1969cc auto	156	211	136	119
Nissan Qashqai 1461cc manual	154	173	147	136
Hyundai Tucson 1598cc manual 85kW	147	165	126	145
Kia Sportage 1598cc manual 100kW	145	164	135	133
Vauxhall Astra 1598cc manual 100kW	143	183	131	126
Vauxhall Insignia 1956cc manual 125kW	142	174	131	117
Ford Focus 1995cc manual 110kW	139	173	112	123
Renault Kadjar 1461cc manual 85kW	138	160	128	127
Honda Civic 1597cc manual 88kW Run 1	138	168	130	114
Skoda Octavia 1598cc manual 85kW	138	155	131	127
Honda Civic 1597cc manual 88kW Run 2	133	164	139	108
Mercedes A class 1461cc auto 85kW	133	170	123	102
Peugeot 3008 1499cc auto	132	160	124	118
Vauxhall Grandland X 1499cc manual 96kW	126	159	117	112

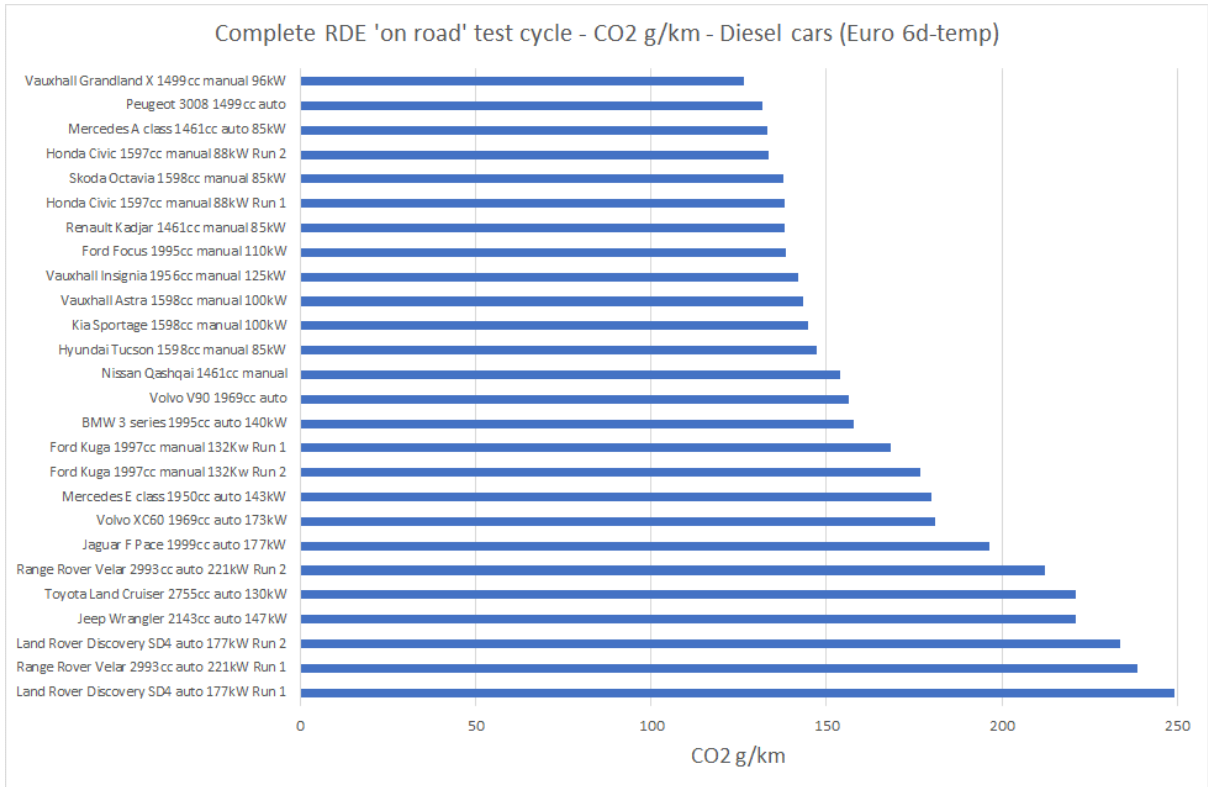


Figure 3: RDE 'on road' PEMS test CO₂ g/km – Diesel cars (Euro 6d-temp) – Complete cycle

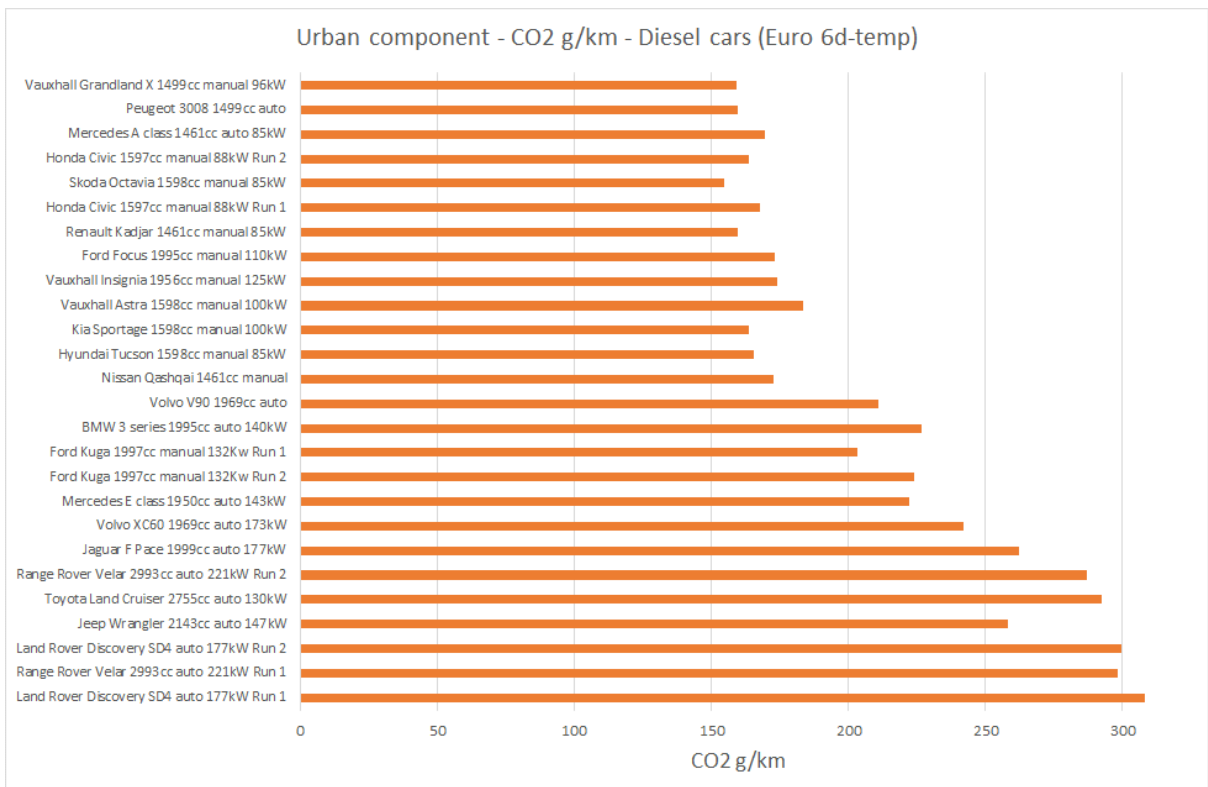


Figure 4: RDE 'on road' PEMS test CO₂ g/km – Diesel cars (Euro 6d-temp) – Urban

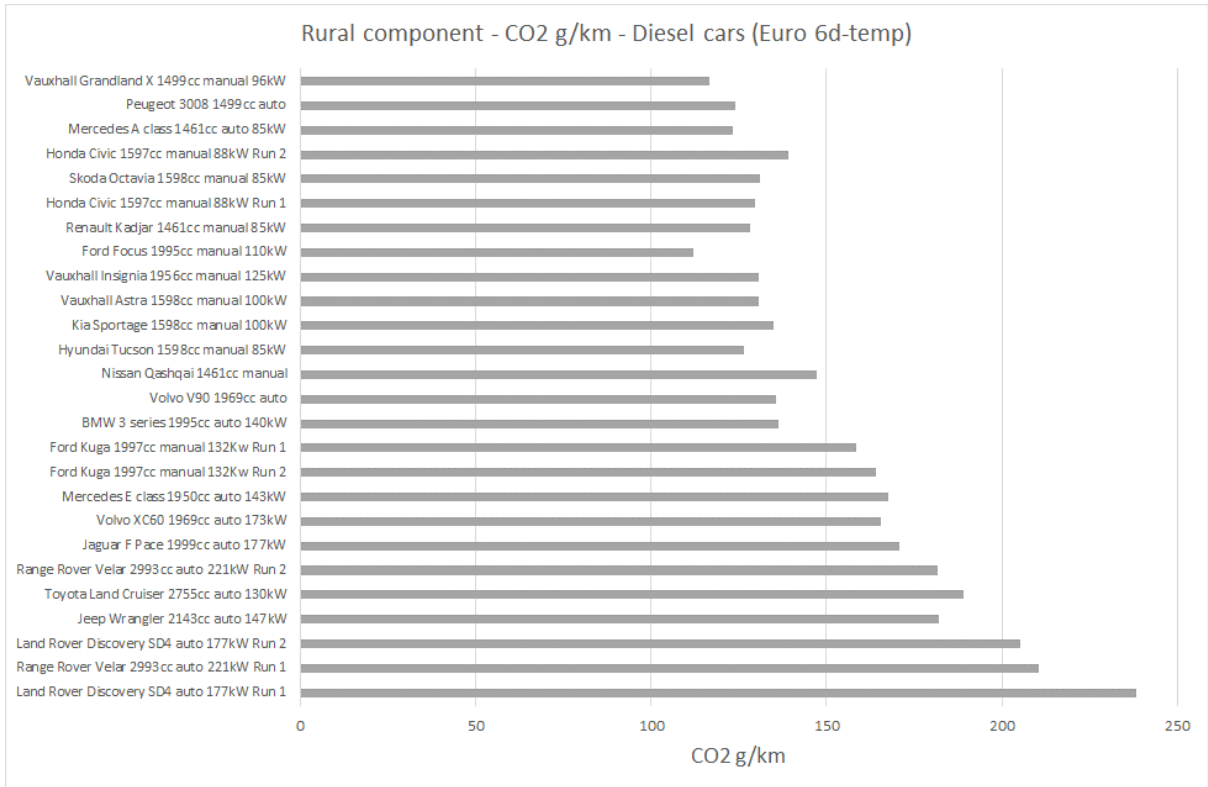


Figure 5: RDE 'on road' PEMS test CO₂ g/km – Diesel cars (Euro 6d-temp) – Rural

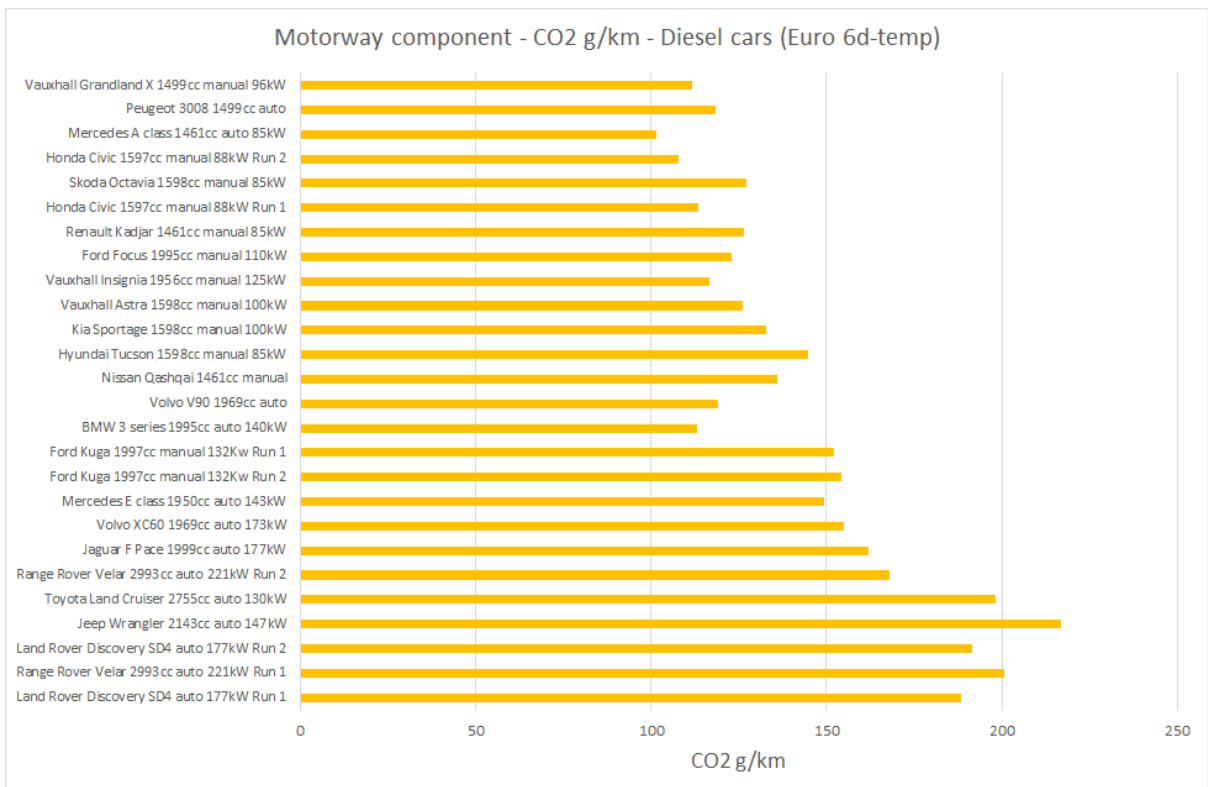


Figure 6: RDE 'on road' PEMS test CO₂ g/km – Diesel cars (Euro 6d-temp) – Motorway

3.2 RDE 'on road' CO₂ g/km values – Diesel cars Euro 6d

Table 4: RDE 'on road' PEMS test CO₂ g/km – Diesel cars (Euro 6d)

Vehicle	Complete test	Urban	Rural	Motorway
Ford Tourneo Custom 1995cc auto 125kW	225	275	195	203
BMW X5 2993cc auto 210 kW	186	232	155	164
Ford Galaxy 1995cc auto 110kW Run 2	181	219	156	160
Mercedes GLC 1950cc auto 143kW	170	199	145	161
Ford Galaxy 1995cc auto 110kW Run 1	163	201	130	148
VW Tiguan 1968cc auto 110kW	162	189	149	144
Audi Q5 1968cc auto 100kW	155	203	134	127
VW Passat 1968cc auto 110kW	135	171	111	118

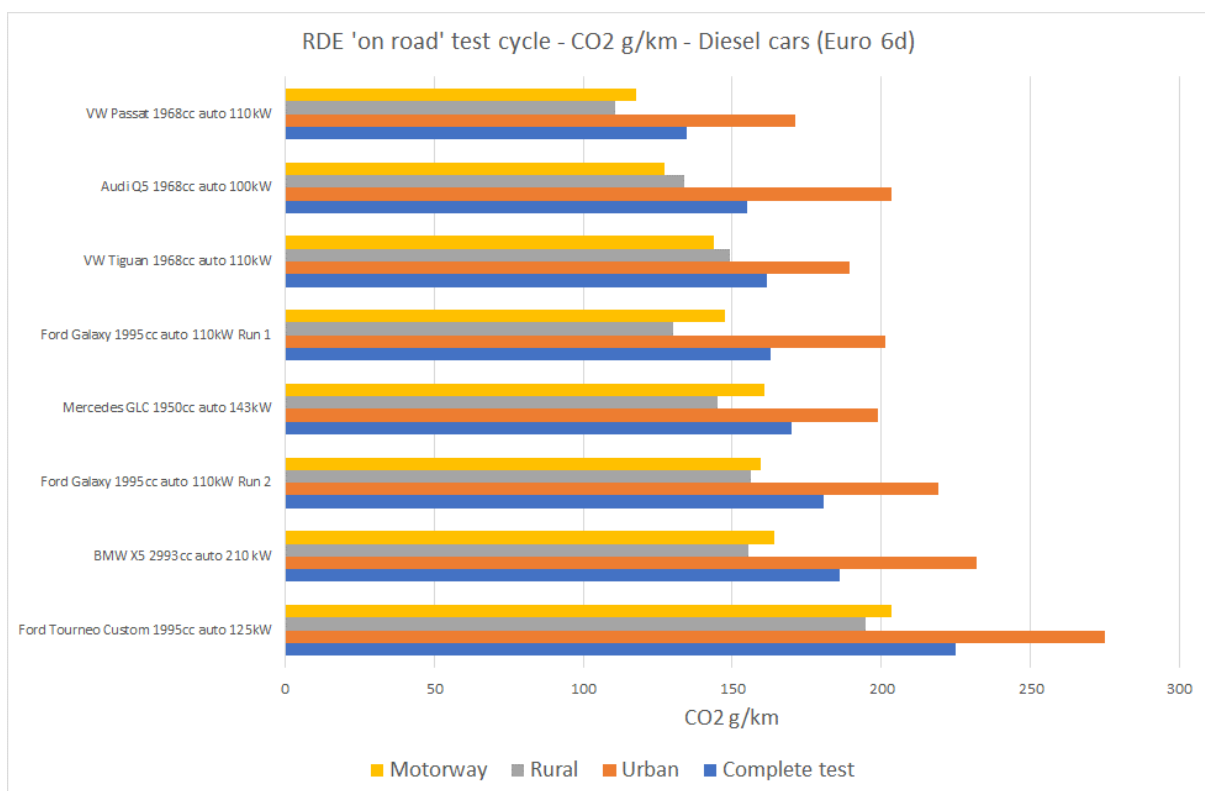


Figure 7: RDE 'on road' PEMS test CO₂ g/km – Diesel cars (Euro 6d-temp)

3.3 RDE 'on road' CO₂ g/km values – Petrol cars Euro 6d-temp

Table 5: RDE 'on road' PEMS test CO₂ g/km – Petrol cars (Euro 6d-temp)

Vehicle	Complete test	Urban	Rural	Motorway
Range Rover Sport SVR 4999cc auto 432kW	307	388	256	264
Jaguar XE R-Sport 1997cc auto 147kW	208	278	183	166
Subaru Outback 2498cc auto 114kW	195	240	164	175
Kia Sportage 1591cc auto	175	223	149	148
Mini Countryman Cooper S 1998cc man. 141kW	175	232	143	156
Vauxhall Mokka 1364cc auto	167	226	140	138
BMW 118i Sport 1499cc manual 100kW	167	205	151	135
Nissan Qashqai 1332cc auto 117kW	165	224	137	132
Mitsubishi Eclipse Cross 1499cc manual	162	190	145	145
Ford Focus 999cc auto 92kW	159	211	136	124
Mazda CX5 1998cc manual 121kW	158	195	142	145
Peugeot 2008 1191cc auto	155	209	135	128
Nissan Juke 999cc auto 86kW	154	171	126	158
Volvo V40 1969cc manual	150	197	136	113
Mercedes A180 Sport 1332cc auto 100kW	148	213	129	118
Renault Captur 1332cc manual	147	187	123	125
Kia XCeed 998cc manual 88.3kW	147	177	121	147
Renault Clio 999cc manual	143	169	129	132
Ford Fiesta 998cc manual 92kW	135	164	120	124
Hyundai i20 1248cc auto 61.8kW	127	150	114	121
VW Polo 999cc manual 59kW	122	141	103	119
VW Golf Life TSI 1498cc manual 96kW	119	153	111	98

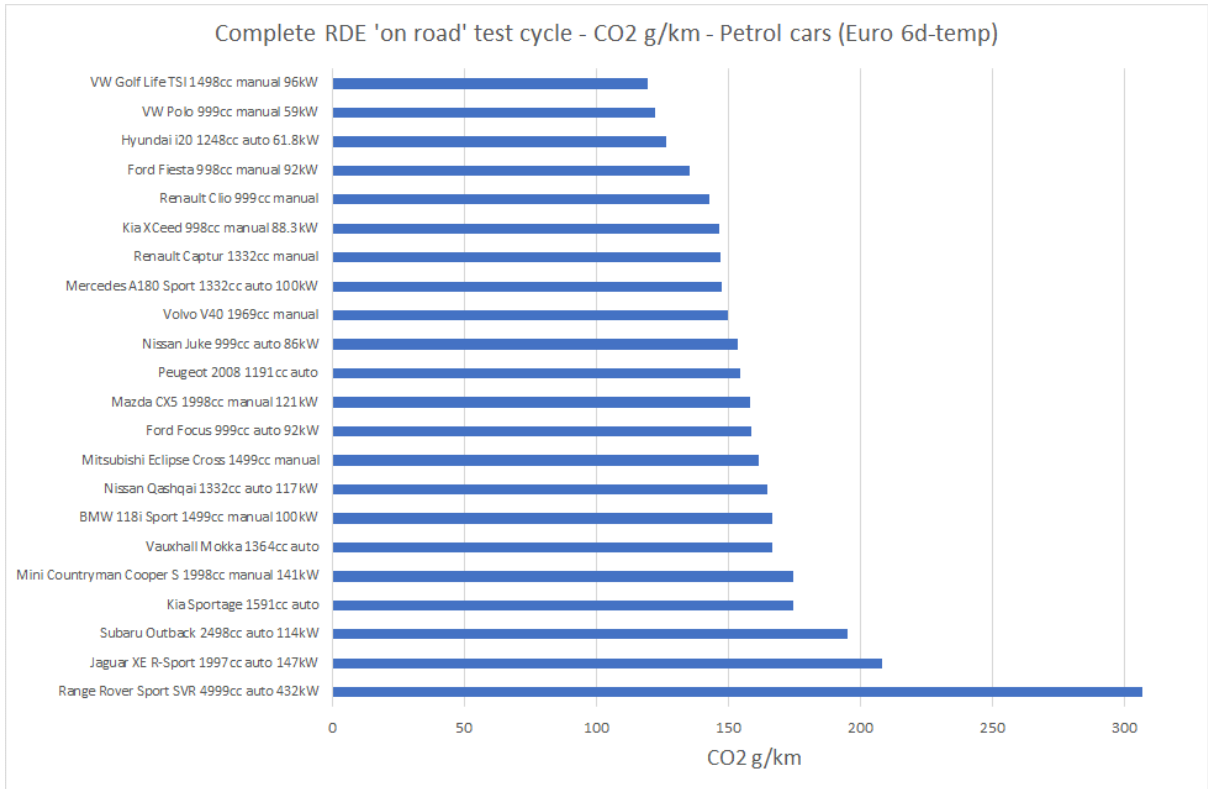


Figure 8: RDE 'on road' PEMS test CO₂ g/km – Petrol cars (Euro 6d-temp) – Complete cycle

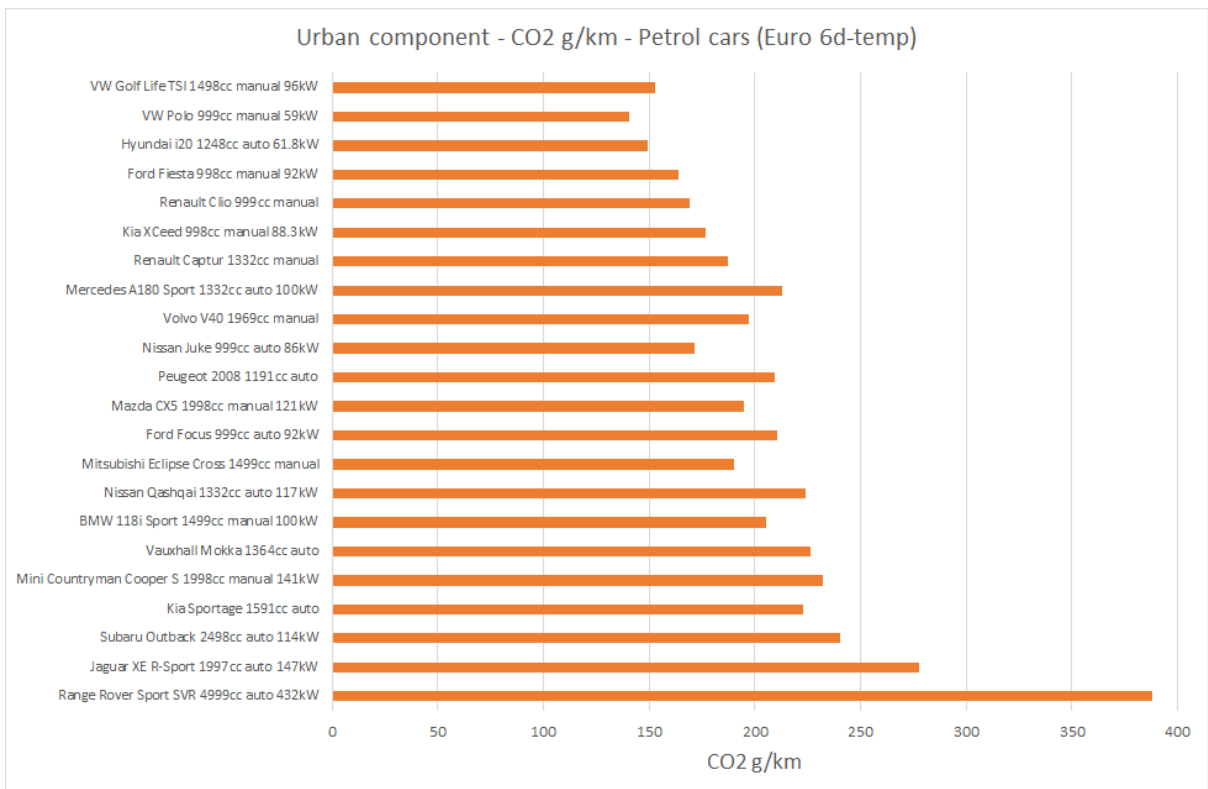


Figure 9: RDE 'on road' PEMS test CO₂ g/km – Petrol cars (Euro 6d-temp) – Urban

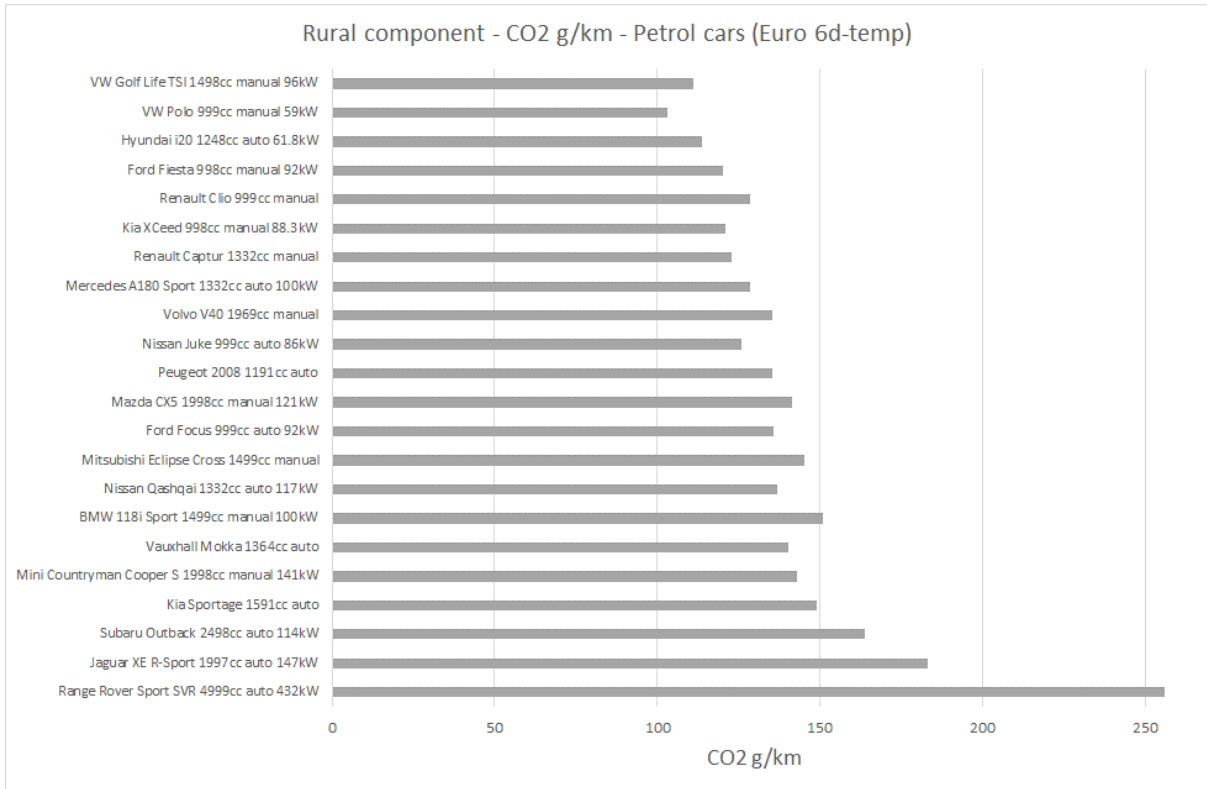


Figure 10: RDE 'on road' PEMS test CO₂ g/km – Petrol cars (Euro 6d-temp) – Rural

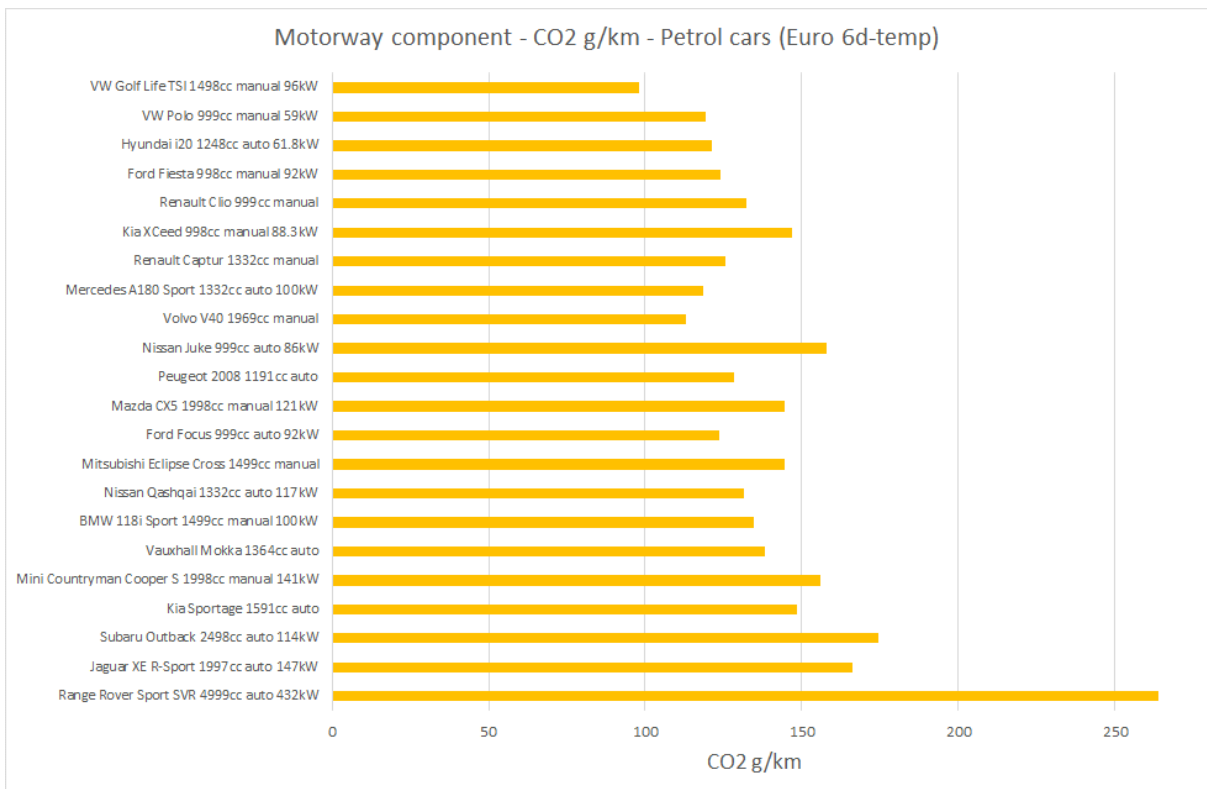


Figure 11: RDE 'on road' PEMS test CO₂ g/km – Petrol cars (Euro 6d-temp) – Motorway

3.4 RDE 'on road' CO₂ g/km values – Petrol cars Euro 6d

Table 6: RDE 'on road' PEMS test CO₂ g/km – Petrol cars (Euro 6d)

Vehicle	Complete test	Urban	Rural	Motorway
Aston Martin DB11 3982cc auto 393.5kW	286	436	222	195
Maserati Levante 1995cc auto 243kW	256	327	217	212
Porsche Macan 1984cc auto 195kW	244	310	219	200
Volvo XC40 1969cc auto 145kW	205	281	169	164
CUPRA Ateca 1984cc auto 221kW	200	271	169	157
VW Tiguan 1498cc auto 110kW	175	202	145	169
Hyundai Tucson 1598cc manual 110kW Run 2	169	218	148	136
Citroen C5 1199cc auto 96kW	168	201	137	157
Audi A1 999cc auto 81kW	159	202	139	136
Mercedes A class 1332cc auto 120kW	157	224	128	123
Honda Civic 998cc manual 93kW	157	196	130	137
Hyundai Tucson 1598cc manual 110kW Run 1	157	205	131	134
Mazda 3 1998cc manual 132kW Run 2	155	203	120	135
Mazda 3 1998cc manual 132kW Run 1	148	185	117	132
Mini Cooper 1499cc manual 100kW	146	199	123	117
Ford Puma 999cc manual 91.9kW	139	167	120	125
Vauxhall Corsa 1199cc manual 74kW	136	161	122	123
Fiat 500 999cc manual 51.5kW	135	166	109	124
Dacia Sandero 999cc manual 74kW	130	148	110	129
Suzuki Vitara 1373cc manual 95kW	123	147	110	113
Toyota Aygo 998cc manual 53kW	117	139	101	114

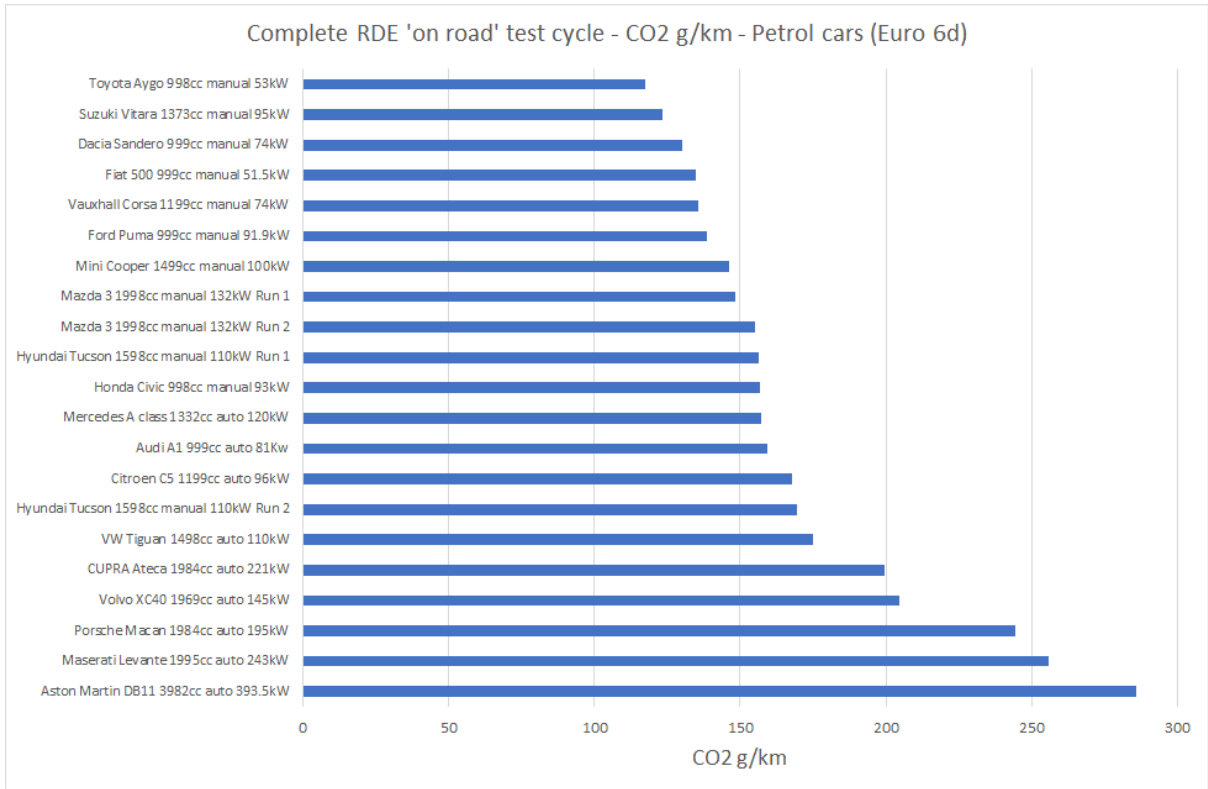


Figure 12: RDE 'on road' PEMS test CO₂ g/km – Petrol cars (Euro 6d) – Complete cycle

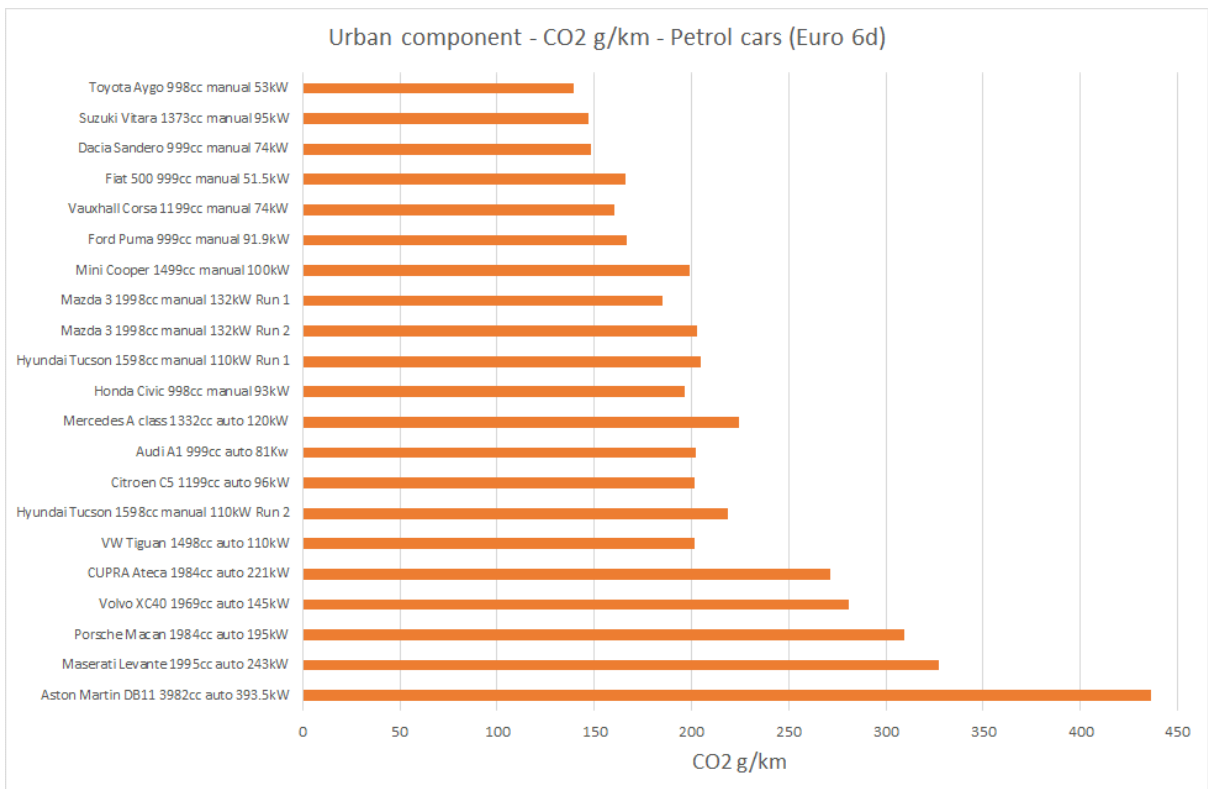


Figure 13: RDE 'on road' PEMS test CO₂ g/km – Petrol cars (Euro 6d) – Urban

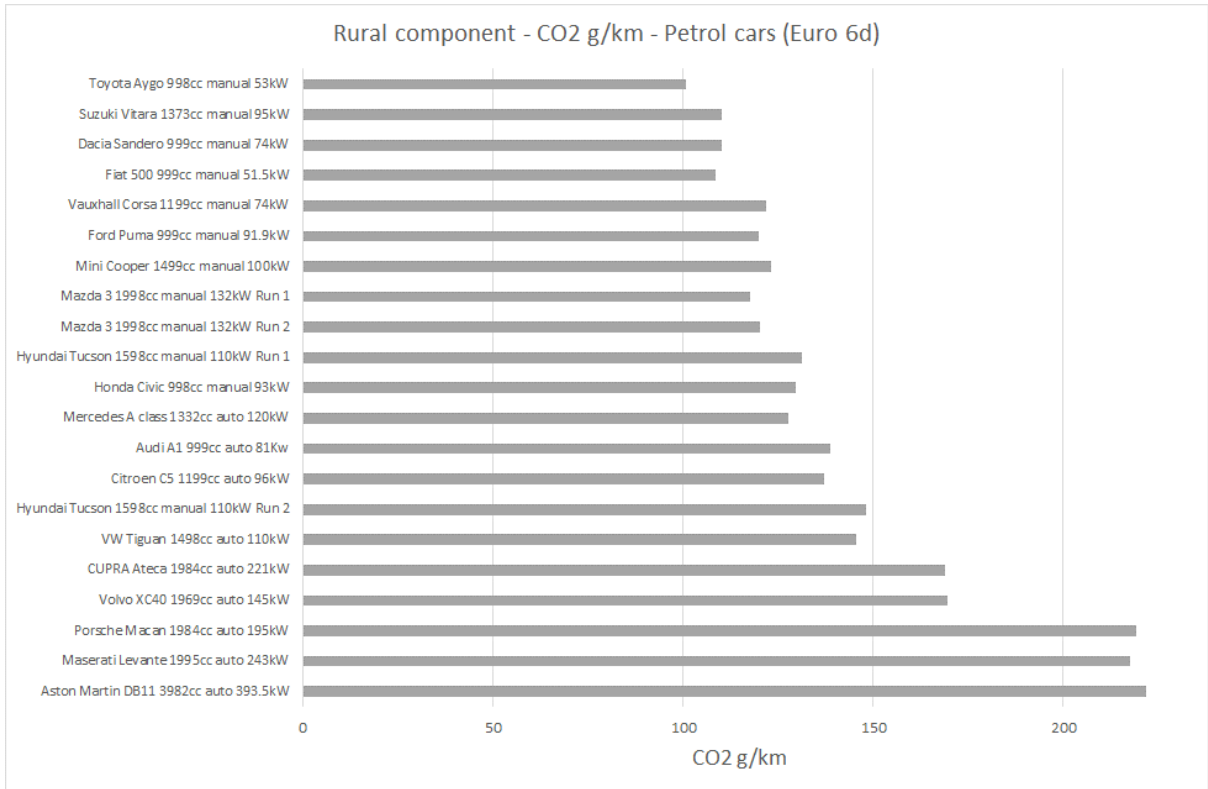


Figure 14: RDE 'on road' PEMS test CO₂ g/km – Petrol cars (Euro 6d) – Rural

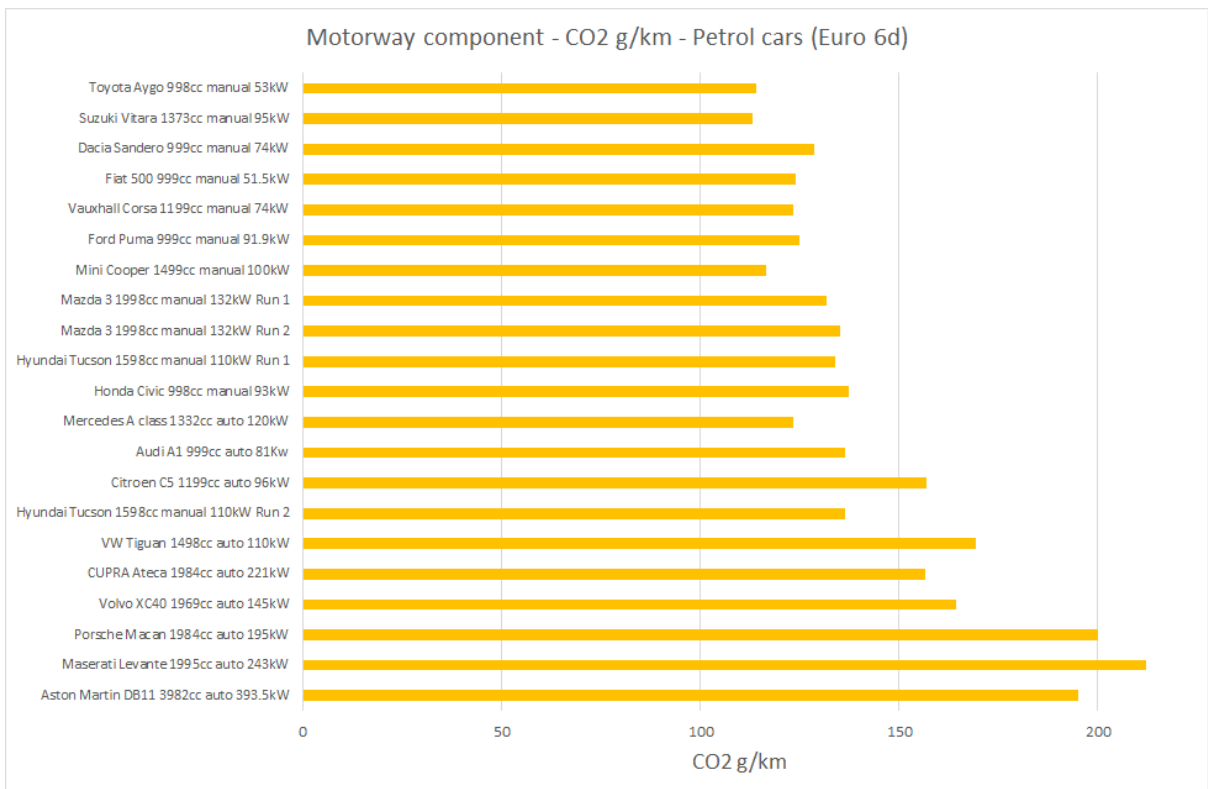


Figure 15: RDE 'on road' PEMS test CO₂ g/km – Petrol cars (Euro 6d) – Motorway

4. Comparison of RDE 'on road' PEMS and published WLTP CO₂ g/km values

As previously stated, published WLTP CO₂ g/km values for new cars are measured in laboratory conditions, so care must be taken when interpreting comparisons with 'real world' on-road data.

For this analysis, WLTP CO₂ g/km values were obtained from the published Vehicle Certification Agency (VCA) datasets found at:

<https://carfueldata.vehicle-certification-agency.gov.uk/downloads/default.aspx>

Acceptable matches were found for a sub-sample of 48 vehicles (18 diesel, 30 petrol). Some interpretation was required because the DfT/DVSA VMSU annual reports do not provide all necessary vehicle parameters to definitively determine an exact match in the VCA WLTP data (for example, wheel size is not recorded in the VMSU reports).

Figure 16 presents a scatter plot of RDE 'on road' PEMS versus available published WLTP CO₂ g/km values. Overall, it was found that RDE 'on road' CO₂ emissions from diesel cars were observed to be on average 5% higher than the published WLTP values. Similarly, RDE 'on road' CO₂ emissions from petrol cars were observed to be on average 6% higher than the published WLTP values, although there are obviously differences observed between individual vehicles.

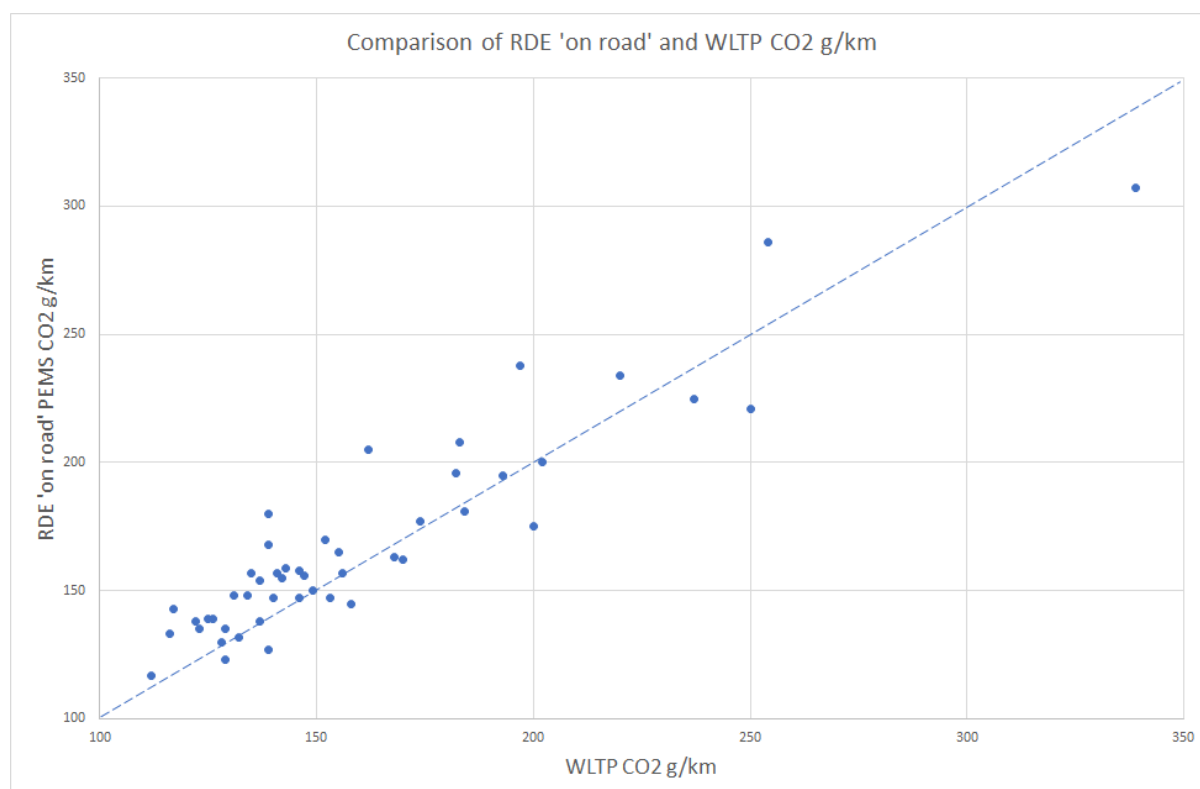


Figure 16: Scatter plot of RDE 'on road' PEMS versus published WLTP CO₂ g/km values (dotted line represents 1:1 equality)

5. Comparison of RDE ‘on road’ PEMS and DEFRA’s Emissions Factors Toolkit v12.1

CO₂ g/km values were abstracted from DEFRA’s Emissions Factors Toolkit v12.1 (EFT), separately for Euro 6d-temp diesel cars, Euro 6d diesel cars, Euro 6d-temp petrol cars, and Euro 6d petrol cars.

<https://laqm.defra.gov.uk/air-quality/air-quality-assessment/emissions-factors-toolkit/>

The default proportions of vehicles by engine size in EFT were adjusted to be consistent with the available DfT/DVSA dataset for each of the four groups of vehicles, as presented in Table 7.

Table 7: Adjusted proportions of vehicles by engine size applied in EFT

	<1400 cc	1400-2000cc	>2000 cc
Euro 6d-temp diesel car	0	0.86	0.14
Euro 6d diesel car	0	0.86	0.14
Euro 6d-temp petrol car	0.55	0.36	0.09
Euro 6d petrol car	0.53	0.42	0.05

Figures 17 to 20 present the comparison of the RDE ‘on-road’ PEMS and EFT v12.1 CO₂ g/km values by 5mph speed bin between 10mph and 70mph. It can be seen that whilst the comparisons are reasonable in aggregate, there are some differences which are noteworthy. Figure 21 illustrates the absolute differences in CO₂ g/km for the four groups of vehicle by speed bin.

With reference to Figure 21, below 20mph the RDE ‘on-road’ CO₂ g/km emission rates are notably **higher** than the EFT values, the difference increasing as speed decreases. Above around 50mph, the RDE ‘on-road’ CO₂ g/km emission rates are **lower** than the EFT values, but by a relatively stable amount (circa 10 to 30 g/km).

Further research is required to determine the reasons for these differences. One possible issue to investigate is the variation in vehicle dynamics within the drive cycle. Figure 22 presents vehicle dynamics over the RDE ‘on-road’ PEMS tests in terms of mean positive velocity * acceleration (m²/s³) by speed bin¹. It can be seen that the peak in RDE CO₂ g/km emissions between 35 and 40mph may be associated with the peak in m²/s³ in the same speed range. However, the reasons for the apparently systematic differences in CO₂ g/km emissions between the RDE data and EFT at lower speeds (<25mph) and higher speeds (>50mph) respectively require further research.

In the context of DEFRA’s Emissions Factors Toolkit, there is one final observation. For historical reasons, engine capacity (cc) has been used to categorise vehicles for the purpose of reporting exhaust pollutants and CO₂. However, with the near ubiquitous adoption of pressure charging (turbo charging and super charging) in modern internal combustion engines, an argument can be made that engine power (kW) is a better metric than engine capacity (cc) for describing fuel consumption and CO₂ emissions in tools such as EFT. To illustrate this point, Figures 23 and 24 present scatter plots of engine capacity (cc) against RDE CO₂ g/km (R²=0.58), and engine power (kW) against RDE CO₂ g/km (R²=0.74) respectively. Future developments of emissions tools such as EFT may wish to take note.

¹ Excludes deceleration and zero acceleration (includes only acceleration values > 0.1m/s²)

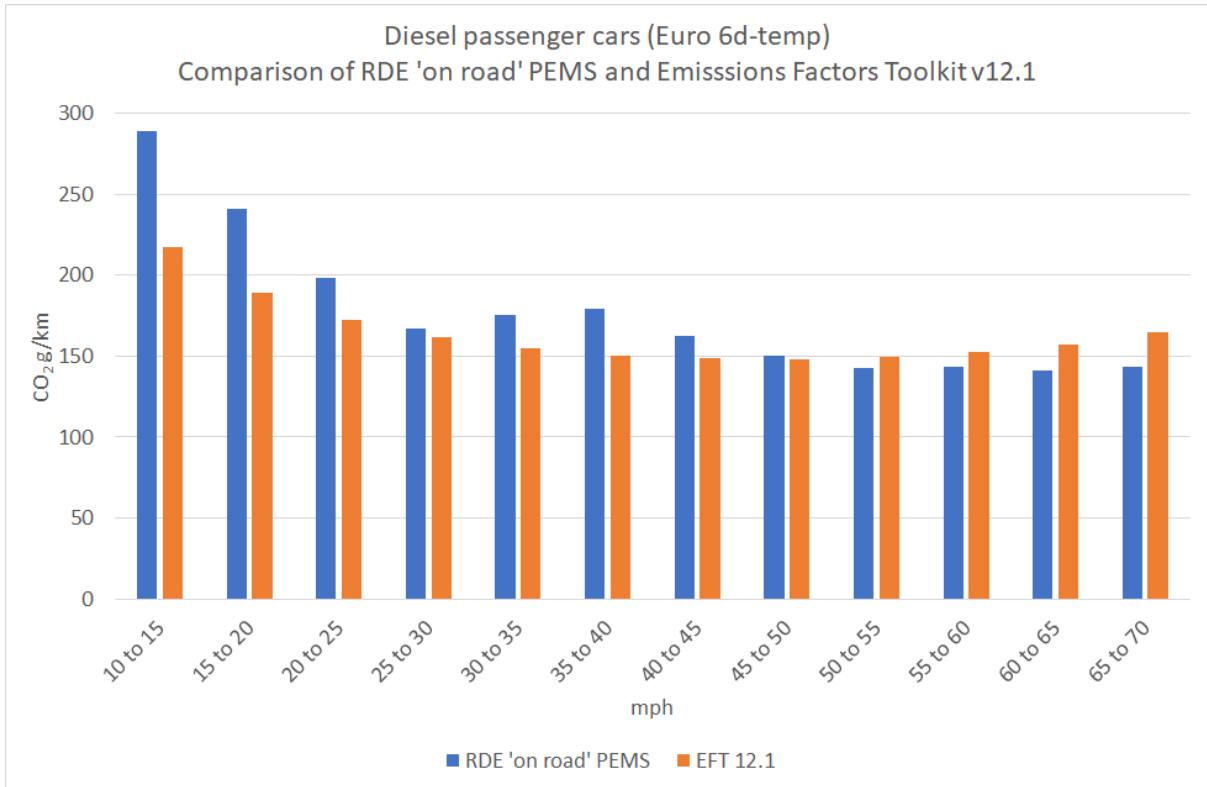


Figure 17: Comparison of RDE 'on-road' PEMS and EFT v12.1 – Euro 6d-temp diesel cars

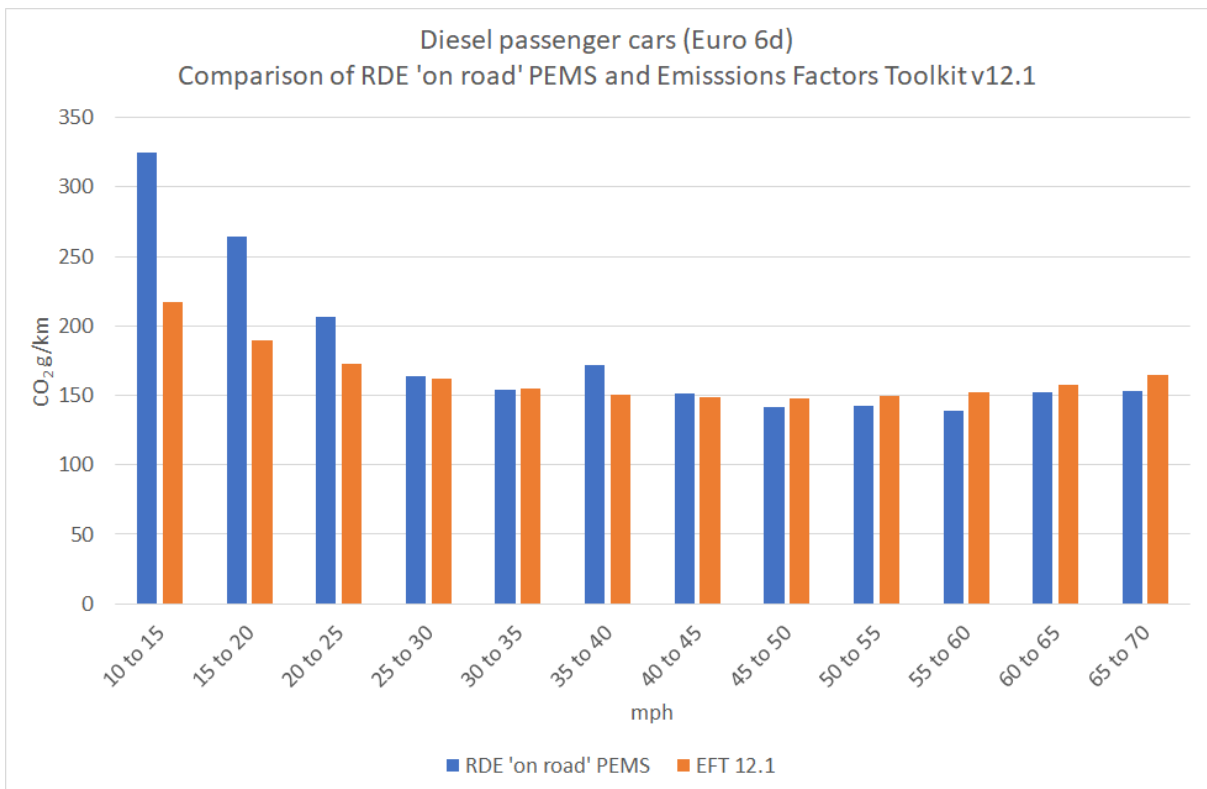


Figure 18: Comparison of RDE 'on-road' PEMS and EFT v12.1 – Euro 6d diesel cars

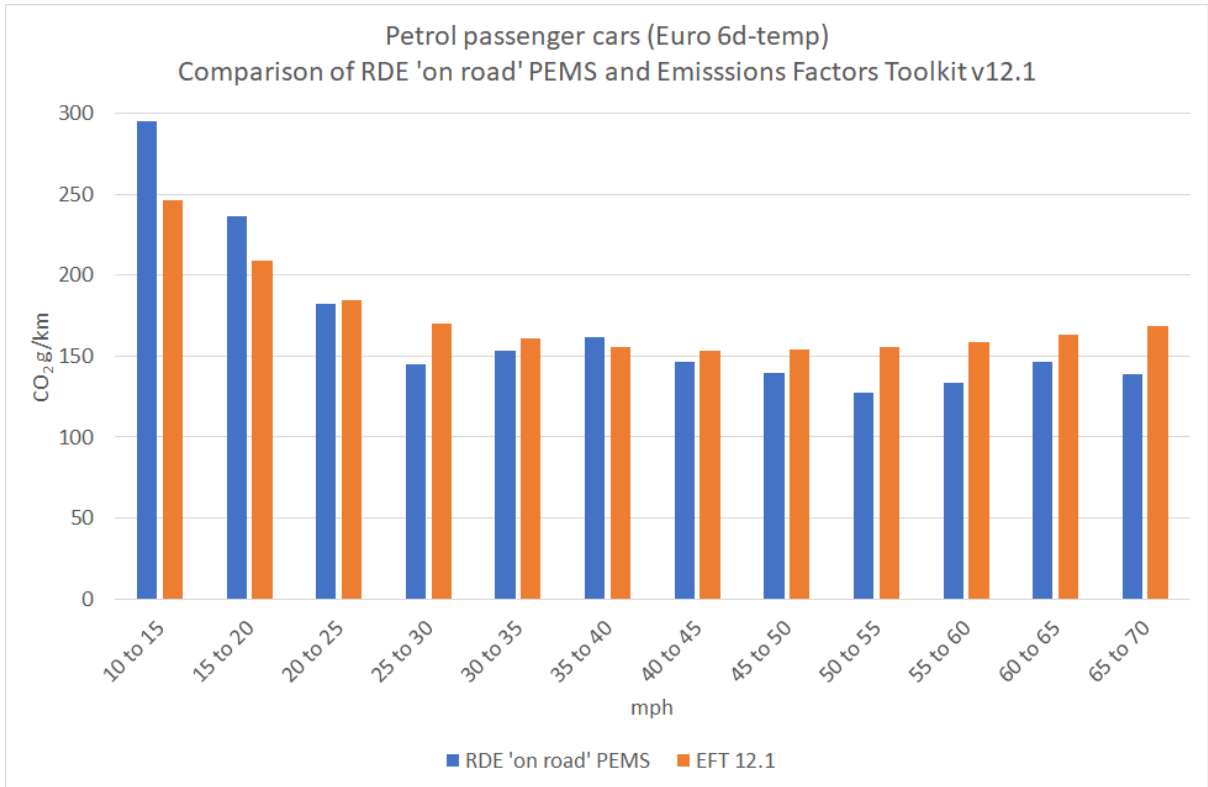


Figure 19: Comparison of RDE 'on-road' PEMS and EFT v12.1 – Euro 6d-temp petrol cars

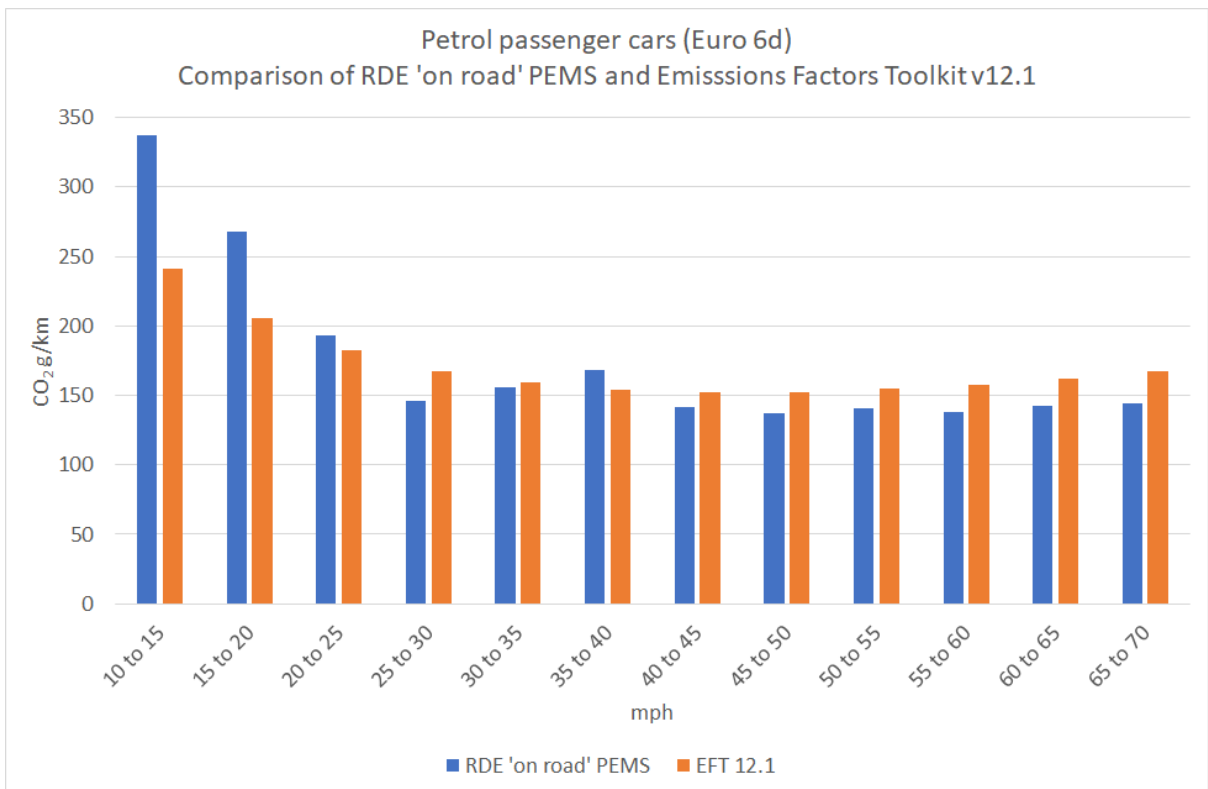


Figure 20: Comparison of RDE 'on-road' PEMS and EFT v12.1 – Euro 6d-temp petrol cars

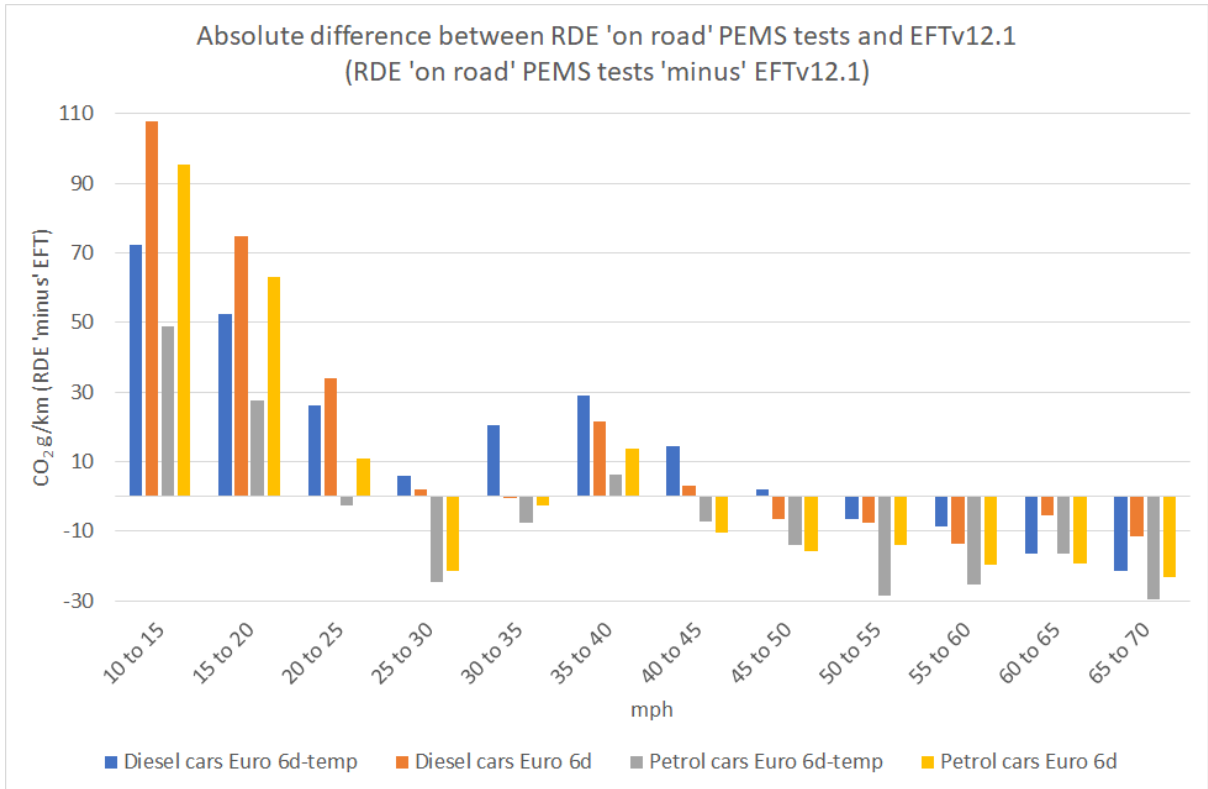


Figure 21: Absolute differences between RDE 'on-road' PEMS and EFT v12.1

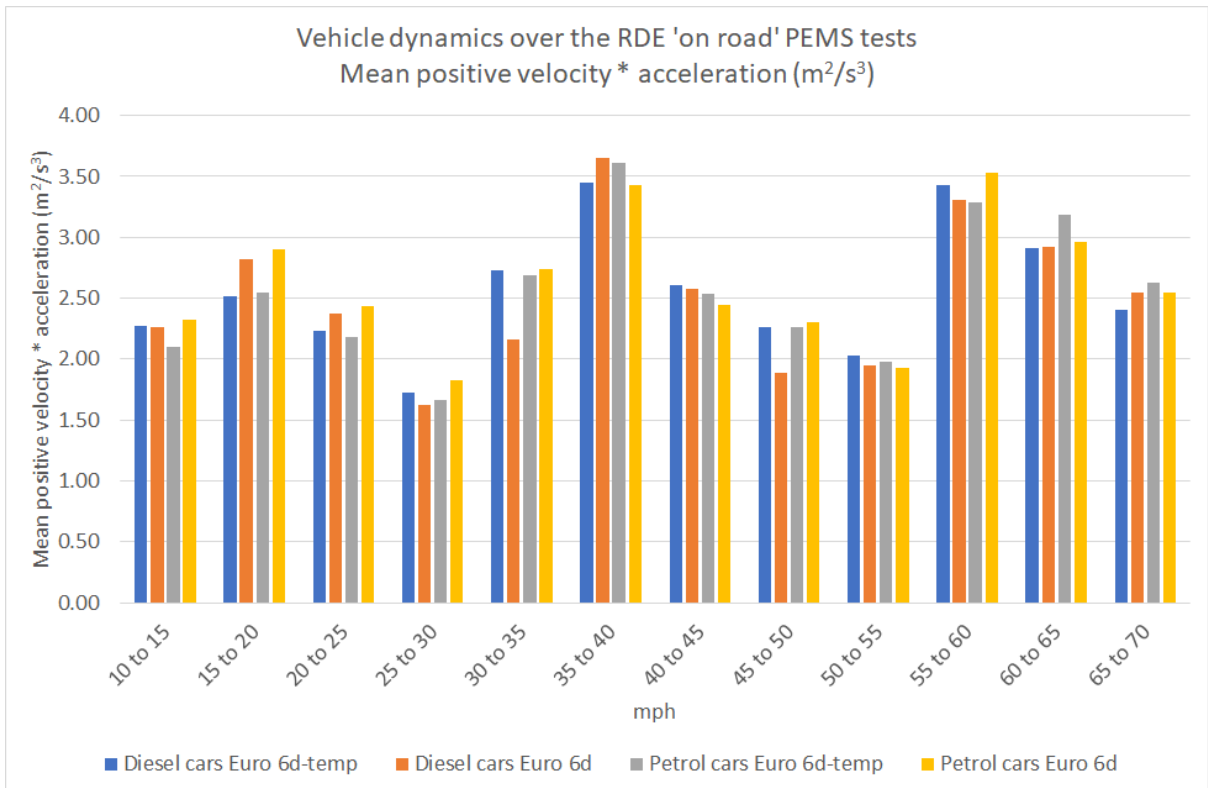


Figure 22: Vehicle dynamics over the RDE 'on-road' PEMS tests. Mean positive velocity * acceleration (m²/s³) by speed bin

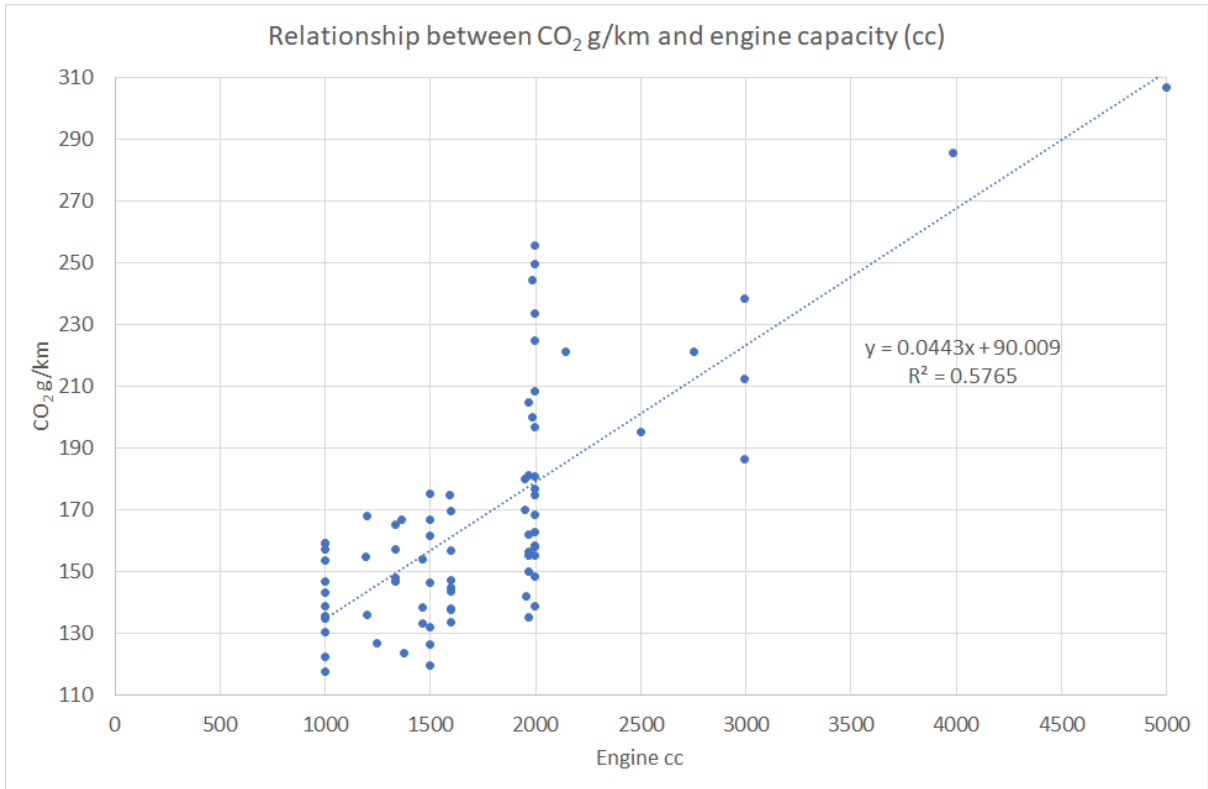


Figure 23: Relationship between CO₂ g/km and engine capacity (cc)

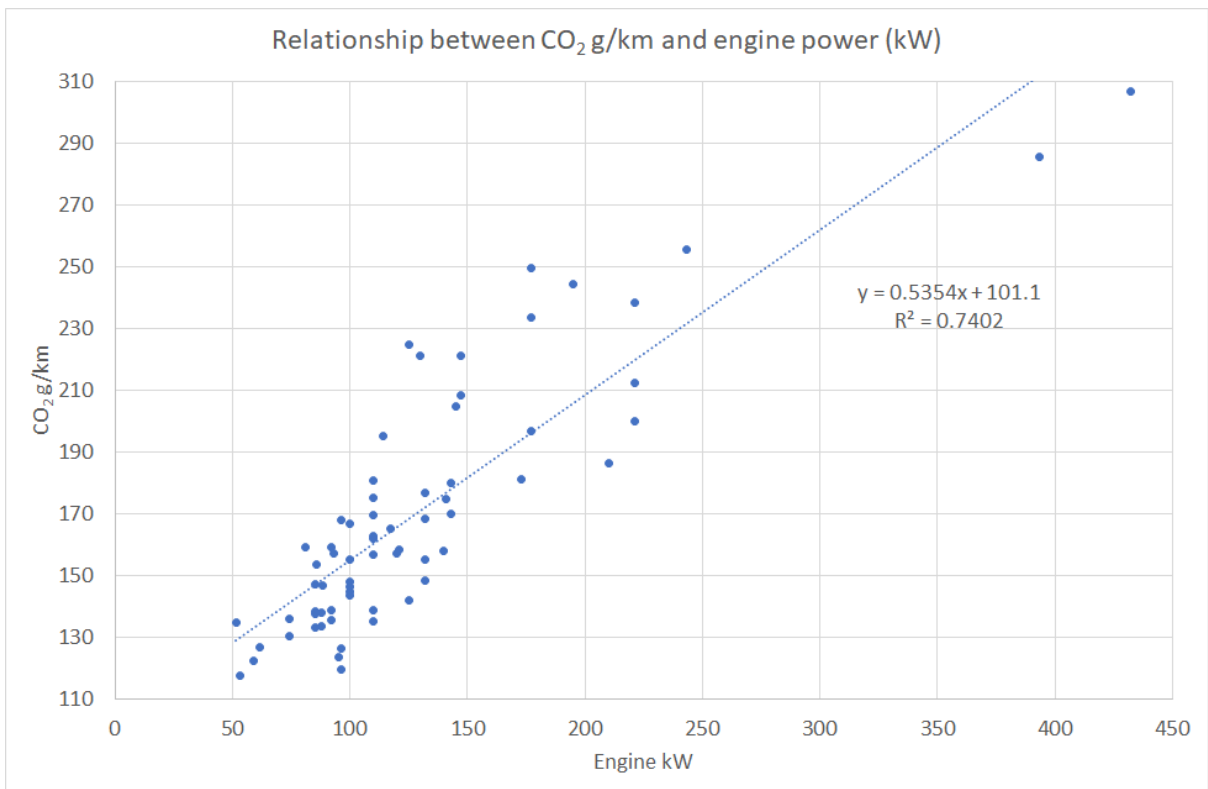


Figure 24: Relationship between CO₂ g/km and engine power (kW)

Appendix A – DfT / DVSA RDE ‘on road’ PEMS survey routes

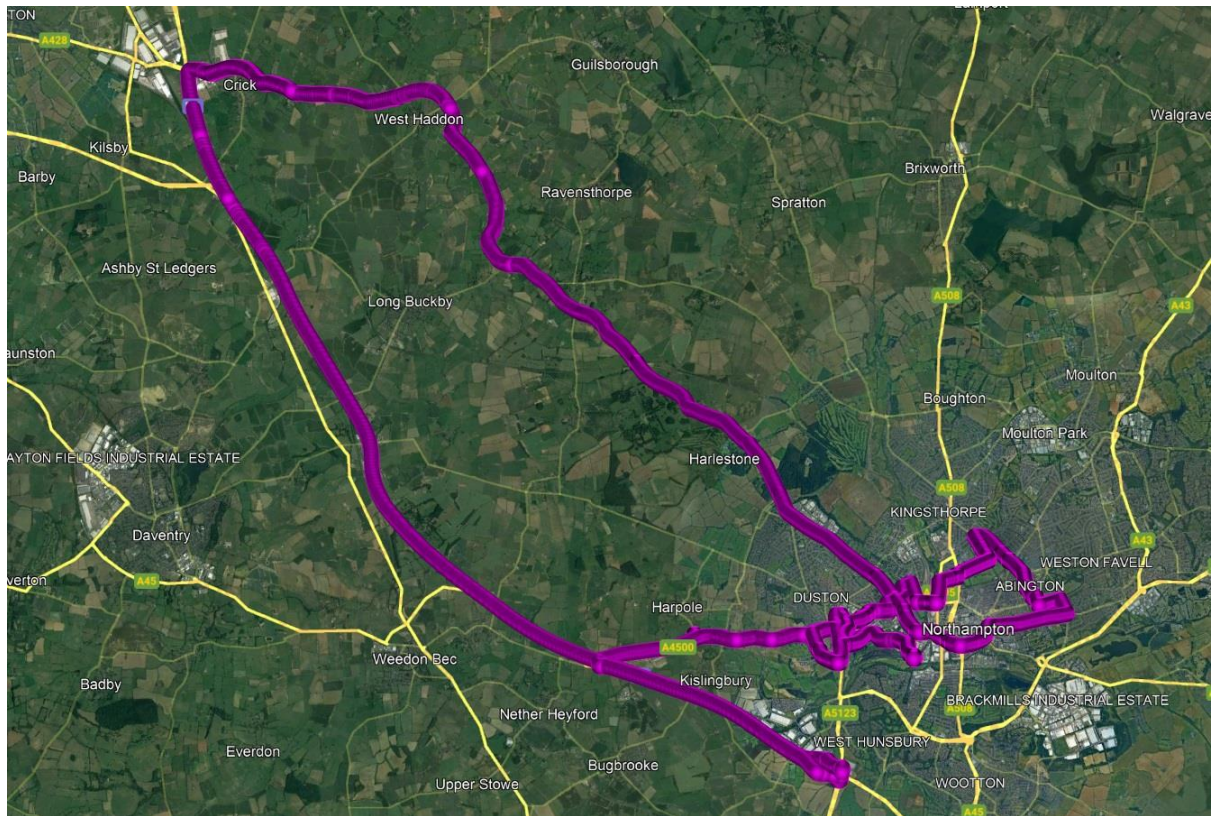


Figure A1: Survey year 2019, 2020 & 2021 – Northampton urban area and M1, A428 west of Northampton

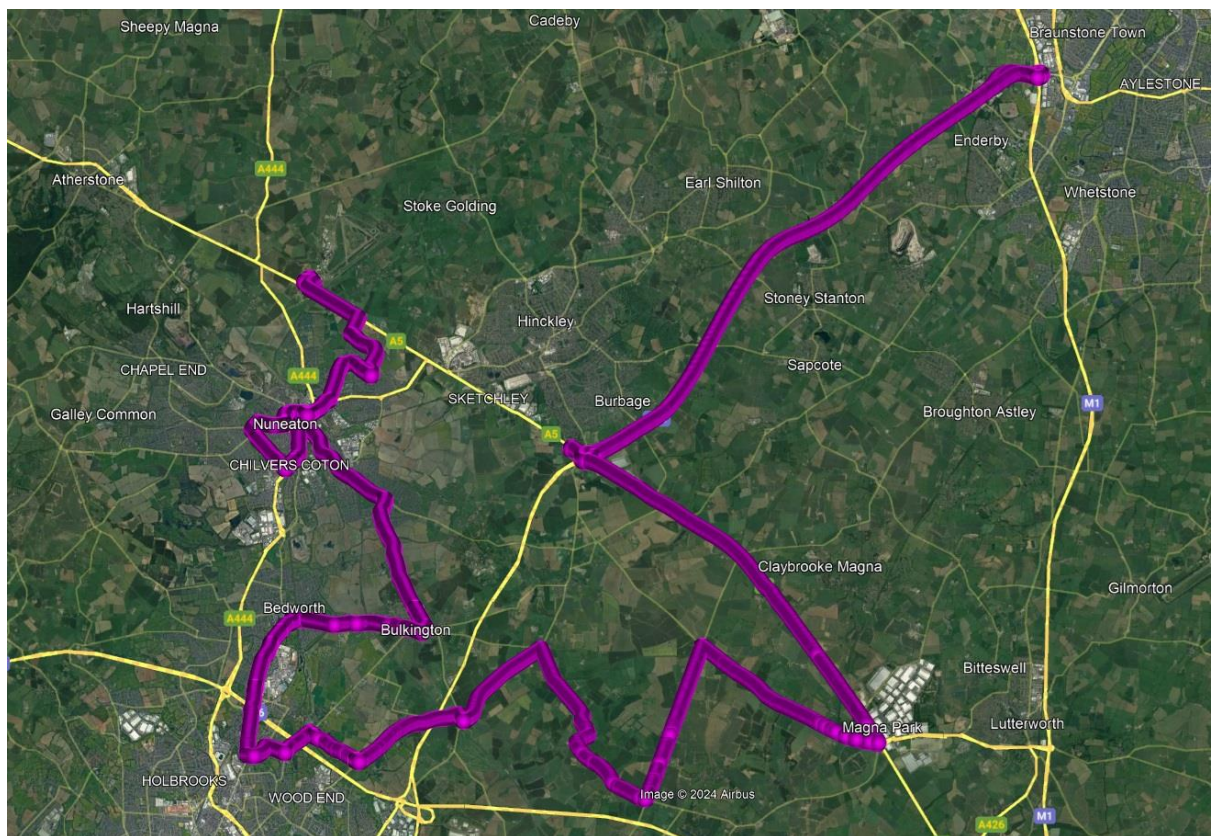


Figure A2: Survey year 2022 – Nuneaton, M69, A5 north of Coventry

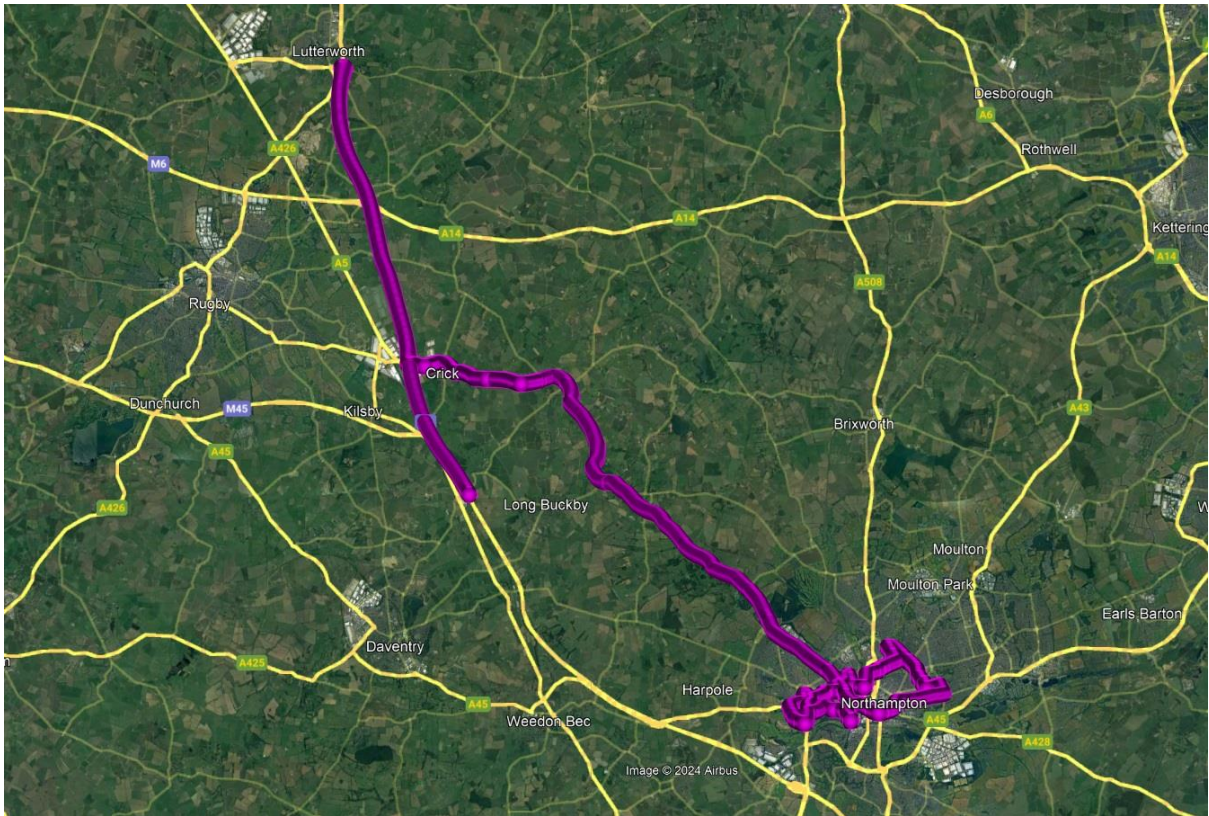


Figure A3: Survey year 2023 – Northampton urban area and A428, M1 to Lutterworth