



Improving our understanding of New Zealand's vehicle fleet greenhouse gas and harmful emissions using measured emissions data – Stage 1

Appendix A - UET and OAT analysis for NO_x – vehicle classes

February 2022

Waka Kotahi NZ Transport Agency research report 687

Contracted research organisation – Pattle Delamore Partners Ltd

RR 687 - Improving our understanding of New Zealand's vehicle fleet greenhouse gas and harmful emissions using measured emissions data - Stage 1

Appendix A: UET and OAT analysis for NO_x – vehicle classes

Colour Key:

- Data Gap
- Unapplicable

$$E_{NO_x,URB,v} = E_{hot,NO_x,v} \times f_{NO_x,v} \times s(m)_{NO_x,v} \times g(x)_{NO_x,v} + E_{Cold,NO_x,v} \times Cold\ Start?$$

Direct from VFEM (No population/mileage breakdown)													Cold start on?			
													1			
													(1 or 0)			
													Eijv		Emission Inventory	
i	j	v	Base year X 2018	Speed 77	M1ijv	M2ijv	M3ijv	M4ijv	M5ijv	Eijv	Absolute Annual VKT	Total Emissions (kg)				
Substance	Situation	Vehicle class	VKT (% fleet)	Ehot (g/km)	f	s(m)	g(x)	Ecold (g/km)	Cold Start?	fleet emission (g/km)	Absolute Annual VKT	Total Emissions (kg)				
NOx	RUR	Cars Petrol	66.34%	0.15	1.08	1.42	1.66	0.03	1	0.274	31677181713	13067936				
NOx	RUR	Cars Diesel	7.75%	0.51	1.00	1.41	1.06	0.02	1	0.061	3702473079	2913331				
NOx	RUR	Cars Hybrid		0.02	1.08	1.00	1.66		1							
NOx	RUR	Cars Plugin Hybrid		0.02	1.08	1.00	1.66		1							
NOx	RUR	Cars Electric							1							
NOx	RUR	LCVs Petrol	3.20%	0.66	1.08	1.49		0.05	1	0.036	1528013885	1705628				
NOx	RUR	LCVs Diesel	15.69%	0.89	1.00	1.45	1.00	0.03	1	0.207	7491746355	9873559				
NOx	RUR	LCVs Hybrid		0.02	1.08	1.00			1							
NOx	RUR	LCVs Plugin Hybrid		0.02	1.08	1.00			1							
NOx	RUR	LCVs Electric							1							
NOx	RUR	HCVs Diesel Rigid 3.5-7.5t	1.30%	2.00	1.01	1.00			1	0.026	619427354	1246436				
NOx	RUR	HCVs Diesel Rigid 7.5-10t	0.22%	2.91	1.01	1.00			1	0.006	105454746	309319				
NOx	RUR	HCVs Diesel Rigid 10-20t	0.40%	3.32	1.01	1.01			1	0.013	190294756	638970				
NOx	RUR	HCVs Diesel Rigid 20-25t	0.44%	4.04	1.01	1.01			1	0.018	212238101	873705				
NOx	RUR	HCVs Diesel Rigid 25-30t	0.59%	3.51	1.01	1.02			1	0.021	281558109	1009252				
NOx	RUR	HCVs Diesel Rigid >30t	0.83%	2.93	1.01	1.01			1	0.025	397566878	1183963				
NOx	RUR	HCVs Diesel Articulated 14-20t			1.01	1.00			1							
NOx	RUR	HCVs Diesel Articulated 20-28t	0.23%	3.82	1.01	1.66			1	0.015	109759021	701348				
NOx	RUR	HCVs Diesel Articulated 28-34t	0.41%	3.92	1.01	1.74			1	0.028	198061889	1356495				
NOx	RUR	HCVs Diesel Articulated 34-40t	0.46%	4.56	1.01	1.92			1	0.041	220900881	1940990				
NOx	RUR	HCVs Diesel Articulated 40-50t	0.61%	4.96	1.01	1.00			1	0.031	293050277	1460426				
NOx	RUR	HCVs Diesel Articulated >50t	0.87%	3.22	1.01	0.83			1	0.023	413794098	1115923				
NOx	RUR	HCVs Electric <10t							1							
NOx	RUR	HCVs Electric >10t							1							
NOx	RUR	Buses Diesel Urban <= 12t	0.22%	2.74	1.01	1.00			1	0.006	103849384	287320				
NOx	RUR	Buses Diesel Urban 12-18t	0.34%	5.44	1.01	1.50			1	0.028	162224760	1330473				
NOx	RUR	Buses Diesel Coach 12-18t	0.08%	1.49	1.01	0.37			1	0.000	40556190	22723				
NOx	RUR	Buses Electric >3.5t							1							
			100%							Eijv	0.859	47748151475	41037799			
									VEPM	0.697	49240081356	34307894				

See notes in 'Fleet emission factors' for discrepancies in outputs

Appendix A: UET and OAT analysis for NO_x – vehicle classes

Absolute value
 Data Gap
 Red font = uncertainty computation
 Input from lit review, data analysis, etc.

Uncertainty			Uncertainty										
Substance	Situation	Vehicle class	VKT (% fleet)	Ehot (g/km)	f	s(m)	g(x)	Eijv (hot)	Ecold (g/km)	Eijv (cold)	δEijv (hot)	δEijv (cold)	U-Eijv (hot + cold)
NOx	RUR	Cars Petrol	3%	78%	20%	8%	14%	82%	82%	82%	0.21	0.02	76%
NOx	RUR	Cars Diesel	6%	39%	5%	6%	3%	40%	40%	41%	0.02	0.00	39%
NOx	RUR	Cars Hybrid		84%	20%		14%	88%	88%				
NOx	RUR	Cars Plugin Hybrid		84%	20%		14%	88%	88%				
NOx	RUR	Cars Electric											
NOx	RUR	LCVs Petrol	5%	51%	20%	28%	14%	63%	63%	64%	0.02	0.00	61%
NOx	RUR	LCVs Diesel	5%	39%	5%	9%	3%	41%	41%	41%	0.08	0.00	40%
NOx	RUR	LCVs Hybrid		84%	20%		14%	88%	88%				
NOx	RUR	LCVs Plugin Hybrid		84%	20%		14%	88%	88%				
NOx	RUR	LCVs Electric											
NOx	RUR	HCVs Diesel Rigid 3.5-7.5t	5%	43%	4%	0%	3%	43%	43%	44%	0.01		43%
NOx	RUR	HCVs Diesel Rigid 7.5-10t	5%	43%	4%	0%	3%	43%	43%	44%	0.00		43%
NOx	RUR	HCVs Diesel Rigid 10-20t	5%	43%	4%	0%	3%	43%	43%	44%	0.01		43%
NOx	RUR	HCVs Diesel Rigid 20-25t	5%	43%	4%	0%	3%	43%	43%	44%	0.01		43%
NOx	RUR	HCVs Diesel Rigid 25-30t	5%	43%	4%	0%	3%	43%	43%	44%	0.01		43%
NOx	RUR	HCVs Diesel Rigid >30t	5%	43%	4%	0%	3%	43%	43%	44%	0.01		43%
NOx	RUR	HCVs Diesel Articulated 14-20t			4%	0%	3%						
NOx	RUR	HCVs Diesel Articulated 20-28t	5%	43%	4%	0%	3%	43%	43%	44%	0.01		43%
NOx	RUR	HCVs Diesel Articulated 28-34t	5%	43%	4%	0%	3%	43%	43%	44%	0.01		43%
NOx	RUR	HCVs Diesel Articulated 34-40t	5%	43%	4%	0%	3%	43%	43%	44%	0.02		43%
NOx	RUR	HCVs Diesel Articulated 40-50t	5%	43%	4%	0%	3%	43%	43%	44%	0.01		43%
NOx	RUR	HCVs Diesel Articulated >50t	5%	43%	4%	0%	3%	43%	43%	44%	0.01		43%
NOx	RUR	HCVs Electric <10t											
NOx	RUR	HCVs Electric >10t											
NOx	RUR	Buses Diesel Urban <= 12t	9%	43%	4%	0%	3%	44%	44%	45%	0.00		44%
NOx	RUR	Buses Diesel Urban 12-18t	9%	43%	4%	0%	3%	44%	44%	45%	0.01		44%
NOx	RUR	Buses Diesel Coach 12-18t	9%	43%	4%	0%	3%	44%	44%	45%	0.00		44%
NOx	RUR	Buses Electric >3.5t											

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If

$$X = a + b + c$$

Then

$$\delta X = \sqrt{(\delta a)^2 + (\delta b)^2 + (\delta c)^2}$$

Or

$$\frac{\delta X}{X} = \frac{\sqrt{\left(\left(\frac{\delta a}{a}\right)^2 a^2 + \left(\left(\frac{\delta b}{b}\right)^2 b^2 + \left(\left(\frac{\delta c}{c}\right)^2 c^2\right)}{X^2}}$$

Substance	Situation	Vehicle class	%	g	(g)^2	Plausible Range		Uncertainty Contribution	uncertainty emission inventory	
			U-Eijv	U-Eijv	U-Eijv^2	LCL Eijv (g)	UCL Eijv (g)	Eijv to Eij (%)	U-Eij	U-Eij
NOx	RUR	Cars Petrol	76%	0.21	0.04	0.067	0.481	82%		
NOx	RUR	Cars Diesel	39%	0.02	0.00	0.037	0.085	1%	27%	0.228
NOx	RUR	Cars Hybrid								
NOx	RUR	Cars Plugin Hybrid								
NOx	RUR	Cars Electric								
NOx	RUR	LCVs Petrol	61%	0.02	0.00	0.014	0.057	1%		
NOx	RUR	LCVs Diesel	40%	0.08	0.01	0.124	0.289	13%		
NOx	RUR	LCVs Hybrid								
NOx	RUR	LCVs Plugin Hybrid								
NOx	RUR	LCVs Electric								
NOx	RUR	HCVs Diesel Rigid 3.5-7.5t	43%	0.01	0.00	0.015	0.037	0%		
NOx	RUR	HCVs Diesel Rigid 7.5-10t	43%	0.00	0.00	0.004	0.009	0%		
NOx	RUR	HCVs Diesel Rigid 10-20t	43%	0.01	0.00	0.008	0.019	0%		
NOx	RUR	HCVs Diesel Rigid 20-25t	43%	0.01	0.00	0.010	0.026	0%		
NOx	RUR	HCVs Diesel Rigid 25-30t	43%	0.01	0.00	0.012	0.030	0%		
NOx	RUR	HCVs Diesel Rigid >30t	43%	0.01	0.00	0.014	0.036	0%		
NOx	RUR	HCVs Diesel Articulated 14-20t								
NOx	RUR	HCVs Diesel Articulated 20-28t	43%	0.01	0.00	0.008	0.021	0%		
NOx	RUR	HCVs Diesel Articulated 28-34t	43%	0.01	0.00	0.016	0.041	0%		
NOx	RUR	HCVs Diesel Articulated 34-40t	43%	0.02	0.00	0.023	0.058	1%		
NOx	RUR	HCVs Diesel Articulated 40-50t	43%	0.01	0.00	0.017	0.044	0%		
NOx	RUR	HCVs Diesel Articulated >50t	43%	0.01	0.00	0.013	0.033	0%		
NOx	RUR	HCVs Electric <10t								
NOx	RUR	HCVs Electric >10t								
NOx	RUR	Buses Diesel Urban <= 12t	44%	0.00	0.00	0.003	0.009	0%		
NOx	RUR	Buses Diesel Urban 12-18t	44%	0.01	0.00	0.016	0.040	0%		
NOx	RUR	Buses Diesel Coach 12-18t	44%	0.00	0.00	0.000	0.001	0%		
NOx	RUR	Buses Electric >3.5t								
								100%		

Appendix A: UET and OAT analysis for NO_x – vehicle classes

Emission Inventory			Relative Importance							
Matrix	Rank	RI Rank	i	j	v	RI	LCL RI	UCL RI	RNG RI	UCL - LCL
11%	1	1	NOx	RUR	Cars Petrol	32%	10%	45%	10.2 - 45.1	35%
0%	3	3	NOx	RUR	Cars Diesel	7%	4%	10%	4.4 - 9.6	5%
		19	NOx	RUR	Cars Hybrid	0%				
		19	NOx	RUR	Cars Plugin Hybrid	0%				
		19	NOx	RUR	Cars Electric	0%				
0%	4	5	NOx	RUR	LCVs Petrol	4%	2%	7%	1.7 - 6.5	5%
4%	2	2	NOx	RUR	LCVs Diesel	24%	16%	31%	16 - 30.7	15%
		19	NOx	RUR	LCVs Hybrid	0%				
		19	NOx	RUR	LCVs Plugin Hybrid	0%				
		19	NOx	RUR	LCVs Electric	0%				
0%	9	9	NOx	RUR	HCVs Diesel Rigid 3.5-7.5t	3%	2%	4%	1.7 - 4.3	3%
0%	16	16	NOx	RUR	HCVs Diesel Rigid 7.5-10t	1%	0%	1%	0.4 - 1.1	1%
0%	15	15	NOx	RUR	HCVs Diesel Rigid 10-20t	2%	1%	2%	0.9 - 2.2	1%
0%	13	13	NOx	RUR	HCVs Diesel Rigid 20-25t	2%	1%	3%	1.2 - 3	2%
0%	12	12	NOx	RUR	HCVs Diesel Rigid 25-30t	2%	1%	3%	1.4 - 3.5	2%
0%	10	10	NOx	RUR	HCVs Diesel Rigid >30t	3%	2%	4%	1.7 - 4.1	2%
		19	NOx	RUR	HCVs Diesel Articulated 14-20t	0%				
0%	14	14	NOx	RUR	HCVs Diesel Articulated 20-28t	2%	1%	2%	1 - 2.4	1%
0%	7	7	NOx	RUR	HCVs Diesel Articulated 28-34t	3%	2%	5%	1.9 - 4.7	3%
0%	5	4	NOx	RUR	HCVs Diesel Articulated 34-40t	5%	3%	7%	2.7 - 6.6	4%
0%	6	6	NOx	RUR	HCVs Diesel Articulated 40-50t	4%	2%	5%	2.1 - 5	3%
0%	11	11	NOx	RUR	HCVs Diesel Articulated >50t	3%	2%	4%	1.6 - 3.8	2%
		19	NOx	RUR	HCVs Electric <10t	0%				
		19	NOx	RUR	HCVs Electric >10t	0%				
0%	17	17	NOx	RUR	Buses Diesel Urban <= 12t	1%	0%	1%	0.4 - 1	1%
0%	8	8	NOx	RUR	Buses Diesel Urban 12-18t	3%	2%	5%	1.8 - 4.6	3%
0%	18	18	NOx	RUR	Buses Diesel Coach 12-18t	0%	0%	0%	0 - 0.1	0%
		19	NOx	RUR	Buses Electric >3.5t	0%				
						<u>100%</u>				

Top Vehicle Classes by RI	
Rank	Vehicle Class
1	Cars Petrol
2	LCVs Diesel
3	Cars Diesel
4	HCVs Diesel Articulated 34-40t
5	LCVs Petrol
6	HCVs Diesel Articulated 40-50t
7	HCVs Diesel Articulated 28-34t
8	Buses Diesel Urban 12-18t
9	HCVs Diesel Rigid 3.5-7.5t
10	HCVs Diesel Rigid >30t
11	HCVs Diesel Articulated >50t
12	HCVs Diesel Rigid 25-30t
13	HCVs Diesel Rigid 20-25t
14	HCVs Diesel Articulated 20-28t
15	HCVs Diesel Rigid 10-20t

Top Vehicle Classes by RI and UCL - LCL Matrix	
Rank	Vehicle Class
1	Cars Petrol
2	LCVs Diesel
3	Cars Diesel
4	LCVs Petrol
5	HCVs Diesel Articulated 34-40t
6	HCVs Diesel Articulated 40-50t
7	HCVs Diesel Articulated 28-34t
8	Buses Diesel Urban 12-18t
9	HCVs Diesel Rigid 3.5-7.5t
10	HCVs Diesel Rigid >30t
11	HCVs Diesel Articulated >50t
12	HCVs Diesel Rigid 25-30t
13	HCVs Diesel Rigid 20-25t
14	HCVs Diesel Articulated 20-28t
15	HCVs Diesel Rigid 10-20t

Appendix A: UET and OAT analysis for NO_x – vehicle classes

Variable to change for OAT
 Input from lit review, data analysis for OAT
 Data Gap

Input changes for OAT

Red font = uncertainty computation
 Input from lit review, data analysis, etc.

Change with 2.5% and 97.5% values one at a time and copy changes in rank to table

Substance	Situation	Vehicle class	Uncertainty	Uncertainty		2.5% P	50% P	97.5% P
			Ehot (g/km)	Eijv (hot)	U-Eijv (hot + cold)	Ehot (g/km)	Ehot (g/km)	Ehot (g/km)
NOx	RUR	Cars Petrol	78%	82%	76%	25%	78%	135%
NOx	RUR	Cars Diesel	39%	40%	39%	15%	39%	152%
NOx	RUR	Cars Hybrid	84%	88%		27%	84%	142%
NOx	RUR	Cars Plugin Hybrid	84%	88%		27%	84%	142%
NOx	RUR	Cars Electric						
NOx	RUR	LCVs Petrol	51%	63%	61%	25%	51%	109%
NOx	RUR	LCVs Diesel	39%	41%	40%	15%	39%	152%
NOx	RUR	LCVs Hybrid	84%	88%		27%	84%	142%
NOx	RUR	LCVs Plugin Hybrid	84%	88%		27%	84%	142%
NOx	RUR	LCVs Electric						
NOx	RUR	HCVs Diesel Rigid 3.5-7.5t	43%	43%	43%	8%	43%	88%
NOx	RUR	HCVs Diesel Rigid 7.5-10t	43%	43%	43%	8%	43%	88%
NOx	RUR	HCVs Diesel Rigid 10-20t	43%	43%	43%	8%	43%	88%
NOx	RUR	HCVs Diesel Rigid 20-25t	43%	43%	43%	8%	43%	88%
NOx	RUR	HCVs Diesel Rigid 25-30t	43%	43%	43%	8%	43%	88%
NOx	RUR	HCVs Diesel Rigid >30t	43%	43%	43%	8%	43%	88%
NOx	RUR	HCVs Diesel Articulated 14-20t						
NOx	RUR	HCVs Diesel Articulated 20-28t	43%	43%	43%	8%	43%	88%
NOx	RUR	HCVs Diesel Articulated 28-34t	43%	43%	43%	8%	43%	88%
NOx	RUR	HCVs Diesel Articulated 34-40t	43%	43%	43%	8%	43%	88%
NOx	RUR	HCVs Diesel Articulated 40-50t	43%	43%	43%	8%	43%	88%
NOx	RUR	HCVs Diesel Articulated >50t	43%	43%	43%	8%	43%	88%
NOx	RUR	HCVs Electric <10t						
NOx	RUR	HCVs Electric >10t						
NOx	RUR	Buses Diesel Urban <= 12t	43%	44%	44%	8%	43%	88%
NOx	RUR	Buses Diesel Urban 12-18t	43%	44%	44%	8%	43%	88%
NOx	RUR	Buses Diesel Coach 12-18t	43%	44%	44%	8%	43%	88%
NOx	RUR	Buses Electric >3.5t						

OAT Outcome Generator

Top Vehicle Classes by RI	
Rank	Vehicle Class
1	Cars Petrol
2	LCVs Diesel
3	Cars Diesel
4	HCVs Diesel Articulated 34-40t
5	LCVs Petrol
6	HCVs Diesel Articulated 40-50t
7	HCVs Diesel Articulated 28-34t
8	Buses Diesel Urban 12-18t
9	HCVs Diesel Rigid 3.5-7.5t
10	HCVs Diesel Rigid >30t
11	HCVs Diesel Articulated >50t
12	HCVs Diesel Rigid 25-30t
13	HCVs Diesel Rigid 20-25t
14	HCVs Diesel Articulated 20-28t
15	HCVs Diesel Rigid 10-20t
16	
17	
18	
19	
20	

probably negligible



Top Vehicle Classes by RI and UCL - LCL Matrix		
Rank	50% P Vehicle Class	OAT Change
1	Cars Petrol	Cars Petrol
2	LCVs Diesel	LCVs Diesel
3	Cars Diesel	Cars Diesel
4	LCVs Petrol	LCVs Petrol
5	HCVs Diesel Articulated 34-40t	HCVs Diesel Articulated 34-40t
6	HCVs Diesel Articulated 40-50t	HCVs Diesel Articulated 40-50t
7	HCVs Diesel Articulated 28-34t	HCVs Diesel Articulated 28-34t
8	Buses Diesel Urban 12-18t	Buses Diesel Urban 12-18t
9	HCVs Diesel Rigid 3.5-7.5t	HCVs Diesel Rigid 3.5-7.5t
10	HCVs Diesel Rigid >30t	HCVs Diesel Rigid >30t
11	HCVs Diesel Articulated >50t	HCVs Diesel Articulated >50t
12	HCVs Diesel Rigid 25-30t	HCVs Diesel Rigid 25-30t
13	HCVs Diesel Rigid 20-25t	HCVs Diesel Rigid 20-25t
14	HCVs Diesel Articulated 20-28t	HCVs Diesel Articulated 20-28t
15	HCVs Diesel Rigid 10-20t	HCVs Diesel Rigid 10-20t
16		
17		
18		
19		
20		

Change?
 No change
 No change
 No change
 No change
 No change
 No change
 No change
 No change
 No change
 No change
 No change
 No change
 No change
 No change
 No change
 No change
 No change
 No change
 No change

Appendix A: UET and OAT analysis for NO_x – vehicle classes

Emission factor OAT Summary		97.5% P Scenario for Emission factors		first five highest			
Rank	50% P Vehicle Class	Cars Petrol	LCVs Diesel	Cars Diesel	LCVs Petrol	HCVs Diesel Articulated 34-40t	Sensitive?
1	Cars Petrol	Cars Petrol	LCVs Diesel	Cars Petrol	Cars Petrol	Cars Petrol	Yes
2	LCVs Diesel	LCVs Diesel	Cars Petrol	LCVs Diesel	LCVs Diesel	LCVs Diesel	Yes
3	Cars Diesel	Cars Diesel	Cars Diesel	Cars Diesel	Cars Diesel	HCVs Diesel Articulated 34-40t	Yes
4	LCVs Petrol	LCVs Petrol	LCVs Petrol	LCVs Petrol	LCVs Petrol	Cars Diesel	Yes
5	HCVs Diesel Articulated 34-40t	HCVs Diesel Articulated 34-40t	HCVs Diesel Articulated 34-40t	HCVs Diesel Articulated 34-40t	HCVs Diesel Articulated 34-40t	LCVs Petrol	Yes
6	HCVs Diesel Articulated 40-50t	HCVs Diesel Articulated 28-34t	HCVs Diesel Articulated 28-34t	HCVs Diesel Articulated 28-34t	HCVs Diesel Articulated 28-34t	HCVs Diesel Articulated 28-34t	
7	HCVs Diesel Articulated 28-34t	Buses Diesel Urban 12-18t	Buses Diesel Urban 12-18t	Buses Diesel Urban 12-18t	Buses Diesel Urban 12-18t	Buses Diesel Urban 12-18t	
8	Buses Diesel Urban 12-18t	HCVs Diesel Rigid 3.5-7.5t	HCVs Diesel Rigid 3.5-7.5t	HCVs Diesel Rigid 3.5-7.5t	HCVs Diesel Rigid 3.5-7.5t	HCVs Diesel Rigid 3.5-7.5t	
9	HCVs Diesel Rigid 3.5-7.5t	HCVs Diesel Rigid >30t	HCVs Diesel Rigid >30t	HCVs Diesel Rigid >30t	HCVs Diesel Rigid >30t	HCVs Diesel Rigid >30t	
10	HCVs Diesel Rigid >30t	HCVs Diesel Articulated >50t	HCVs Diesel Articulated >50t	HCVs Diesel Articulated >50t	HCVs Diesel Articulated >50t	HCVs Diesel Articulated >50t	
11	HCVs Diesel Articulated >50t	HCVs Diesel Rigid 25-30t	HCVs Diesel Rigid 25-30t	HCVs Diesel Rigid 25-30t	HCVs Diesel Rigid 25-30t	HCVs Diesel Rigid 25-30t	
12	HCVs Diesel Rigid 25-30t	HCVs Diesel Rigid 20-25t	HCVs Diesel Rigid 20-25t	HCVs Diesel Rigid 20-25t	HCVs Diesel Rigid 20-25t	HCVs Diesel Rigid 20-25t	
13	HCVs Diesel Rigid 20-25t	HCVs Diesel Articulated 20-28t	HCVs Diesel Articulated 20-28t	HCVs Diesel Articulated 20-28t	HCVs Diesel Articulated 20-28t	HCVs Diesel Articulated 20-28t	
14	HCVs Diesel Articulated 20-28t	HCVs Diesel Rigid 10-20t	HCVs Diesel Rigid 10-20t	HCVs Diesel Rigid 10-20t	HCVs Diesel Rigid 10-20t	HCVs Diesel Rigid 10-20t	
15	HCVs Diesel Rigid 10-20t	HCVs Diesel Rigid 10-20t	HCVs Diesel Rigid 10-20t	HCVs Diesel Rigid 10-20t	HCVs Diesel Rigid 10-20t	HCVs Diesel Rigid 10-20t	

Emission factor OAT Summary		2.5% P Scenario for Emission factors					
Rank	50% P Vehicle Class	Cars Petrol	LCVs Diesel	Cars Diesel	LCVs Petrol	HCVs Diesel Articulated 34-40t	Sensitive?
1	Cars Petrol	Cars Petrol	Cars Petrol	Cars Petrol	Cars Petrol	Cars Petrol	No
2	LCVs Diesel	LCVs Diesel	LCVs Diesel	LCVs Diesel	LCVs Diesel	LCVs Diesel	No
3	Cars Diesel	Cars Diesel	Cars Diesel	LCVs Petrol	Cars Diesel	Cars Diesel	Yes
4	LCVs Petrol	LCVs Petrol	LCVs Petrol	HCVs Diesel Articulated 34-40t	HCVs Diesel Articulated 34-40t	LCVs Petrol	Yes
5	HCVs Diesel Articulated 34-40t	HCVs Diesel Articulated 34-40t	HCVs Diesel Articulated 34-40t	Cars Diesel	LCVs Petrol	HCVs Diesel Articulated 40-50t	Yes
6	HCVs Diesel Articulated 40-50t	HCVs Diesel Articulated 28-34t	HCVs Diesel Articulated 28-34t	HCVs Diesel Articulated 28-34t	HCVs Diesel Articulated 28-34t	Buses Diesel Urban 12-18t	Yes
7	HCVs Diesel Articulated 28-34t	Buses Diesel Urban 12-18t	Buses Diesel Urban 12-18t	Buses Diesel Urban 12-18t	Buses Diesel Urban 12-18t	HCVs Diesel Rigid 3.5-7.5t	Yes
8	Buses Diesel Urban 12-18t	HCVs Diesel Rigid 3.5-7.5t	HCVs Diesel Rigid 3.5-7.5t	HCVs Diesel Rigid 3.5-7.5t	HCVs Diesel Rigid 3.5-7.5t	HCVs Diesel Rigid >30t	Yes
9	HCVs Diesel Rigid 3.5-7.5t	HCVs Diesel Rigid >30t	HCVs Diesel Rigid >30t	HCVs Diesel Rigid >30t	HCVs Diesel Rigid >30t	HCVs Diesel Articulated >50t	Yes
10	HCVs Diesel Rigid >30t	HCVs Diesel Articulated >50t	HCVs Diesel Articulated >50t	HCVs Diesel Articulated >50t	HCVs Diesel Articulated >50t	HCVs Diesel Rigid 25-30t	Yes
11	HCVs Diesel Articulated >50t	HCVs Diesel Rigid 25-30t	HCVs Diesel Rigid 25-30t	HCVs Diesel Rigid 25-30t	HCVs Diesel Rigid 25-30t	HCVs Diesel Articulated 34-40t	Yes
12	HCVs Diesel Rigid 25-30t	HCVs Diesel Rigid 20-25t	HCVs Diesel Rigid 20-25t	HCVs Diesel Rigid 20-25t	HCVs Diesel Rigid 20-25t	HCVs Diesel Rigid 20-25t	
13	HCVs Diesel Rigid 20-25t	HCVs Diesel Articulated 20-28t	HCVs Diesel Articulated 20-28t	HCVs Diesel Articulated 20-28t	HCVs Diesel Articulated 20-28t	HCVs Diesel Articulated 20-28t	
14	HCVs Diesel Articulated 20-28t	HCVs Diesel Rigid 10-20t	HCVs Diesel Rigid 10-20t	HCVs Diesel Rigid 10-20t	HCVs Diesel Rigid 10-20t	HCVs Diesel Rigid 10-20t	
15	HCVs Diesel Rigid 10-20t	HCVs Diesel Rigid 10-20t	HCVs Diesel Rigid 10-20t	HCVs Diesel Rigid 10-20t	HCVs Diesel Rigid 10-20t	HCVs Diesel Rigid 10-20t	

Appendix A: UET and OAT analysis for NO_x – vehicle classes

$$E_{NO_2,URB,v} = E_{NO_x,URB,v} \times f_{NO_2}$$

$$E_{NO_x,URB,v} = E_{hot,NO_x,v} \times f_{NO_x,v} \times s(m)_{NO_x,v} \times g(x)_{NO_x,v} + E_{cold,NO_x,v} \times Cold\ Start?$$

Direct from VFEM (No population/mileage breakdown)

Cold start on?

1

Emission Inventory

i	j	v	Base year X		Speed							Cold start on?		Emission Inventory	
			2018	77	eijv	M1ijv	M2ijv	M3ijv	eMijv hot	M4ijv	M5ijv	eMijv cold	Eijv	Eijv	Absolute Annual VKT
Substance	Situation	Vehicle Standard	VKT (% fleet)	Ehot (g/km)	f	s(m)	g(x)	Ecold (g/km)	Cold Start?	(1 or 0)	emission (g/km)	fleet emission (g/km)			
NOx	RUR	PC_Petrol PRE ECE Small < 1.4 l		2.08	1.08	1.00	1.66	0.04	1		3.756				
NOx	RUR	PC_Petrol PRE ECE Medium 1.4 - 2.0 l		2.79	1.08	1.00	1.66	0.06	1		5.055				
NOx	RUR	PC_Petrol PRE ECE Large-SUV-Executive > 2.0 l		4.40	1.08	1.00	1.66	0.09	1		7.967				
NOx	RUR	PC_Petrol ECE 15/00-01 Small < 1.4 l		2.08	1.08	1.00	1.66	0.04	1		3.756				
NOx	RUR	PC_Petrol (ECE 15/00) Medium 1.4 - 2.0 l		2.79	1.08	1.00	1.66	0.06	1		5.055				
NOx	RUR	PC_Petrol (ECE 15/00) Large-SUV-Executive > 2.0		4.40	1.08	1.00	1.66	0.09	1		7.967				
NOx	RUR	PC_Petrol ECE 15/00-01 Small < 1.4 l		2.08	1.08	1.00	1.66	0.04	1		3.756				
NOx	RUR	PC_Petrol (ECE 15/01) Medium 1.4 - 2.0 l		2.79	1.08	1.00	1.66	0.06	1		5.055				
NOx	RUR	PC_Petrol (ECE 15/01) Large-SUV-Executive > 2.0		4.40	1.08	1.00	1.66	0.09	1		7.967				
NOx	RUR	PC_Petrol ECE 15/02 Small < 1.4 l		2.26	1.08	1.00	1.66	0.05	1		4.092				
NOx	RUR	PC_Petrol ECE 15/02 Medium 1.4 - 2.0 l		2.56	1.08	1.00	1.66	0.05	1		4.626				
NOx	RUR	PC_Petrol ECE 15/02 Large-SUV-Executive > 2.0		2.87	1.08	1.00	1.66	0.06	1		5.201				
NOx	RUR	PC_Petrol ECE 15/03 Small < 1.4 l		2.45	1.08	1.00	1.66	0.05	1		4.436				
NOx	RUR	PC_Petrol ECE 15/03 Medium 1.4 - 2.0 l		2.76	1.08	1.00	1.66	0.06	1		5.003				
NOx	RUR	PC_Petrol ECE 15/03 Large-SUV-Executive > 2.0		3.66	1.08	1.00	1.66	0.08	1		6.631				
NOx	RUR	PC_Petrol ECE 15/04 Small < 1.4 l	0.282%	2.21	1.08	1.00	1.66	0.011133641	0.05	1	0.000127666	3.994	0.011	134621748	537707
NOx	RUR	PC_Petrol ECE 15/04 Medium 1.4 - 2.0 l	0.770%	2.92	1.08	1.00	1.66	0.040272799	0.06	1	0.000461797	5.291	0.041	367632668	1945002
NOx	RUR	PC_Petrol ECE 15/04 Large-SUV-Executive > 2.0	0.418%	2.93	1.08	1.00	1.66	0.021889245	0.06	1	0.000250998	5.295	0.022	199655581	1057156
NOx	RUR	PC_Petrol Euro 1 Small < 1.4 l	0.145%	0.31	1.08	2.12	1.66	0.001698103	0.23	1	0.000333959	1.405	0.002	69075702	97027
NOx	RUR	PC_Petrol Euro 1 Medium 1.4 - 2.0 l	1.432%	0.31	1.08	2.12	1.66	0.016809001	0.22	1	0.003176316	1.396	0.020	683759128	954262
NOx	RUR	PC_Petrol Euro 1 Large-SUV-Executive > 2.0 l	1.815%	0.31	1.08	2.12	1.66	0.02130696	0.17	1	0.003081798	1.344	0.024	866727795	1164518
NOx	RUR	PC_Petrol Euro 2 Small < 1.4 l	0.236%	0.16	1.08	2.12	1.66	0.00142236	0.09	1	0.000201405	0.688	0.002	112619436	77532
NOx	RUR	PC_Petrol Euro 2 Medium 1.4 - 2.0 l	2.200%	0.16	1.08	2.12	1.66	0.013264692	0.08	1	0.001804726	0.685	0.015	1050269954	719537
NOx	RUR	PC_Petrol Euro 2 Large-SUV-Executive > 2.0 l	1.991%	0.16	1.08	2.12	1.66	0.012005304	0.06	1	0.001250226	0.666	0.013	950554301	632927
NOx	RUR	PC_Petrol Euro 3 Small < 1.4 l	0.829%	0.06	1.08	1.00	1.66	0.000848846	0.01	1	0.000113177	0.116	0.001	395934999	45935
NOx	RUR	PC_Petrol Euro 3 Medium 1.4 - 2.0 l	6.172%	0.06	1.08	1.44	1.66	0.009808606	0.01	1	0.000809432	0.160	0.010	2947095705	472613
NOx	RUR	PC_Petrol Euro 3 Large-SUV-Executive > 2.0 l	5.553%	0.06	1.08	1.44	1.66	0.008176481	0.01	1	0.000557379	0.157	0.009	2651327465	417026
NOx	RUR	PC_Petrol Euro 4 Small < 1.4 l	1.110%	0.03	1.08	1.00	1.66	0.00053101	0.00	1	3.98248E-05	0.051	0.001	529791413	27256
NOx	RUR	PC_Petrol Euro 4 Medium 1.4 - 2.0 l	7.489%	0.03	1.08	1.23	1.66	0.004404336	0.00	1	0.000258271	0.062	0.005	3575809624	222631
NOx	RUR	PC_Petrol Euro 4 Large-SUV-Executive > 2.0 l	5.783%	0.03	1.08	1.23	1.66	0.003401227	0.00	1	0.000152662	0.061	0.004	2761401483	169692
NOx	RUR	PC_Petrol Euro 5 Small < 1.4 l	0.444%	0.02	1.08	1.00	1.66	0.000139508	0.00	1	1.04628E-05	0.034	0.000	211973459	7161
NOx	RUR	PC_Petrol Euro 5 Medium 1.4 - 2.0 l	4.074%	0.02	1.08	0.85	1.66	0.001085585	0.00	1	9.22662E-05	0.029	0.001	1945459847	56240
NOx	RUR	PC_Petrol Euro 5 Large-SUV-Executive > 2.0 l	2.453%	0.02	1.08	0.85	1.66	0.000653691	0.00	1	4.25258E-05	0.028	0.001	1171469400	33243
NOx	RUR	PC_Petrol Euro 6 up to 2016 Small < 1.4 l		0.02	1.08	1.00	1.66	0.00	1		0.037				
NOx	RUR	PC_Petrol Euro 6 up to 2016 Medium 1.4 - 2.0 l		0.02	1.08	0.80	1.66	0.00	1		0.030				
NOx	RUR	Petrol Euro 6 up to 2016 Large-SUV-Executive >		0.02	1.08	0.80	1.66	0.00	1		0.029				
NOx	RUR	PC_Petrol Euro 6 2017-2019 Small < 1.4 l		0.02	1.08	1.00	1.66	0.00	1		0.039				
NOx	RUR	PC_Petrol Euro 6 2017-2019 Medium 1.4 - 2.0 l		0.02	1.08	0.80	1.66	0.00	1		0.032				
NOx	RUR	Petrol Euro 6 2017-2019 Large-SUV-Executive >		0.02	1.08	0.80	1.66	0.00	1		0.031				
NOx	RUR	PC_Petrol Euro 6 2020+ Small < 1.4 l		0.02	1.08	1.00	1.66	0.00	1		0.039				
NOx	RUR	PC_Petrol Euro 6 2020+ Medium 1.4 - 2.0 l		0.02	1.08	0.80	1.66	0.00	1		0.032				
NOx	RUR	PC_Petrol Euro 6 2020+ Large-SUV-Executive > 2.0		0.02	1.08	0.80	1.66	0.00	1		0.031				
NOx	RUR	PC_Petrol NZ new Small < 1.4 l		2.26	1.08	1.00	1.66		1		4.046				
NOx	RUR	PC_Petrol NZ new Medium 1.4 - 2.0 l		2.56	1.08	1.00	1.66		1		4.573				
NOx	RUR	PC_Petrol NZ new Large-SUV-Executive > 2.0 l		2.87	1.08	1.00	1.66		1		5.142				

Appendix A: UET and OAT analysis for NO_x – vehicle classes

Absolute value
Data Gap
Red font = uncertainty computation
Input from lit review, data analysis, etc.

Substance	Situation	Uncertainty Vehicle Standard	Uncertainty											
			VKT (% fleet)	Ehot (g/km)	f_NOx	s(m)	g(x)	Eijv (hot)	Ecold (g/km)	Eijv (cold)	ΔEijv (hot)	ΔEijv (cold)	U-Eijv NOx	
NOx	RUR	PC_Petrol PRE ECE Small < 1.4 l	3%	44%	20%	8%	14%	51%	51%	51%				
NOx	RUR	PC_Petrol PRE ECE Medium 1.4 - 2.0 l	3%	44%	20%	8%	14%	51%	51%	51%				
NOx	RUR	PC_Petrol PRE ECE Large-SUV-Executive > 2.0 l	3%	44%	20%	8%	14%	51%	51%	51%				
NOx	RUR	PC_Petrol ECE 15/00-01 Small < 1.4 l	3%	44%	20%	8%	14%	51%	51%	51%				
NOx	RUR	PC_Petrol (ECE 15/00) Medium 1.4 - 2.0 l	3%	44%	20%	8%	14%	51%	51%	51%				
NOx	RUR	PC_Petrol (ECE 15/00) Large-SUV-Executive > 2.0 l	3%	44%	20%	8%	14%	51%	51%	51%				
NOx	RUR	PC_Petrol ECE 15/00-01 Small < 1.4 l	3%	44%	20%	8%	14%	51%	51%	51%				
NOx	RUR	PC_Petrol (ECE 15/01) Medium 1.4 - 2.0 l	3%	44%	20%	8%	14%	51%	51%	51%				
NOx	RUR	PC_Petrol (ECE 15/01) Large-SUV-Executive > 2.0 l	3%	44%	20%	8%	14%	51%	51%	51%				
NOx	RUR	PC_Petrol ECE 15/02 Small < 1.4 l	3%	44%	20%	8%	14%	51%	51%	51%				
NOx	RUR	PC_Petrol ECE 15/02 Medium 1.4 - 2.0 l	3%	44%	20%	8%	14%	51%	51%	51%				
NOx	RUR	PC_Petrol ECE 15/02 Large-SUV-Executive > 2.0 l	3%	44%	20%	8%	14%	51%	51%	51%				
NOx	RUR	PC_Petrol ECE 15/03 Small < 1.4 l	3%	44%	20%	8%	14%	51%	51%	51%				
NOx	RUR	PC_Petrol ECE 15/03 Medium 1.4 - 2.0 l	3%	44%	20%	8%	14%	51%	51%	51%				
NOx	RUR	PC_Petrol ECE 15/03 Large-SUV-Executive > 2.0 l	3%	44%	20%	8%	14%	51%	51%	51%				
NOx	RUR	PC_Petrol ECE 15/04 Small < 1.4 l	3%	44%	20%	8%	14%	51%	51%	51%	0.01	0.00	51%	
NOx	RUR	PC_Petrol ECE 15/04 Medium 1.4 - 2.0 l	3%	44%	20%	8%	14%	51%	51%	51%	0.02	0.00	51%	
NOx	RUR	PC_Petrol ECE 15/04 Large-SUV-Executive > 2.0 l	3%	44%	20%	8%	14%	51%	51%	51%	0.01	0.00	51%	
NOx	RUR	PC_Petrol Euro 1 Small < 1.4 l	3%	69%	20%	8%	14%	74%	74%	74%	0.00	0.00	63%	
NOx	RUR	PC_Petrol Euro 1 Medium 1.4 - 2.0 l	3%	69%	20%	8%	14%	74%	74%	74%	0.01	0.00	63%	
NOx	RUR	PC_Petrol Euro 1 Large-SUV-Executive > 2.0 l	3%	69%	20%	8%	14%	74%	74%	74%	0.02	0.00	65%	
NOx	RUR	PC_Petrol Euro 2 Small < 1.4 l	3%	77%	20%	8%	14%	81%	81%	81%	0.00	0.00	72%	
NOx	RUR	PC_Petrol Euro 2 Medium 1.4 - 2.0 l	3%	77%	20%	8%	14%	81%	81%	81%	0.01	0.00	72%	
NOx	RUR	PC_Petrol Euro 2 Large-SUV-Executive > 2.0 l	3%	77%	20%	8%	14%	81%	81%	81%	0.01	0.00	74%	
NOx	RUR	PC_Petrol Euro 3 Small < 1.4 l	3%	82%	20%	8%	14%	86%	86%	86%	0.00	0.00	77%	
NOx	RUR	PC_Petrol Euro 3 Medium 1.4 - 2.0 l	3%	82%	20%	8%	14%	86%	86%	86%	0.01	0.00	80%	
NOx	RUR	PC_Petrol Euro 3 Large-SUV-Executive > 2.0 l	3%	82%	20%	8%	14%	86%	86%	86%	0.01	0.00	81%	
NOx	RUR	PC_Petrol Euro 4 Small < 1.4 l	3%	84%	20%	8%	14%	88%	88%	88%	0.00	0.00	82%	
NOx	RUR	PC_Petrol Euro 4 Medium 1.4 - 2.0 l	3%	84%	20%	8%	14%	88%	88%	88%	0.00	0.00	83%	
NOx	RUR	PC_Petrol Euro 4 Large-SUV-Executive > 2.0 l	3%	84%	20%	8%	14%	88%	88%	88%	0.00	0.00	84%	
NOx	RUR	PC_Petrol Euro 5 Small < 1.4 l	3%	84%	20%	8%	14%	88%	88%	88%	0.00	0.00	82%	
NOx	RUR	PC_Petrol Euro 5 Medium 1.4 - 2.0 l	3%	84%	20%	8%	14%	88%	88%	88%	0.00	0.00	82%	
NOx	RUR	PC_Petrol Euro 5 Large-SUV-Executive > 2.0 l	3%	84%	20%	8%	14%	88%	88%	88%	0.00	0.00	83%	
NOx	RUR	PC_Petrol Euro 6 up to 2016 Small < 1.4 l	3%	84%	20%	8%	14%	88%	88%	88%				
NOx	RUR	PC_Petrol Euro 6 up to 2016 Medium 1.4 - 2.0 l	3%	84%	20%	8%	14%	88%	88%	88%				
NOx	RUR	PC_Petrol Euro 6 up to 2016 Large-SUV-Executive > 2.0 l	3%	84%	20%	8%	14%	88%	88%	88%				
NOx	RUR	PC_Petrol Euro 6 2017-2019 Small < 1.4 l	3%	84%	20%	8%	14%	88%	88%	88%				
NOx	RUR	PC_Petrol Euro 6 2017-2019 Medium 1.4 - 2.0 l	3%	84%	20%	8%	14%	88%	88%	88%				

Appendix A: UET and OAT analysis for NO_x – vehicle classes

$$\begin{aligned} &\text{If} \\ &X = a + b + c \\ &\text{Then} \\ &\delta X = \sqrt{(\delta a)^2 + (\delta b)^2 + (\delta c)^2} \\ &\text{Or} \\ &\frac{\delta X}{X} = \sqrt{\left(\frac{\delta a}{a}\right)^2 + \left(\frac{\delta b}{b}\right)^2 + \left(\frac{\delta c}{c}\right)^2} \end{aligned}$$

Substance	Situation	Vehicle Standard	%	g	(g) ²	Plausible Range		Uncertainty Contribution	uncertainty emission inventory	
			U-Eijv	U-Eijv	U-Eijv ²	LCL Eijv (g)	UCL Eijv (g)	Eijv to Eij (%)	U-Eij	U-Eij
NOx	RUR	PC_Petrol PRE ECE Small < 1.4 l								
NOx	RUR	PC_Petrol PRE ECE Medium 1.4 - 2.0 l								
NOx	RUR	PC_Petrol PRE ECE Large-SUV-Executive > 2.0 l								
NOx	RUR	PC_Petrol ECE 15/00-01 Small < 1.4 l								
NOx	RUR	PC_Petrol (ECE 15/00) Medium 1.4 - 2.0 l								
NOx	RUR	PC_Petrol (ECE 15/00) Large-SUV-Executive > 2.0 l								
NOx	RUR	PC_Petrol ECE 15/00-01 Small < 1.4 l								
NOx	RUR	PC_Petrol (ECE 15/01) Medium 1.4 - 2.0 l								
NOx	RUR	PC_Petrol (ECE 15/01) Large-SUV-Executive > 2.0 l								
NOx	RUR	PC_Petrol ECE 15/02 Small < 1.4 l								
NOx	RUR	PC_Petrol ECE 15/02 Medium 1.4 - 2.0 l								
NOx	RUR	PC_Petrol ECE 15/02 Large-SUV-Executive > 2.0 l								
NOx	RUR	PC_Petrol ECE 15/03 Small < 1.4 l								
NOx	RUR	PC_Petrol ECE 15/03 Medium 1.4 - 2.0 l								
NOx	RUR	PC_Petrol ECE 15/03 Large-SUV-Executive > 2.0 l								
NOx	RUR	PC_Petrol ECE 15/04 Small < 1.4 l	51%	0.01	0.00	0.006	0.017	1%		
NOx	RUR	PC_Petrol ECE 15/04 Medium 1.4 - 2.0 l	51%	0.02	0.00	0.020	0.061	11%		
NOx	RUR	PC_Petrol ECE 15/04 Large-SUV-Executive > 2.0 l	51%	0.01	0.00	0.011	0.033	3%		
NOx	RUR	PC_Petrol Euro 1 Small < 1.4 l	63%	0.00	0.00	0.001	0.003	0%		
NOx	RUR	PC_Petrol Euro 1 Medium 1.4 - 2.0 l	63%	0.01	0.00	0.007	0.033	4%		
NOx	RUR	PC_Petrol Euro 1 Large-SUV-Executive > 2.0 l	65%	0.02	0.00	0.008	0.040	6%		
NOx	RUR	PC_Petrol Euro 2 Small < 1.4 l	72%	0.00	0.00	0.000	0.003	0%		
NOx	RUR	PC_Petrol Euro 2 Medium 1.4 - 2.0 l	72%	0.01	0.00	0.004	0.026	3%		
NOx	RUR	PC_Petrol Euro 2 Large-SUV-Executive > 2.0 l	74%	0.01	0.00	0.003	0.023	2%		
NOx	RUR	PC_Petrol Euro 3 Small < 1.4 l	77%	0.00	0.00	0.000	0.002	0%		
NOx	RUR	PC_Petrol Euro 3 Medium 1.4 - 2.0 l	80%	0.01	0.00	0.002	0.018	2%		
NOx	RUR	PC_Petrol Euro 3 Large-SUV-Executive > 2.0 l	81%	0.01	0.00	0.002	0.016	1%		
NOx	RUR	PC_Petrol Euro 4 Small < 1.4 l	82%	0.00	0.00	0.000	0.001	0%		
NOx	RUR	PC_Petrol Euro 4 Medium 1.4 - 2.0 l	83%	0.00	0.00	0.001	0.009	0%		
NOx	RUR	PC_Petrol Euro 4 Large-SUV-Executive > 2.0 l	84%	0.00	0.00	0.001	0.007	0%		
NOx	RUR	PC_Petrol Euro 5 Small < 1.4 l	82%	0.00	0.00	0.000	0.000	0%		
NOx	RUR	PC_Petrol Euro 5 Medium 1.4 - 2.0 l	82%	0.00	0.00	0.000	0.002	0%		
NOx	RUR	PC_Petrol Euro 5 Large-SUV-Executive > 2.0 l	83%	0.00	0.00	0.000	0.001	0%		
NOx	RUR	PC_Petrol Euro 6 up to 2016 Small < 1.4 l								



uncertainty emission inventory
%
g
U-Eij
12%
U-Eij
0.063

Appendix A: UET and OAT analysis for NO_x – vehicle classes

Matrix	Rank	Emission Inventory			Relative Importance	Relative Importance					
		RI Rank	Substance	Situation		RI	LCL RI	UCL RI	RNG RI	UCL - LCL	
		72	NOx	RUR	PC_Petrol PRE ECE Small < 1.4 l	0%					
		72	NOx	RUR	PC_Petrol PRE ECE Medium 1.4 - 2.0 l	0%					
		72	NOx	RUR	PC_Petrol PRE ECE Large-SUV-Executive > 2.0 l	0%					
		72	NOx	RUR	PC_Petrol ECE 15/00-01 Small < 1.4 l	0%					
		72	NOx	RUR	PC_Petrol (ECE 15/00) Medium 1.4 - 2.0 l	0%					
		72	NOx	RUR	PC_Petrol (ECE 15/00) Large-SUV-Executive > 2.0 l	0%					
		72	NOx	RUR	PC_Petrol ECE 15/00-01 Small < 1.4 l	0%					
		72	NOx	RUR	PC_Petrol (ECE 15/01) Medium 1.4 - 2.0 l	0%					
		72	NOx	RUR	PC_Petrol (ECE 15/01) Large-SUV-Executive > 2.0 l	0%					
		72	NOx	RUR	PC_Petrol ECE 15/02 Small < 1.4 l	0%					
		72	NOx	RUR	PC_Petrol ECE 15/02 Medium 1.4 - 2.0 l	0%					
		72	NOx	RUR	PC_Petrol ECE 15/02 Large-SUV-Executive > 2.0 l	0%					
		72	NOx	RUR	PC_Petrol ECE 15/03 Small < 1.4 l	0%					
		72	NOx	RUR	PC_Petrol ECE 15/03 Medium 1.4 - 2.0 l	0%					
		72	NOx	RUR	PC_Petrol ECE 15/03 Large-SUV-Executive > 2.0 l	0%					
0%	15	14	NOx	RUR	PC_Petrol ECE 15/04 Small < 1.4 l	2%	1%	3%	1 - 3.1	2%	
1%	3	3	NOx	RUR	PC_Petrol ECE 15/04 Medium 1.4 - 2.0 l	8%	4%	11%	3.9 - 11	7%	
0%	7	7	NOx	RUR	PC_Petrol ECE 15/04 Large-SUV-Executive > 2.0 l	4%	2%	6%	2.1 - 6.1	4%	
0%	34	37	NOx	RUR	PC_Petrol Euro 1 Small < 1.4 l	0%	0%	1%	0.1 - 0.6	0%	
0%	6	9	NOx	RUR	PC_Petrol Euro 1 Medium 1.4 - 2.0 l	4%	1%	6%	1.4 - 5.9	5%	
0%	5	5	NOx	RUR	PC_Petrol Euro 1 Large-SUV-Executive > 2.0 l	5%	2%	7%	1.6 - 7.3	6%	
0%	38	40	NOx	RUR	PC_Petrol Euro 2 Small < 1.4 l	0%	0%	1%	0.1 - 0.5	0%	
0%	10	11	NOx	RUR	PC_Petrol Euro 2 Medium 1.4 - 2.0 l	3%	1%	5%	0.8 - 4.7	4%	
0%	11	13	NOx	RUR	PC_Petrol Euro 2 Large-SUV-Executive > 2.0 l	2%	1%	4%	0.7 - 4.2	4%	
0%	46	48	NOx	RUR	PC_Petrol Euro 3 Small < 1.4 l	0%	0%	0%	0 - 0.3	0%	
0%	13	16	NOx	RUR	PC_Petrol Euro 3 Medium 1.4 - 2.0 l	2%	0%	3%	0.4 - 3.3	3%	
0%	16	19	NOx	RUR	PC_Petrol Euro 3 Large-SUV-Executive > 2.0 l	2%	0%	3%	0.3 - 2.9	3%	
0%	50	50	NOx	RUR	PC_Petrol Euro 4 Small < 1.4 l	0%	0%	0%	0 - 0.2	0%	
0%	24	26	NOx	RUR	PC_Petrol Euro 4 Medium 1.4 - 2.0 l	1%	0%	2%	0.1 - 1.6	1%	
0%	27	28	NOx	RUR	PC_Petrol Euro 4 Large-SUV-Executive > 2.0 l	1%	0%	1%	0.1 - 1.2	1%	
0%	55	55	NOx	RUR	PC_Petrol Euro 5 Small < 1.4 l	0%	0%	0%	0 - 0.1	0%	
0%	42	45	NOx	RUR	PC_Petrol Euro 5 Medium 1.4 - 2.0 l	0%	0%	0%	0 - 0.4	0%	
0%	49	49	NOx	RUR	PC_Petrol Euro 5 Large-SUV-Executive > 2.0 l	0%	0%	0%	0 - 0.2	0%	
		72	NOx	RUR	PC_Petrol Euro 6 up to 2016 Small < 1.4 l	0%					
		72	NOx	RUR	PC_Petrol Euro 6 up to 2016 Medium 1.4 - 2.0 l	0%					
		72	NOx	RUR	PC_Petrol Euro 6 up to 2016 Large-SUV-Executive > 2.0 l	0%					
		72	NOx	RUR	PC_Petrol Euro 6 2017-2019 Small < 1.4 l	0%					
		72	NOx	RUR	PC_Petrol Euro 6 2017-2019 Medium 1.4 - 2.0 l	0%					
		72	NOx	RUR	PC_Petrol Euro 6 2017-2019 Large-SUV-Executive > 2.0 l	0%					
		72	NOx	RUR	PC_Petrol Euro 6 2020+ Small < 1.4 l	0%					
		72	NOx	RUR	PC_Petrol Euro 6 2020+ Medium 1.4 - 2.0 l	0%					
		72	NOx	RUR	PC_Petrol Euro 6 2020+ Large-SUV-Executive > 2.0 l	0%					
		72	NOx	RUR	PC_Petrol NZ new Small < 1.4 l	0%					
		72	NOx	RUR	PC_Petrol NZ new Medium 1.4 - 2.0 l	0%					
		72	NOx	RUR	PC_Petrol NZ new Large-SUV-Executive > 2.0 l	0%					
0%	17	15	NOx	RUR	PC_Petrol NZ new Small < 1.4 l	2%	1%	3%	0.9 - 2.8	2%	
0%	21	22	NOx	RUR	PC_Petrol NZ new Medium 1.4 - 2.0 l	1%	1%	2%	0.6 - 1.9	1%	
0%	8	8	NOx	RUR	PC_Petrol NZ new Large > 2.0 l	4%	2%	6%	1.9 - 5.8	4%	

Rank	Top Vehicle Classes by RI Vehicle Class
1	LCV_Deisel Euro 4 N1-III 08 - 15
2	LCV_Deisel Euro 5 N1-III 16 - 19
3	PC_Petrol ECE 15/04 Medium 1.4 - 2.0 l
4	PC_Petrol Euro 1 Medium 1.4 - 2.0 l
5	PC_Petrol Euro 1 Large-SUV-Executive > 2.0 l
6	LCV_Deisel Euro 3 N1-III 04 - 07
7	PC_Petrol ECE 15/04 Large-SUV-Executive > 2.0 l
8	PC_Petrol NZ new Large > 2.0 l
9	PC_Petrol Euro 1 Medium 1.4 - 2.0 l
10	PC_Diesel Euro 4 Large-SUV-Executive > 2.0 l
11	PC_Petrol Euro 2 Medium 1.4 - 2.0 l
12	LCV_Deisel Euro 2 N1-III 00 - 03
13	PC_Petrol Euro 2 Large-SUV-Executive > 2.0 l
14	PC_Petrol ECE 15/04 Small < 1.4 l
15	PC_Petrol NZ new Small < 1.4 l
16	PC_Petrol Euro 3 Medium 1.4 - 2.0 l
17	PC_Diesel Euro 4 Medium < 2.0 l
18	PC_Diesel Euro 1 Large-SUV-Executive > 2.0 l
19	PC_Petrol Euro 3 Large-SUV-Executive > 2.0 l
20	PC_Petrol Euro 1 Large-SUV-Executive > 2.0 l

Rank	Top Vehicle Classes by RI and UCL - LCL Matrix Vehicle Class
1	LCV_Deisel Euro 4 N1-III 08 - 15
2	LCV_Deisel Euro 5 N1-III 16 - 19
3	PC_Petrol ECE 15/04 Medium 1.4 - 2.0 l
4	PC_Petrol Euro 1 Medium 1.4 - 2.0 l
5	PC_Petrol Euro 1 Large-SUV-Executive > 2.0 l
6	PC_Petrol Euro 1 Medium 1.4 - 2.0 l
7	PC_Petrol ECE 15/04 Large-SUV-Executive > 2.0 l
8	PC_Petrol NZ new Large > 2.0 l
9	LCV_Deisel Euro 3 N1-III 04 - 07
10	PC_Petrol Euro 2 Medium 1.4 - 2.0 l
11	PC_Petrol Euro 2 Large-SUV-Executive > 2.0 l
12	PC_Diesel Euro 4 Large-SUV-Executive > 2.0 l
13	PC_Petrol Euro 3 Medium 1.4 - 2.0 l
14	LCV_Deisel Euro 2 N1-III 00 - 03
15	PC_Petrol ECE 15/04 Small < 1.4 l
16	PC_Petrol Euro 3 Large-SUV-Executive > 2.0 l
17	PC_Petrol NZ new Small < 1.4 l
18	PC_Petrol Euro 1 Large-SUV-Executive > 2.0 l
19	PC_Diesel Euro 4 Medium < 2.0 l
20	PC_Diesel Euro 1 Large-SUV-Executive > 2.0 l