

Appendix G Vehicle Emission Factor - Sensitivity Analysis

A sensitivity analysis of vehicle emission rates, relative to changes in fleet profile and vehicle speed, has been undertaken to determine the effect on predicted ambient concentrations of air pollutants as a result of deviations in the assumed values used in the modelling assessment.

Table G-1 presents the results of a sensitivity analysis on emission rates with respect to an increase in the percentage of HCV using the Expressway for the 2021 With Project 'Scenario'. Table G-1 shows that an increase in the percentage of HCV would result in a decrease in CO emissions and an increase in NO₂ and PM₁₀ emissions. The results also show that a 10% increase in HCV would result in an increase in NO₂ and PM₁₀ emissions of 34% and 20%, respectively. While these increases may seem significant, the additional contribution is not expected to result in exceedances in air quality assessment criteria. For example, the maximum 1-hr average NO₂ concentration predicted at a sensitive receptor location in Otaki, predicted to give the highest concentration of all the selected receptors, for the 2021 'With Project Scenario', was 94 µg/m³ (Vehicle Contribution 41 µg/m³ + Background 53 µg/m³). An increase in the contribution from vehicles associated with a 10 % increase in HCV would result in a maximum 1-hr average NO₂ concentration at the sensitive receptor location of 108 µg/m³, well below the assessment criteria of 200 µg/m³.

Table G-1 Sensitivity Analysis of Emission Rates Relative to Fleet Profile

Link	Vehicle Type		Emission Factors g/km/vehicle			Percentage Change (%)		
	% LCV	% HCV	CO	NO ₂	PM ₁₀	CO	NO ₂	PM ₁₀
Typical Expressway Link	87%	13%	2.23	0.13	0.03			
2% Increase in HCV	85%	15%	2.18	0.14	0.04	-2%	7%	4%
5% Increase in HCV	82%	18%	2.12	0.15	0.04	-5%	17%	10%
10% Increase in HCV	77%	23%	2.01	0.17	0.04	-10%	34%	20%

Table G-2 presents the results of a sensitivity analysis on emission rates with respect to a decrease in vehicle speed. For the purposes of the modelling assessment the speed of LCV vehicles travelling along the Expressway was assumed to be the speed limited of 100 kph, with HCV travelling 10 kph slower. Table F-2 shows the effect on emission rates over a range of speeds below the speed used in the assessment. The results show a slight reduction in emissions when vehicles travel between 10 kph and 50 kph below the speed limit, with greater emissions predicted when vehicles travel below 50 kph. This emission profile is shown graphically in Figure G-1.

The atmospheric dispersion modelling assessment considered the effect of vehicles travelling at low speeds along the Otaki section of expressway, such as during holiday periods, see Section 10.2. The results of this assessment predicted that roadside concentrations of air pollutants will be below air quality assessment criteria. Overall the effect of a reduction in the speed of vehicles travelling on the Expressway is not considered to be significant with respect to the potential for exceedances in air quality assessment criteria.

Appendix G - Vehicle Emission Factor - Sensitivity Analysis

Table G-2 Sensitivity Analysis of Emission Rates Relative to Vehicle Speed

Link	Speed (kph)	Emission Factors g/km/vehicle			Percentage Change (%)		
		CO	NO ₂	PM ₁₀	CO	NO ₂	PM ₁₀
Typical Expressway Link	100	2.23	0.13	0.03			
10 kph Reduction in Speed	90	1.97	0.12	0.03	-12%	-4%	-5%
20 kph Reduction in Speed	80	1.81	0.12	0.03	-19%	-7%	-8%
30 kph Reduction in Speed	70	1.74	0.12	0.03	-22%	-8%	-7%
40 kph Reduction in Speed	60	1.78	0.12	0.03	-20%	-8%	-4%
50 kph Reduction in Speed	50	1.92	0.12	0.04	-14%	-4%	4%
60 kph Reduction in Speed	40	2.09	0.14	0.04	-6%	4%	20%
70 kph Reduction in Speed	30	2.29	0.16	0.05	3%	20%	50%
80 kph Reduction in Speed	20	3.13	0.21	0.08	41%	60%	126%
90 kph Reduction in Speed	10	5.14	0.23	0.09	131%	79%	167%

Figure G-1 Fleet Emissions Relative to Vehicle Speed

