Vehicle Specific Power (VSP) model

To calculate the fuel consumption, we used the (VSP) model, and then by applying conversion factors depending on the fuel type, we have calculated the correspondent emissions. More in details, VSP is a direct measure of the road load on a vehicle which characterizes vehicles and driving profiles using real-world on-road measured data. To estimate the power demand by the vehicle, the VSP methodology combines speed, acceleration and road grade, according to the following equation, which is applicable to light-duty vehicles (Jimenez-Palacio, 1999).

$$\mathrm{VSP}\left[\frac{\mathrm{W}}{\mathrm{kg}}\right] = \frac{\mathrm{Power}}{\mathrm{Mass}} = \frac{\frac{\mathrm{d}}{\mathrm{dt}}\left(\mathrm{E_{kinetic}} + \mathrm{E_{potential}}\right) + \mathrm{F_{rolling}} * \mathrm{v} - \mathrm{F_{aerodynamic}} * \mathrm{v}}{\mathrm{m}}$$
$$= \mathrm{v}(1.1 * \mathrm{a} + 9.81 * \mathrm{grade} + 0.132) + 3.02 * 10^{-4} * \mathrm{v}$$

in which:
$E_{kinetic}$ is the kinetic energy
$E_{potential}$ is the potential energy
$F_{rolling}$ is the rolling resistance force
$F_{aerodynamic}$ is the aerodynamic resistance force
v is the instantaneous speed (m/s)
m is the mass (kg)
a is the acceleration (m/s2)
grade is the road grade
Each second of driving was associated to a VSP bin and the corresponding power requirements interval for each mode. [33]

Table S1. VSP mode and corresponding power requirements.

VSP mode	W/kg
1	VSP < -2
2	-2 ≤ VSP < 0
3	0 ≤ VSP < 1
4	1 ≤ VSP < 4
5	4 ≤ VSP < 7
6	7 ≤ VSP < 10
7	10 ≤ VSP < 13

VSP mode	W/kg
8	13 ≤ VSP < 16
9	16 ≤ VSP < 19
10	19 ≤ VSP < 23
11	23 ≤ VSP < 28
12	28 ≤ VSP < 33
13	33 ≤ VSP < 39
14	VSP ≥ 39

Once obtained second by second the corresponding VSP mode, it was possible to correlate every mode with instantaneous fuel consumption and emissions by using conversion factors based on the assumption of the linear relation between fuel consumption and CO_2 emissions. By using the methodology described above, each second of driving has been correlated to a specific VSP mode and through the conversion factors based on the reference [37], we have estimated the instantaneous fuel consumption and emissions [33,36,37]. In the next table there are the correspondent coefficient used for the evaluation.

Table S2. Instantaneous Fuel consumption regarding to VSP mode.

	Instantaneous fuel consumption (l)	
VSP mode	GASOLINE	DIESEL
1	0.01244	0.01116
2	0.01866	0.01674
3	0.020526	0.018414
4	0.0622	0.0558
5	0.08397	0.07533
6	0.11507	0.10323
7	0.14306	0.12834
8	0.16794	0.15066
9	0.19904	0.17856
10	0.22703	0.20367
11	0.27368	0.24552

- Convert Fuel consumption to CO2 emissions

The value of CO_2 emission was converted from value of fuel consumption using the emission factor extracted from the EMEP/EEA air pollutant emission inventory guidebook (2016) for petrol and diesel light vehicle [37].