

31 August 2021

Commercial-in-Confidence

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Waikato Expressway Greenhouse Gas Emission Changes

Introduction

Waka Kotahi has commissioned AECOM NZ Limited to provide Greenhouse Gas (GHG)¹ emissions estimates for the Waikato Expressway 110km/h project. This document examines the use of a higher maximum speed limit of 110km/h on the Expressway between Hampton Downs and Tamahere. The GHG emissions estimate for the project are based on the predicted traffic modelling data provided by Waka Kotahi. The Vehicle Emissions Prediction Model (V.6.2: 2021)², was used to calculate the effect that an increase to a 110km/h speed limit will have along the new Hamilton bypass section to Hampton Downs on GHG emissions from vehicles using this section of expressway.

Infrastructure investigated

The Waikato Expressway, a length of approximately 64.1 km, is being investigated for an increase to a 110km/h speed limit. The GHG analysis was undertaken on the following sections of the expressway. For reference a schematic of the route is also included in Appendix A.

- Hampton Downs to Te Kauwhata
- Te Kauwhata to Rangiriri
- Rangiriri to Ohinewai
- Ohinewai to Huntly Section
- Huntly Section
- Ngaruawahia Section (only as far south to interface with the northern extent of the Hamilton bypass)

Hamilton bypass

- Tamahere section (between southern extent of the Hamilton bypass to the Tamahere/Cambridge 110km/h interface)

¹ Following the UNFCC Kyoto Protocol six main greenhouse gases were identified including carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF₆). Of the main six gases for Waka Kotahi carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) are most likely to be important for consideration in emission estimates.

² [Vehicle emissions prediction model | Waka Kotahi NZ Transport Agency \(nzta.govt.nz\)](#)

Scope of work

The scope of work covers:

- Enabled emissions from the increase in speed limit. These are the GHG emissions that arise from use of the infrastructure. Sources of enabled emissions include emissions from vehicles (including cars, buses, trucks, and trains), using the transport system.
- Model GHG emissions expressed as Carbon Dioxide Equivalents (CO₂e)³ using the Vehicle Emissions Prediction Model provided by Waka Kotahi.
- Model traffic flows based on Annual Average Daily Traffic (AADT) and the percentage of Heavy Vehicles (HV) relating to a design year between 2031 and 2041, provided by Waka Kotahi.
- Model two scenarios for each design year 2031 and 2041:
 - GHG emissions estimated for the existing 100km/h maximum speed limit
 - GHG emissions estimated for the proposed 110km/h maximum speed limit
- Summarise results in a memo, detailing the model parameters, and presenting a table of corridor sections with a column for each scenario listed above (this memo).

Method summary

The model developed uses the AADT, details of the vehicle fleet content and distances provided by Waka Kotahi to calculate the Vehicle Kilometres Travelled (VKT) breakdown for each section of the expressway in the predicted years. The VKT and speed data is then multiplied by the VEPM (version 6.2) estimate of vehicle fleet emissions predicted in the design year to calculate the emissions tonnes CO₂e (or tCO₂e). Finally, the change in emissions due to the increased speed limit and the percentage change are then calculated.

³ For any quantity and type of greenhouse gas, carbon-dioxide equivalent (CO₂e) signifies the amount of CO₂ which would have the equivalent global warming impact. The carbon dioxide equivalent is calculated using the mass of a given GHG multiplied by its global warming potential.

Results Summary

The full results for the modelled scenario are shown in Table 1 Expressway Section Data Summary. The findings include:

- An increase in the average fleet speed from 100 km/hr to the proposed 110 km/hr results in a predicted increase in annual emissions of 4,324 tCO₂e and 3,257 tCO₂e for years 2031 and 2041 respectively
- An increase in average fleet speed to 110km/hr results in a predicted increase of 4.34% and 3.77% in GHG emissions for years 2031 and 2041 when compared to 100km/h
- The increase in the average fleet speed to 110km/hr results in a cumulative increase in GHG emissions over the 2031 to 2041 period from 929,684 to 967,586 tCO₂e, an increase of 37,903 tCO₂e, or 4.08%

The main reason for the predicted increase in GHG emissions is due to light vehicles (e.g. passenger vehicles) operating further beyond optimal fuel efficiency of around 80km from 100 km/hr to 110 km/hr. Results show the increase in GHG emissions due to the increase in speed to 110km/hr is slightly reduced by changes in the make-up of the New Zealand vehicle fleet between 2031 and 2041. The increase in GHG emissions is smaller for 2041 when compared to 2031 because of the higher proportion of electric vehicles in the light vehicle fleet that reduces the average emissions of the fleet.

Assumptions

1. All assumptions included in the Waka Kotahi VEPM (V6.2) default values, such as:
 - a. Heavy commercial vehicles are travelling at a maximum of 86 km/hr
 - b. Heavy commercial vehicle load is 50%
 - c. An ambient temperature of 13.1 degrees Celsius
 - d. The road gradient is 0%
2. The results assume the proportion of Heavy/ Light Vehicles and the subgroups within those based on the data and traffic modelling provided by Waka Kotahi is an accurate representation of the traffic along the sections of expressway.
3. The AADT provided by Waka Kotahi is an accurate average of the traffic throughout the year
4. All light vehicles travelling along the expressway will travel at the relevant maximum speed limit
5. The speed limit is maintained throughout the expressway sections examined
6. VEPM predicted emissions from vehicles in the New Zealand fleet under typical road, traffic and operating conditions. Emissions factors are based on predicted fleet average emissions.

Table 1 Expressway Section Data Summary

Section (between Interchanges)	Distance (km)	Total Annual tCO ₂ e @ existing 100 km/hr		Total Annual tCO ₂ e @ proposed 110km/hr		Change in Emissions tCO ₂ e		Percentage Change in Emissions		Cumulative Change in Emissions tCO ₂ e	Cumulative Percentage Change in Emissions
		Predicted 2031	Predicted 2041	Predicted 2031	Predicted 2041	Predicted 2031	Predicted 2041	Predicted 2031	Predicted 2041	Predicted 2031-2041	Predicted 2031-2041
Hampton Downs to Te Kauwhata	8.1	15,364.15	12,853.43	16,056.56	13,362.62	692.41	509.19	4.51%	3.96%	6,008.00	4.26%
Te Kauwhata to Rangiriri	2.1	3,448.74	3,041.45	3,604.17	3,161.94	155.42	120.49	4.51%	3.96%	1,379.55	4.25%
Rangiriri to Ohinewai	7.6	13,666.88	12,155.72	14,282.79	12,637.27	615.92	481.55	4.51%	3.96%	5,487.35	4.25%
Ohinewai to Huntly Section	1.3	2,252.36	1,972.85	2,353.86	2,051.00	101.51	78.15	4.51%	3.96%	898.30	4.25%
Huntly Section	15.3	20,124.63	18,357.67	20,956.55	19,010.71	831.91	653.03	4.13%	3.56%	7,424.74	3.86%
Ngaruawahia Section (to Lake Road)	7.4	16,637.26	13,796.90	17,432.25	14,385.65	794.99	588.74	4.78%	4.27%	6,918.67	4.55%
Hamilton Section											
Lake Road to Resolution	3.9	4,961.06	3,780.54	5,166.15	3,915.02	205.08	134.48	4.13%	3.56%	1,697.83	3.88%
Resolution to Greenhill	7.2	6,764.28	6,373.00	6,994.01	6,551.81	229.73	178.81	3.40%	2.81%	2,042.70	3.11%
Greenhill to Ruakura	4.1	6,208.90	5,308.48	6,465.57	5,497.32	256.66	188.84	4.13%	3.56%	2,227.51	3.87%
Ruakura to Tamahere	4.9	5,661.44	4,981.86	5,870.47	5,136.30	209.03	154.44	3.69%	3.10%	1,817.32	3.41%
Tamahere to Airport Road	1.9	4,561.56	3,663.61	4,792.88	3,832.41	231.32	168.81	5.07%	4.61%	2,000.64	4.86%
Column Totals	64	99,651	86,285	103,975	89,542	4,324	3,257	4.34%	3.77%	37,903	4.08%

Closing Statement

This document outlines the predicted changes in greenhouse gas emissions (tCO₂e) caused by a change in the maximum speed limit on the Waikato Expressway from 100km/hr to 110km/hr. The method uses the Vehicle Emissions Prediction Model to estimate the enabled emissions. Results show it is estimated that there will be an increase of 4,324 and 3,257 tCO₂e for year 2031 and 2041 respectively. This is a cumulative increase from 929,684 to 967,586 tCO₂e in the period 2031 to 2041, or increase of 37,903 tCO₂e, 4.08%.

Yours faithfully

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Waikato Expressway overview

