

# Emissions from a Modern Euro 6D Diesel Plug-In Hybrid

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## 1. Tables

**Table S1.** – On-road route details for selected examples: RDE-compliant route (RDE), mainly high-way driving (Motorway), or mainly city driving (City).

	RDE	Motorway	City
Total trip duration (min)	103	117	116
Total trip distance (km)	91.1	187.7	129.2
Average speed (km/h)	52.8	95.6	67.1
Urban distance (km)	35.5	15.0	33.9
Rural distance (km)	29.1	18.1	12.47
Motorway distance (km)	26.5	154.6	82.9

**Table S2.** – List of performed experiments.

Laboratory tests
WLTP procedure
@23°C/-10°C (CD+CS)
WLTC test @ 40°C (CS)
BAB test @23°C/-10°C/40°C (CS)
TfL test @23°C/-10°C/40°C (CS)
simulated RDE @23°C/-10°C/40°C (CS)
On-road tests
RDE route test (CD100/CD50/CD25/CS)
Motorway route test (CS)
Urban route test (CS)
WLTP: Worldwide Harmonised Light-Duty Vehicles Test Procedure, CD: charge depleting, CS: charge sustaining, CDXX: charge depleting with initial SOC of high voltage battery equal to XX, * user selectable mode equal to electric; in all other cases is the default one. BAB: Bundesautobahn cycle, TfL: Traffic for London cycle, RDE: cycle compliant with real driving emission regulation 2017/1151

**Table S3.** – Tested vehicles.

Fuel	Diesel
Traction	ICE + Electric Motor
Injection	DI
Emission control system	DOC, DPF, SCR, ASC
Registration	2020
Mileage (km)	4494

Euro standard			Euro 6d-ISC-FCM		
ICE size (cm <sup>3</sup> )			1950		
Electric range (km)			82		

ICE: internal combustion engine, DI: direct injection, DOC: Diesel oxidation catalyst, DPF: Diesel particulate filter, SCR: Selective catalytic reduction, ASC: Ammonia slip catalyst, ISC: in-service conformity, FCM: fuel consumption meter

On-road tests										
Route	Condi- tions @ test start	Aver- age T <sub>ambient</sub> (°C)	Mode of opera- tion	SOC @ start	User se- lectable mode	NOx (mg/k m)	CO (mg/k m)	PN (#/km)	N <sub>2</sub> O (mg/km )	CO <sub>2</sub> (g/km)
RDE	cold	16	CD	100%	Default	24	2	3×10 <sup>9</sup>	2	43
RDE	cold	13	CD	100%	Default	17	0	6×10 <sup>9</sup>	1	45
RDE	cold	13	CD	100%	Default	29	22	4×10 <sup>10</sup>	2	42
RDE	cold	17	CD	50%	Default	10	0	2×10 <sup>10</sup>	3	121
RDE	hot	15	CD	25%	Default	16	0	8×10 <sup>9</sup>	4	155
RDE	cold	12	CD	25%	Default	19	0	3×10 <sup>10</sup>	n/a	169
RDE	hot	14	CS	min	Default	15	0	3×10 <sup>10</sup>	12	193
RDE	hot	15	CS	min	Default	17	3	6×10 <sup>10</sup>	6	200
RDE	cold	9	CS	min	Default	21	6	8×10 <sup>10</sup>	5	220
RDE	cold	14	CS	min	Default	26	0	1×10 <sup>11</sup>	n/a	214
motor- way	hot	15	CS	min	Default	19	0	2×10 <sup>9</sup>	n/a	248
city	cold	18	CS	min	Default	59	19	3×10 <sup>10</sup>	n/a	104

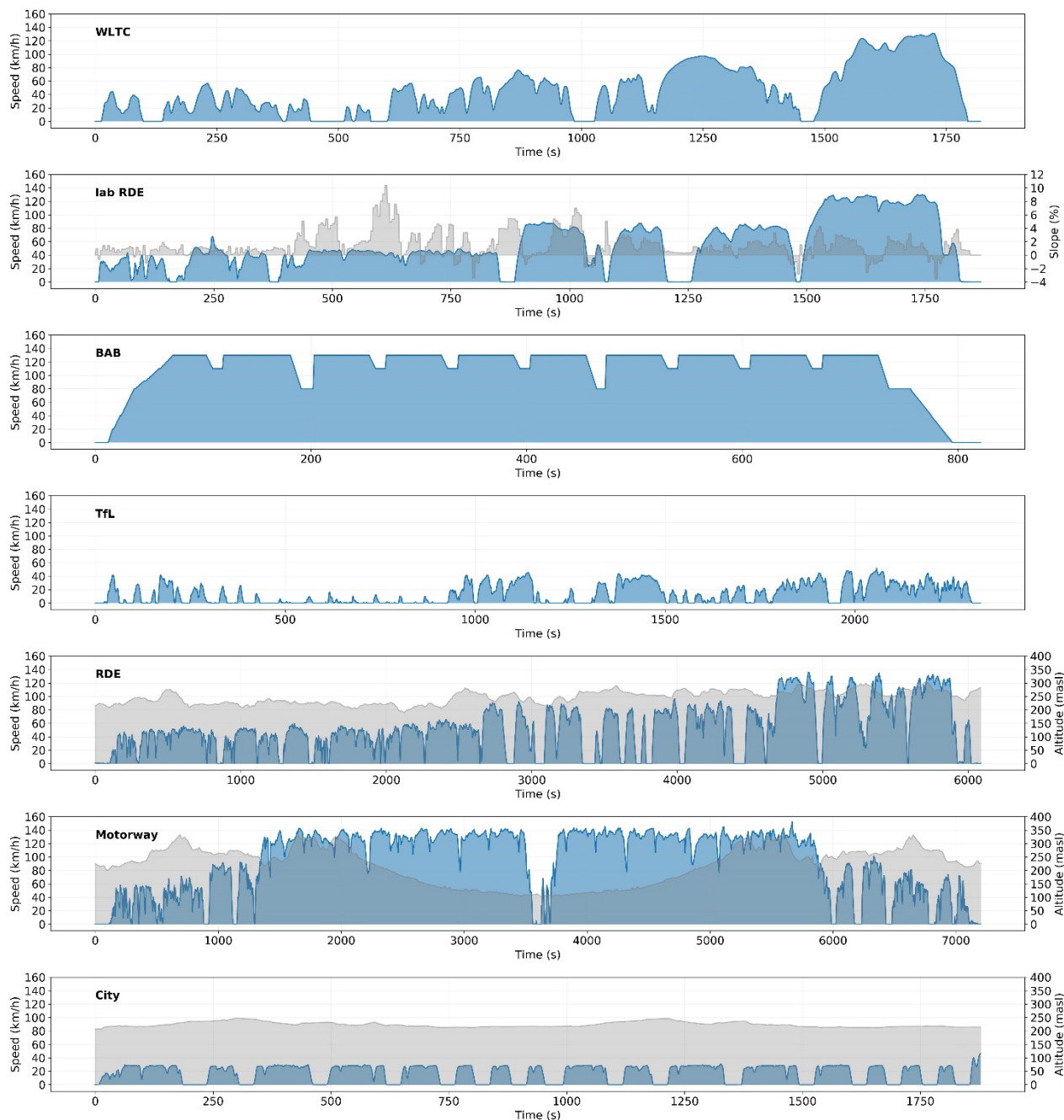
RDE, motorway and city as defined in experimental section and Table S1, CD: charge depleting, CS: charge sustaining, SOC: state of charge of high voltage (HV) battery

Table S4. – Data summary.

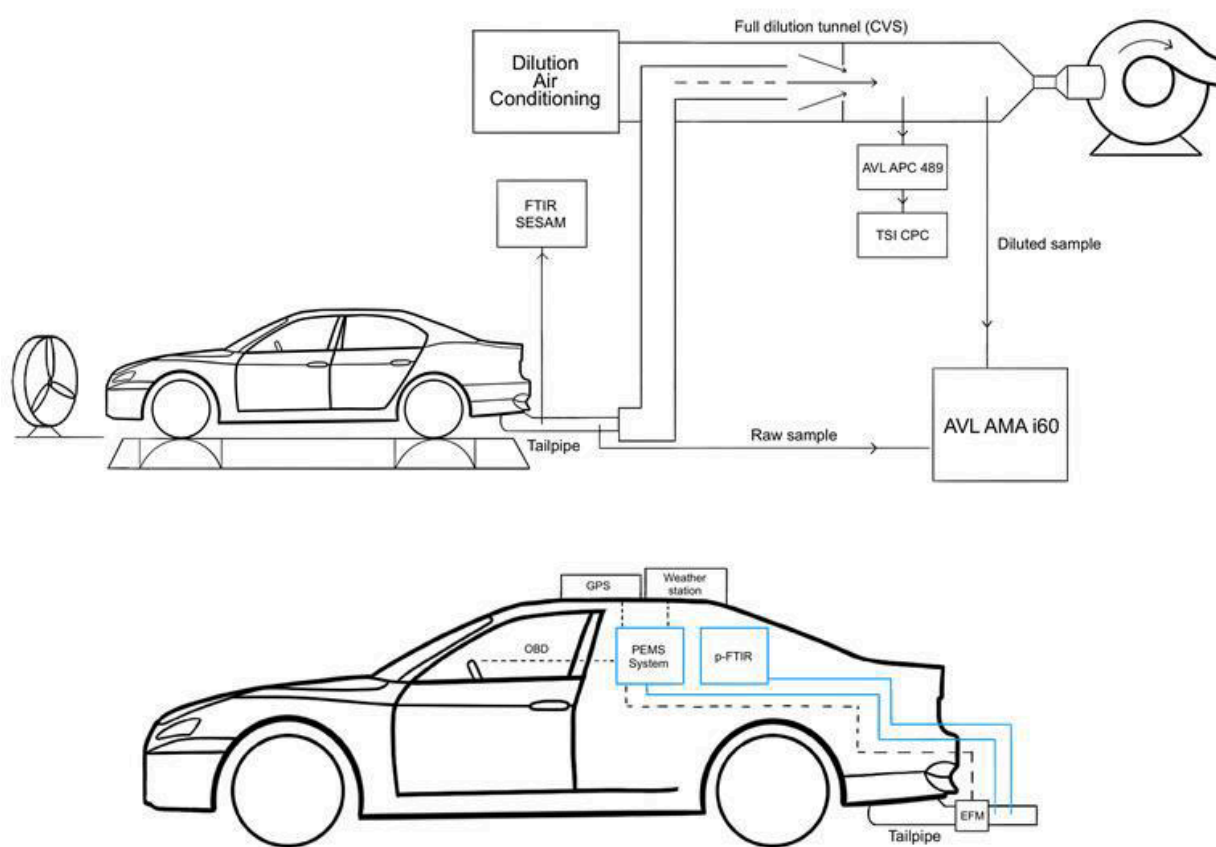
Test type	NOx (mg/km)	CO (mg/km)	HC + NOx (mg/km)	SPN <sub>23</sub> (#/km)	N <sub>2</sub> O (mg/km)	SPN <sub>10</sub> (#/km)
Tests @ 23°C						
WLTC CD4	26	6	27	3×10 <sup>11</sup>	5	5×10 <sup>9</sup>
WLTC CS	29	12	31	3×10 <sup>9</sup>	9	
Weighted	4	1	4	2×10 <sup>10</sup>		
BAB	66	0	66	2×10 <sup>8</sup>	9	
TFL	66	0	66	6×10 <sup>8</sup>	22	
Lab RDE	20	10	20	6×10 <sup>8</sup>	14	
Tests @ -10°C						
WLTC CD1	170	44	174	4×10 <sup>11</sup>	4	
WLTC CS	379	22	383	4×10 <sup>11</sup>	13	8×10 <sup>11</sup>
BAB	618	2	618	1×10 <sup>11</sup>	7	
TFL	168	0	170	6×10 <sup>11</sup>	29	
Lab RDE	154	69	157	1×10 <sup>11</sup>	15	
Tests @ 5°C						
WLTC CS	37	0	38	3×10 <sup>11</sup>	10	
BAB	97	1	97	4×10 <sup>11</sup>	10	
TFL	68	0	69	8×10 <sup>11</sup>	26	
Lab RDE	34	9	35	1×10 <sup>11</sup>	12	
Tests @ 40°C						
WLTC CS	36	0	37	2×10 <sup>9</sup>	10	3×10 <sup>9</sup>
BAB	131	0	131	2×10 <sup>10</sup>	9	
TFL	85	0	86	5×10 <sup>10</sup>	25	
Lab RDE	25	0	25	1×10 <sup>10</sup>	12	

Lab RDE as defined in experimental section and Table S1, CD: charge depleting, CS: charge sustaining.

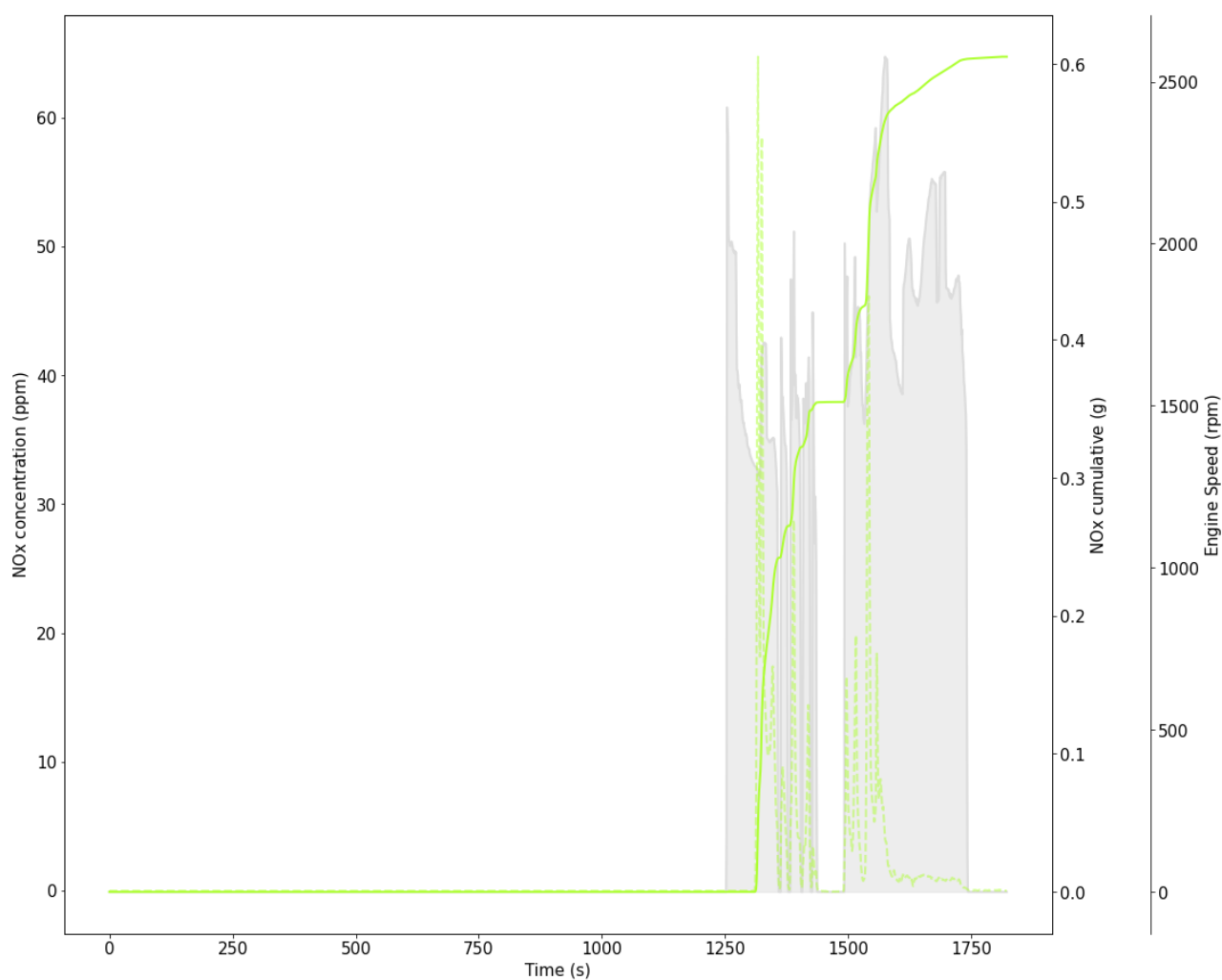
## 2. Figures



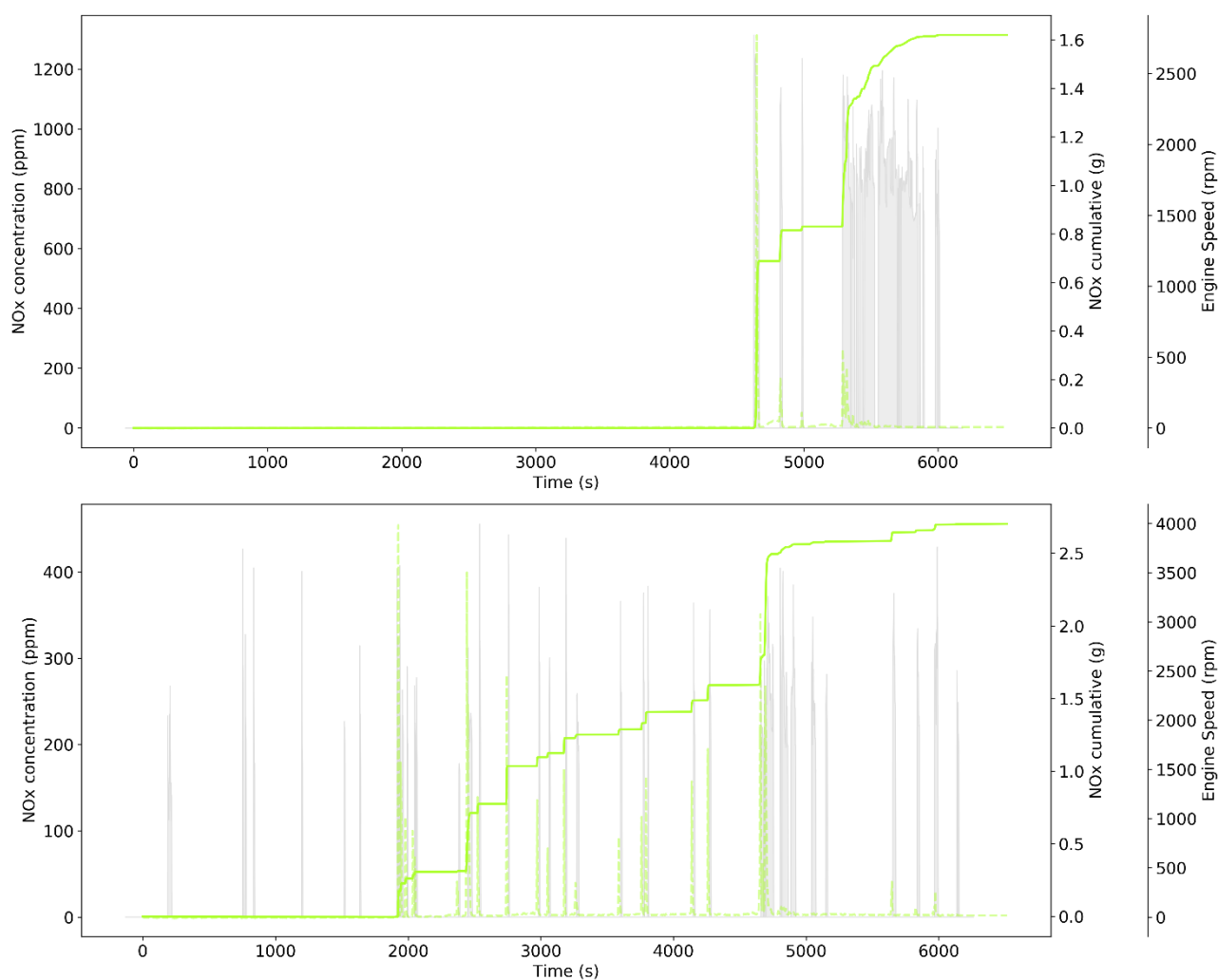
**Figure S1.** – Profiles of speed and slope (when relevant) for laboratory cycles. Examples of speed and altitude profiles for on-road routes.



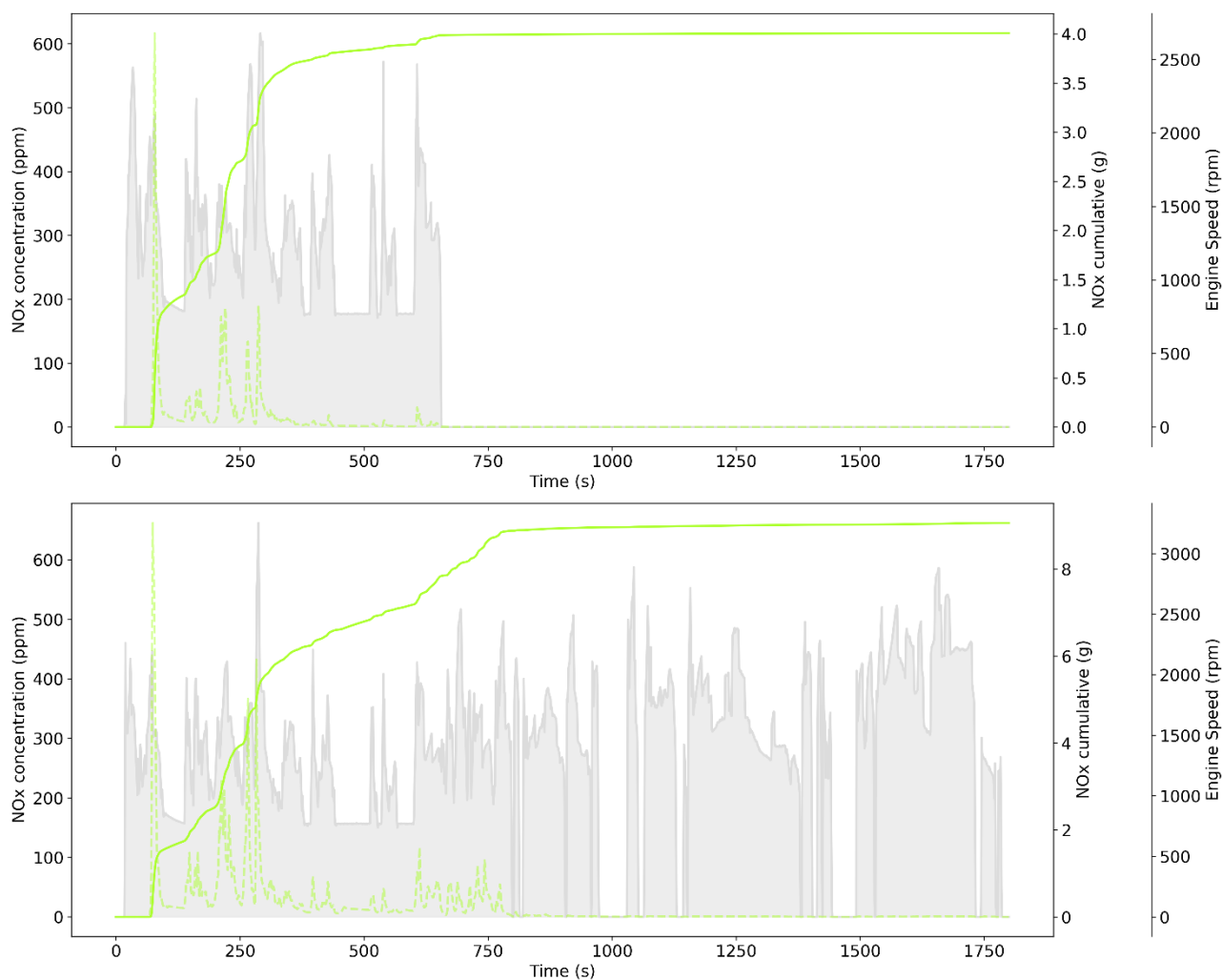
**Figure S2.** – Experimental set-up used during the tests performed at VELA 8 laboratory (top) and on-road (bottom).



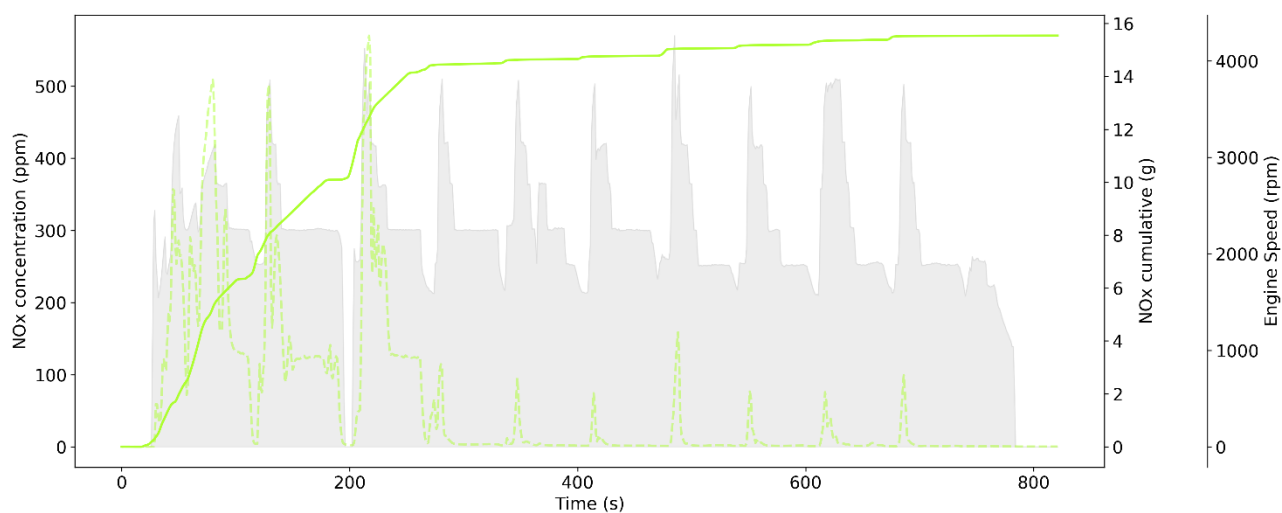
**Figure S3.** – Emissions of NOx during CD4 of the WLTP.



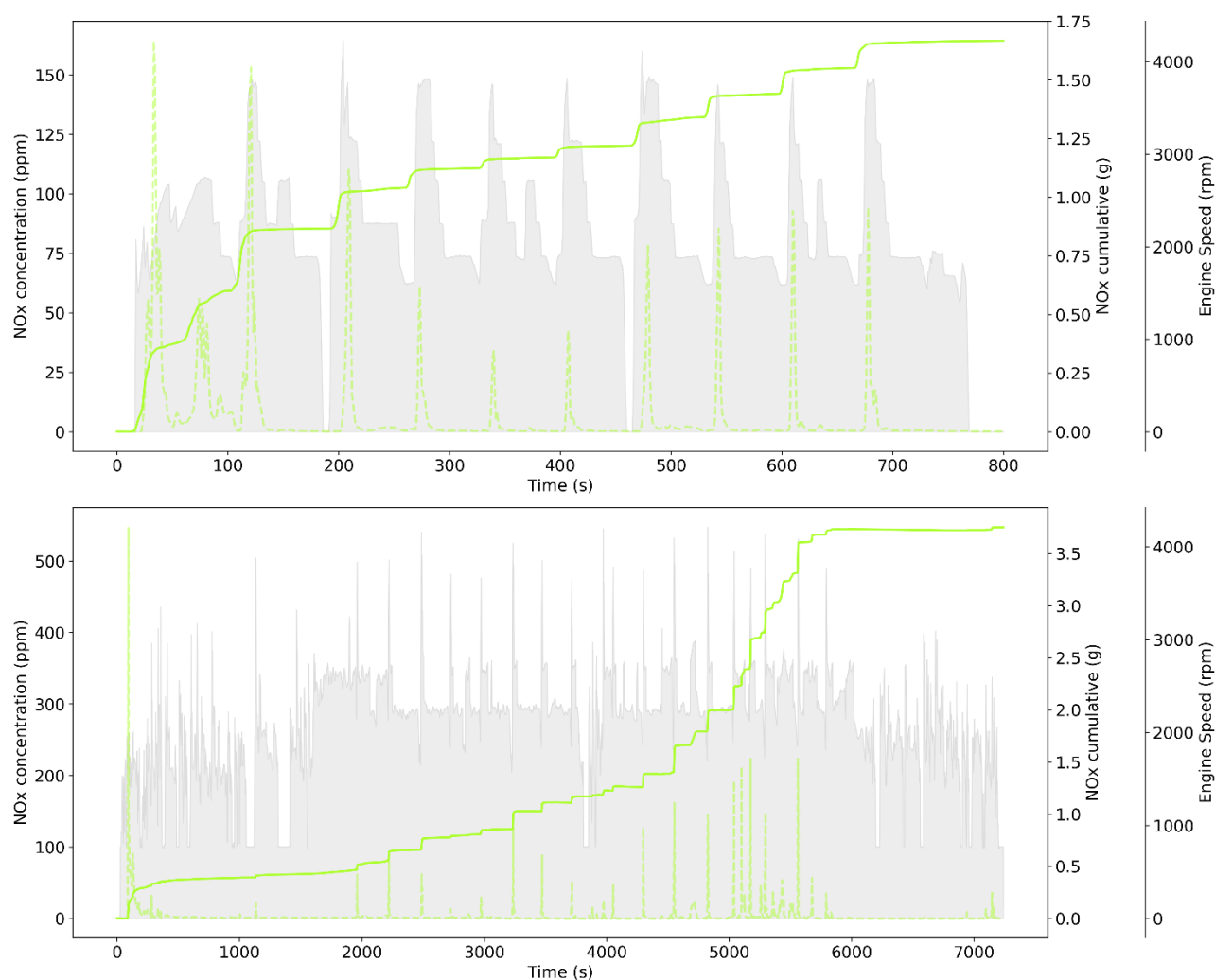
**Figure S4.** – Emissions of NO<sub>x</sub> during two RDE test with initial SOC equals to 100.



**Figure S5.** – Emissions of NO<sub>x</sub> during CD (top) and CS (bottom) of the WLTP at -10°C.



**Figure S6.** – Emissions of NO<sub>x</sub> during BAB test at -10°C.



**Figure S7.** – Emissions of NO<sub>x</sub> during highway tests (Motorway route (bottom) and BAB (top)).