AECOM

AECOM New Zealand Limited
Level 19, 171 Featherston Street
Pōneke|Wellington 6011
PO Box 27277
Pōneke|Wellington 6141
New Zealand
www.aecom.com
+64 4 896 6000 tel
+64 4 896 6001 fax

Memorandum

To	Shivam Jakhu	Page	1
CC	Tyler Ross		
Subject	AADT 2031 Forecasts to inform the Post-Implementation Transmission Gully Noise Modelling		
From	Ming Bai		
File/Ref No.		Date	16-Jan-23

1.0 Purpose

The purpose of this memo is to document the modelling methodology and provide the modelling results for the Transmission Gully motorway project (Project), as an input into the post-opening noise mitigation plan assessment and validation. The forecast will be provided for 2031 and is extrapolated from traffic data obtained post-opening of the Project.

2.0 Background

The Transmission Gully motorway project (Project) was opened in March 2022, providing a new route for State Highway (SH1) between Linden (Tawa) and Mackay's Crossing (north of Paekākāriki) traversing a distance of approximately 27km.

At the request of Waka Kotahi, an updated traffic forecast calculation was requested to inform the post-construction validation of the noise assessment in line with the conditions for the project. Traffic monitoring was be conducted to establish the required variables for noise modelling, including traffic volumes and traffic speeds on key locations separated by vehicle types. A traffic survey at five key locations along Transmission Gully was conducted using a laser survey.

Existing transport models covering the project area are available, from which the required forecast data was extracted. The most appropriate model for this study is the Wellington Transport Strategy Model (WTSM), which is a four-step conventional strategic travel demand forecast model. The model extent covers the entire Wellington metropolitan area and is developed and maintained by Wellington Analytics Unit in the EMME software platform.

The WTSM can model future travel demand with rigorous algorithms and procedures for different model years (2001 ,2006, 2011, 2013 and ongoing). It was proposed that the scenario (2036) best matched the future design year (2031) for extraction of the model outputs. Meanwhile a Northern Wellington SATURN Model (NWSM) is available to serve as an auxiliary model to provide improved representation of network performance.

The NWSM aims to balance replication of existing traffic conditions while maintaining sufficient linkage with WTSM to provide forecasting robustness. It is understood that an updated WSTM will be developed in 2023, and a new Porirua Transport Model, developed in AIMSUN, covering year 2031 is in development to ultimately replace the NWSM model. We anticipate an up-to-date model output will be available for use in the near future.

It is understood that the design year that the previous noise modelling was based upon is 2031. The Waka Kotahi acoustics specialist confirmed that the updated forecasts would need to be for the year 2031 as that was the year for which all previous noise predictions were calculated for, however updated forecasts based on the latest iteration of the regional transport model would be sufficient. Accordingly, some data conversion process was needed to make sure the data corresponded to the future design year conditions used in the noise model.

3.0 Data analysis

Primary inputs for the analysis include:

- Post-Construction traffic monitoring data.
- Population growth data from both observed and model forecast.

- Vehicle Kilometres Travelled (VKT) data and rail patronage from transport models.
- Traffic volume data from Wellington Transport Strategy Model and North of Wellington Saturn Model.

3.1 Traffic monitoring data (2022)

The all-day traffic volume data for the post-construction period from 21st September to 13th October was provided in an excel format that allowed comparison against model outputs during the validation process.

It should be noted that the traffic data around SH1-Linden was provided by the Wellington Data Analytics Unit and separately collected from 1st August to 5th August. The locations of the monitoring data collected along are shown in Table 1 and Figure 1. Traffic flow data for the period from the 9th to the 19th of September were also provided for the post-completion noise assessment.

Depending on how much differentiation can be achieved, the general traffic would normally be grouped by:

- Private Class 1 passenger vehicle (3.5 tonnes).
- Medium Commercial (3.5-12 tonnes).
- Heavy Commercial (>12 tonnes).

However due to technical constraints, the traffic data were categorised by vehicle length rather than by weight (tonnes). The vehicle lengths were classified as 0-6m, 6-11m, 11-17m and 17m above. Based on this, we assumed vehicle type classifications based on the following criteria:

- Private Class 1 passenger vehicle (0-6m).
- Medium Commercial (6-11m).
- Heavy Commercial (11-17m and 17m above).

An example screenshot of traffic monitoring data for Southbound traffic at Mackays Crossing Mainline is presented in Table 2.

Table 1 Traffic count data locations

Name	NZTA	Section	Chainage	lat	lon
SBD - Mackays Crossing Mainline	11031	13	1300	-40.980086	174.975084
NBD - Mackays Crossing Mainline	21031	14	1400	-40.980537	174.973989
SBD - Horokiri ki Raro Mainline	11038	86	8550	-41.041336	174.953299
NBD - Horokiri ki Raro Mainline	21038	87	8650	-41.042131	174.953114
SBD - Waitangirua Mainline	11048	181	18050	-41.118359	174.913666
NBD - Waitangirua Mainline	21048	182	18150	-41.118885	174.912784
SBD - South of Wai o Hata mainline	11053	238	23750	-41.155742	174.870937
NBD - South of Wai o Hata mainline	21053	239	23850	-41.155542	174.86975
NBD - SH1-Linden (Tawa College)	22053			-41.159720	174.836530
SBD - SH1-Linden (Tawa College)	12053			-41.159720	174.836530

AECOM

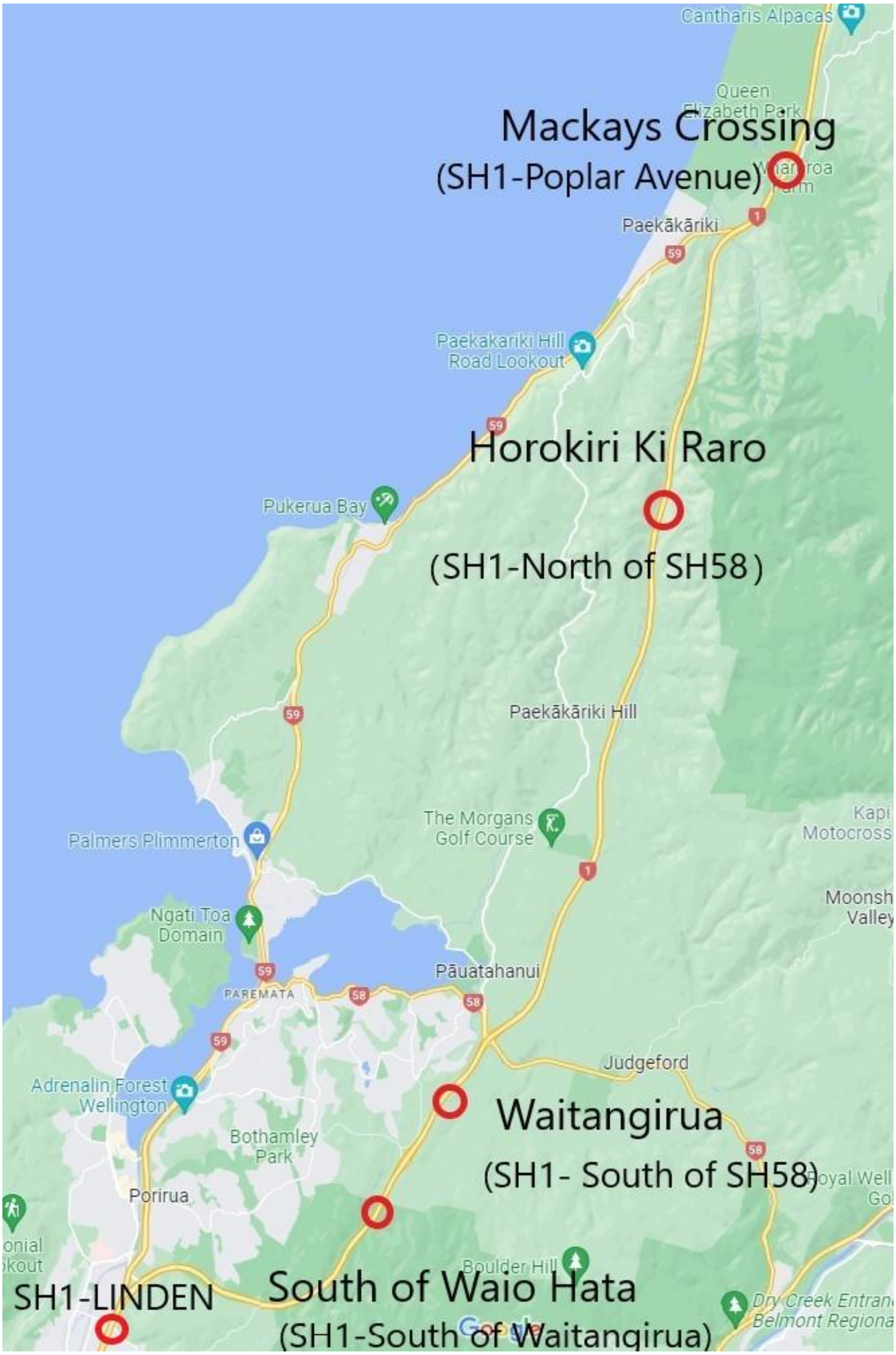

Figure 1 Map of monitoring data sites

Table 2 An example of Traffic monitoring data by vehicle length at Mackays Crossing

DateTime	FromHour	0-6	6-11	11-17	17+	Total
21-Sep	00	54	4	8	3	69
	01	32	2	2	5	41
	02	36	10	17	3	66
	03	87	5	38	5	135
	04	146	10	44	7	207
	05	437	31	50	7	525
	06	1235	79	59	6	1379
	07	1439	83	49	8	1579
	08	1230	44	42	4	1320
	09	953	41	40	3	1037
	10	790	42	39	7	878
	11	818	32	42	4	896
	12	796	36	53	4	889
	13	742	40	53	7	842
	14	785	37	45	5	872
	15	845	40	36	2	923
	16	916	51	31	7	1005
	17	889	37	34	2	962
	18	546	25	35	6	612
	19	286	11	11	1	309
	20	254	13	12	4	283
	21	170	6	3	2	181
	22	121	3	7	2	133
	23	88	1	16	6	111

3.2 Population Growth data

The land use inputs that were used for the various future forecasts in WTSM were also provided together with the baseline data in 2006 and current reported population (2022). The population growth data is divided into two parts as follows:

- Western corridor (Porirua, Kapiti)
- Rest of region (Wellington City, Hutt Valley, Wairarapa)

The comparison between the observed and forecast population growth is summarised in Table 3.

AECOM

Table 3 Population growth comparison

	Population					Difference (cf 2006 base)			
	2006 Obs	2026 Forecast	2022 Obs	2036 Forecast	2036 Sense Partners	2026 Forecast	2022 Obs	2036 Forecast	2036 Sense Partners
Western	97,900	112,300	121,100	142,000	145,400	15%	24%	45%	49%
Rest	364,300	405,000	428,500	455,600	495,700	11%	18%	25%	36%
Region	462,200	517,300	549,600	597,600	641,100	12%	19%	29%	39%

The population figures show that:

- For the western corridor (Porirua, Kapiti), the actual population growth rate between 2006 and 2022 at 24% is greater than the 15% growth the was assumed for the 2026 forecasts used for the Assessment of Environmental Effects (AEE) modelling in 2011.
- The latest 2036 WTSM forecasts show a 45% population growth for the corridor (compared to 2006), which equates to a further 20% growth between 2026 and 2036.
- The 2036 Sense partners projections, that will be used for the new WTSM, show broadly the same growth along the western corridor in the next 10 to 15 years as the current forecasts. The distribution of this growth is different, with less growth in Porirua and more in Kapiti compared to the current forecasts.

Overall, the observed population growth has been higher than forecast, and the revised WTSM forecasts (to be developed in January 2023) will are expected to show a similar level of demand along the western corridor.

From the perspective of population growth, the 2036 forecasts presented in this calculation process should be taken as an indicative range, given both future uncertainty and that the forecasts will be superseded in a couple of months.

3.2.1 VKT and rail patronage data

VKT along the corridor is influenced by the percentage of passenger commuters travelling between Kapiti and Wellington City. Table 4 below summarises the rate of change, expressed in terms of percentage change per annum to control for different forecast horizons, for the following metrics:

- Population change
- Change in annual VKT and VKT per capita
- Change in daily peak period rail trips and daily peak period rail trips per capita

The purpose of this analysis is to understand the following:

- Any bias in the 2026 forecasts – under/over estimation of VKT or rail patronage
- Benchmark the 2036 model, to understand the extent to which the trends being forecast by the model, at a regional level, are reflective of what has happened in the last 10 to 15 years.

Table 4 Changes in VKT and peak period rail patronage

Metric	Change per annum		
	Current Observed (cf 2006 observed)	2026 model (cf 2006 observed)	2036 model (cf 2013 modelled)
Population change pa	1.2%	0.6%	1.0%
Annual VKT change pa	1.1%	1.0%	0.8%
Annual VKT per capita change pa	0.0%	0.4%	-0.1%
Daily peak rail trips change pa	2.7%	1.1%	2.2%
Peak rail trips per capita change pa	1.3%	1.1%	1.1%

The analysis shows the following:

- Reported population growth between 2006 and 2022 is twice what assumed for the 2026 forecasts in WTSM.
- Whilst VKT per annum growth is comparable between what has been observed since 2006 and what the 2026 model forecast, when presented in per capita terms, the model provided for a forecast 0.4% pa growth, whereas the observed VKT per capita growth has been flat since 2006.
- The 2026 model forecast a 1.1% pa growth in peak rail patronage, whereas observed growth is nearer 3% per annum. However, allowing for growth in population, the 2026 forecast and 2022 observed rail patronage growth since 2006 is similar.
- The 2036 model forecasts generally reflect the VKT and public transport (PT) patronage trends that have been observed over the last 10 to 15 years.

The VKT and the rail patronage data analysis implies that the 2036 forecasts can be considered robust, however as noted previously, they will be updated in 2023. The outcomes could be further influenced given the new policy changes for VKT and emissions reductions and the likely interventions that may be required in the next 5 to 10 years to deliver on this policy direction.

3.2.2 Traffic volume data

The transport modelling for developing WTSM was undertaken in 2011, using the 2006 version of WTSM, to inform the AEE. This modelling used the best forecast data available at that point in time for economic growth, changes in fuel price, PT fares and changes in land use, as inputs to the model. It should be noted some of those assumptions at the time used in developing the transport model will not materialise and therefore the observed reality can be different to what was forecasted by the original modelling work.

The key scenarios that were used are as follows:

- 2026 forecast - this is the forecast SATURN model developed in 2011 using demographic assumptions developed in 2008 from the 2006 based WTSM.
- 2036 forecast - this is the current WTSM future forecast, developed in 2019 from the 2013 base model.

The 2036 forecasts are effectively Do Minimum forecasts that do not assume any Let's Get Wellington Moving or Regional Rail Plan related investment.

The traffic volume data of 2026 and 2036 forecast in all peak periods as well as the comparison between them for the five key locations are provided in the following Table 5 to Table 9.

Table 5 SH1-Poplar Avenue(Mackays Crossing)

	2022 Observed	2026 Forecast	2036 Forecast	Diff - 2022 obs vs 2026 forecast		Diff - 2022 obs vs 2036 forecast		Diff - 2026 forecast vs 2036 forecast	
AM - NB	880	760	1170	-120	-14%	290	33%	410	54%
AM - SB	1420	1560	2040	140	10%	620	44%	480	31%
IP - NB	840	700	860	-140	-17%	20	2%	160	23%
IP - SB	800	660	880	-140	-18%	80	10%	220	33%
PM - NB	1650	1520	1800	-130	-8%	150	9%	280	18%
PM - SB	1040	840	1360	-200	-19%	320	31%	520	62%

Table 6 SH1 – North of SH58 (Horokiri Ki Raro)

	2022 Observed	2026 Forecast	2036 Forecast	Diff - 2022 obs vs 2026 forecast		Diff - 2022 obs vs 2036 forecast		Diff - 2026 forecast vs 2036 forecast	
AM - NB	590	530	900	-60	-10%	310	53%	370	70%
AM - SB	1120	1490	2160	370	33%	1040	93%	670	45%
IP - NB	640	570	610	-70	-11%	-30	-5%	40	7%
IP - SB	550	570	610	20	4%	60	11%	40	7%
PM - NB	1270	1410	1430	140	11%	160	13%	20	1%
PM - SB	680	670	900	-10	-1%	220	32%	230	34%

Table 7 SH1 – South of SH58 (Waitangirua)

	2022 Observed	2026 Forecast	2036 Forecast	Diff - 2022 obs vs 2026 forecast		Diff - 2022 obs vs 2036 forecast		Diff - 2026 forecast vs 2036 forecast	
AM - NB	700	490	860	-210	-30%	160	23%	370	76%
AM - SB	1330	1350	1940	20	2%	610	46%	590	44%
IP - NB	620	470	620	-150	-24%	0	0%	150	32%
IP - SB	630	470	650	-160	-25%	20	3%	180	38%
PM - NB	1320	1100	1670	-220	-17%	350	27%	570	52%
PM - SB	850	620	1010	-230	-27%	160	19%	390	63%

Table 8 SH1 - South of Waitangirua (South of Waio Hata)

	2022 Observed	2026 Forecast	2036 Forecast	Diff - 2022 obs vs 2026 forecast		Diff - 2022 obs vs 2036 forecast		Diff - 2026 forecast vs 2036 forecast	
AM - NB	570	430	570	-140	-25%	0	0%	140	33%
AM - SB	1530	1480	1980	-50	-3%	450	29%	500	34%
IP - NB	590	490	510	-100	-17%	-80	-14%	20	4%
IP - SB	660	510	560	-150	-23%	-100	-15%	50	10%
PM - NB	1590	1100	1590	-490	-31%	0	0%	490	45%
PM - SB	790	760	790	-30	-4%	0	0%	30	4%

Table 9 SH1 – Linden (Tawa College)

	2022 Observed (all veh)	2026 Forecast (All veh)	2036 Forecast (All veh)	Diff - 2022 obs vs 2026 forecast		Diff - 2022 obs vs 2036 forecast		Diff - 2026 forecast vs 2036 forecast	
AM - NB	1750	1560	1760	-190	-11%	10	1%	200	13%
AM - SB	2690	3770	3690	1080	40%	1000	37%	-80	-2%
IP - NB	1490	1650	1290	160	11%	-200	-13%	-360	-22%
IP - SB	1410	1650	1470	240	17%	60	4%	-180	-11%
PM - NB	3070	3340	3450	270	9%	380	12%	110	3%
PM - SB	1950	2080	2260	130	7%	310	16%	180	9%

The analysis shows that:

- Observed 2022 volumes are higher than 2026 forecast volumes, with the exception being the AM peak southbound at Poplar Ave and North of SH58.
- In the PM peak northbound south of Waitangirua, the 2026 forecast traffic volume is nearly 500 vehicles lower than the 2022 observed counts.
- The 2036 traffic forecasts are suggesting, compared to the 2022 observed counts
    - a 40% to 90% increase in traffic volumes during the AM peak, particularly in the southbound direction and north of the Project (Poplar Ave and the Project)
    - little forecast growth in the inter-peak
    - up to 30% growth in the PM peak
- A 95% growth in AM peak southbound traffic volumes is forecast for the Project north of SH58 between the 2022 and 2036 forecast. Given the 2022 observed is nearly 30% less than the 2026 forecast, and the much less return traffic of 1,430 vehicles in the PM peak Northbound, a 95% growth in traffic volumes from 2022 to 2036 is considered unlikely.
- The observed traffic volumes are 1000 lower than the modelled in AM peak southbound traffic volume at the SH1 - Linden count site (fronting Tawa College). This demonstrates the impact that the Project merge and slow moving traffic has on effective capacity at peak times. This will also have an impact on traffic volumes upstream, and if modelled in AIMSUN, would potentially reduce traffic volumes on the Project or result in re-timing of trips.

Overall, the growth in traffic volumes on the Project between the 2022 observed traffic counts and 2036 forecasts are on the high side based on historic growth rates. Particularly in the AM peak and to the north of SH58, the growth rates are in the order of 1% to 2% per annum along the region’s state highways over the last 10 years, even accounting for forecast rates of population growth in the area.

The growth in traffic volumes could be potentially considered unrealistically high – particularly north of SH58 - for a number of reasons:

- The forecasts do not assume any rail investment along the western corridor (Rail Plan nor the Lower North Island Rail business case) and therefore driving during peak periods would be more attractive (relative to rail) than could be the case if this investment materialises.
- The 2036 results come from the strategic model (as opposed to the SATURN model that generated the 2026 results) that has a limited representation of downstream bottleneck queuing (that in reality is likely to constrain traffic) and limited parking constraint in the Wellington CBD.

Therefore, it can be seen that:

- Broadly the 2022 observed volumes are higher than 2026 forecast, which is a function of higher than forecast population growth along the western corridor

- The 2036 forecasts indicate a 40% to 80% growth in AM peak traffic volumes (compared to 2022) and a 10% to 30% increase in the PM peak, again a function of high levels of forecast population growth
- This forecast growth potentially represents a ‘high end’ estimate as;
    - The 2036 forecasts are Do Minimum scenarios assuming no rail investment, or investment through Let’s Get Wellington Moving.
    - The forecasts reflect a ‘BAU’ scenario that does not reflect potential policy interventions that could be required to achieve the VKT and emissions targets.
    - WTSM is a strategic model with limited representation of intersection capacity, bottleneck queuing and capacity constraints within urban centres such as Wellington CBD; model granular modelling using AIMSUN would provide a more robust estimate of future traffic volumes.
    - The forecasts do not reflect recent Sense Partners population projections that represent a different distribution of population growth on the Western corridor.

In summary, the 2036 forecasts should be used with caution. They should potentially be scaled down to adjust for differences between the 2022 observed and 2026 forecasts. They should be presented with appropriate caveats and expressed as a range to reflect future model uncertainty.

4.0 Covid-19 Restriction Impacts

It is expected that the observed traffic counts could potentially be influenced by the normalising of public transport patronage and working from home behaviour after the removal of the Covid-19 restrictions. In particular, passenger rail patronage on the Kapiti Line influences vehicle trips. As noted in Table 10 below, passenger rail patronage has been significantly affected across the Wellington Region in November 2020 and 2021 when restrictions were in place. There was an increase in rail patronage in November 2022 compared for 2021, but this is still significantly less than 2018 and 2019.

Table 10: Rail Passenger Patronage

Year	Month	Rail Patronage	Covid Alert Level
2022	November	967,718	
2021	November	895,491	Covid-19 alert level 2
2020	November	973,598	Covid-19 alert level 1
2019	November	1,237,691	
2018	November	1,239,803	

For the purposes of estimating the AADT top 2031 it has been assumed that growth in rail patronage will continue through over the short-term until it normalises to 2018/19 volumes.

5.0 Methodology

The below procedure was followed for this modelling work:

- Model fitness analysis based on the data that was supplied
- Back calculation for 2031 based on the model output from 2036 forecast assuming the travel demand follows a linear growth pattern
- Results adjustment by comparing the actual data vs forecast model

The data analysis between observed and forecast has shown a discrepancy in traffic volume and population growth. This indicates high growth by traffic volume analysis and robust growth by population growth and VKT analysis. Therefore, back calculation from 2036 to 2031 is recommended for both a lower growth and higher growth scenario separately.

5.1.1 Higher growth 2031 calculation

Considering the higher assumption in traffic volumes and the possibility of rail investment in the future, the traffic volume calculation represents a high side estimate. For each location, based on the traffic volume data from the 2026 and 2036 forecast, the detailed back calculation process can be summarised as the following steps:

1. Based on the difference in travel volume between 2026 and 2036, the modelled annual growth factor has been calculated as a result.
2. The growth factor then is applied to back calculate the modelled traffic volume for 2022 and 2031 respectively.
3. The difference factor between the modelled and observed traffic monitoring data for 2022 can be calculated as a result.
4. The difference factor is then applied to the modelled 2031 forecast to produce the revised 2031 traffic volume.
5. The breakdown of traffic volume by vehicle types is produced by multiplying the mode split.
6. AADT regression model development based on the observed data with coefficients to be identified.
7. The AADT for each vehicle types are then calculated based on the linear regression model.

An example of back calculation for the northbound traffic volume at SH1-Poplar Avenue in the AM peak is illustrated in Figure 2.

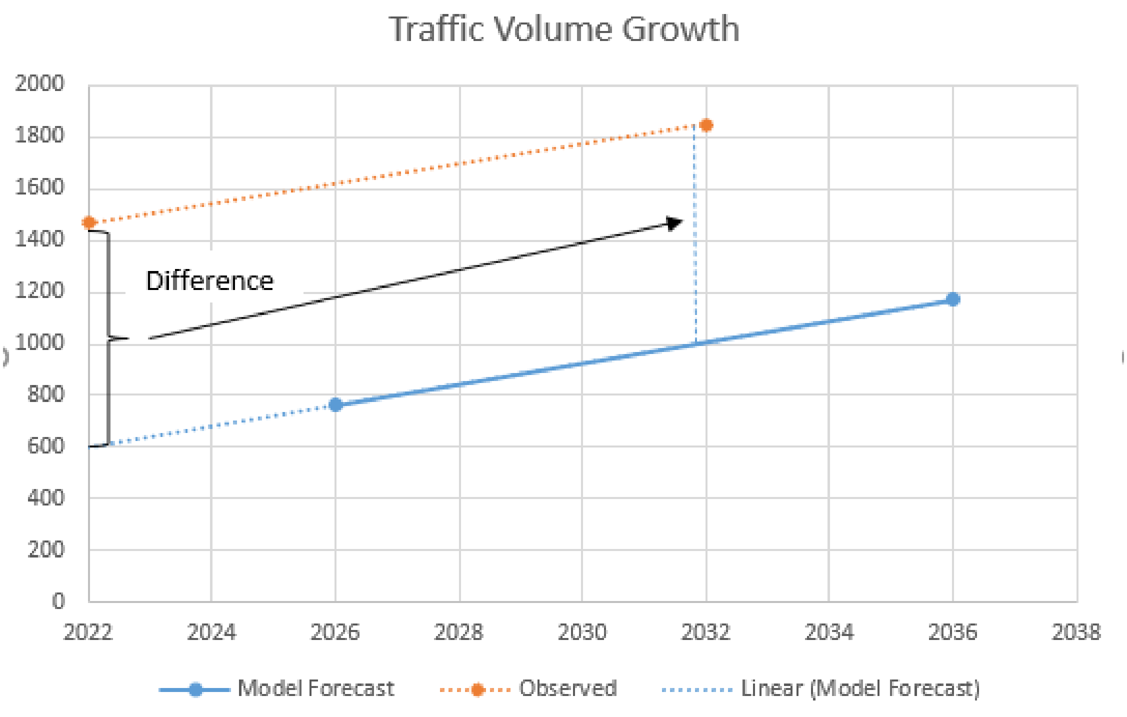

Figure 2 High-case Back calculation based on Traffic volume

5.1.2 Lower growth 2031 calculation

It is understood from discussions with the Wellington Analytics Unit that the revised WTSM forecasts will likely show a similar level of population growth along the western corridor. Based on the population growth data between the observed and forecast data, the detailed back calculation process can be summarised through the following steps:

1. Taking the 2006 observed as the benchmark, based on the difference between 2006 observed and 2022 forecast, the modelled annual growth factor has been calculated as a result.
2. This growth factor then is applied to back calculate the modelled population for 2022.
3. The growth factor between the modelled and observed population data for 2022 can be calculated as a result.
4. The growth factor is assumed to be same for each location and applied to each location to produce the revised 2031 traffic volume.
5. The breakdown of traffic volume by vehicle types is produced by multiplying the mode split.
6. AADT regression model development based on the observed data with coefficients identified.
7. The AADT for each vehicle type is calculated based on the linear regression model.

An example of back calculation based on population growth is illustrated in Figure 3. The result shows that the difference between the observed and modelled population in 2022 is generally lower than travel volume-based calculation except for several peak periods with a difference factor of 1.21.

- Horokiri ki Raro: SB
- South of Waio Hata: SB
- SH1 - Linden: NB and SB

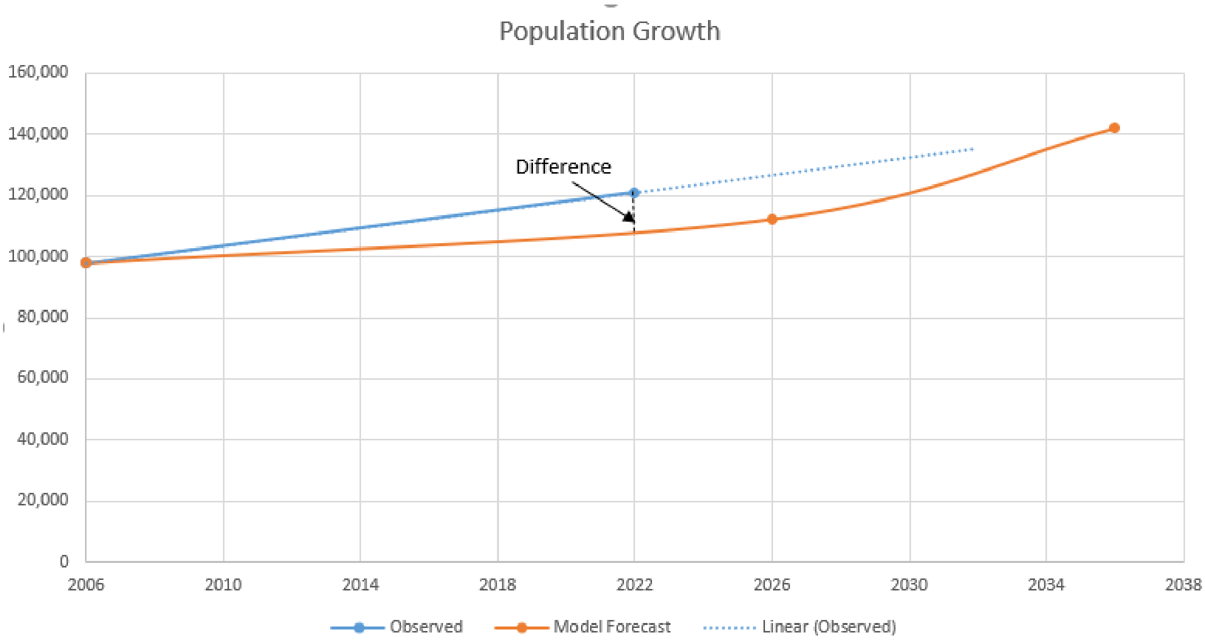

Figure 3 Low-case Back calculation based on Population growth

5.1.3 Mode split assumption

It was required that the traffic volume should be summarised by vehicle class. However, the modal split in WTSM is separated by heavy and light vehicles only, which is not conforming to a specific vehicle classification. To this end, the mode split in observed data was assumed to be the same as in model forecast. Based on the traffic volume of each vehicle type in the traffic monitoring data, the daily mode split for each section can be calculated. In this case, the average mode split over the survey period is taken as the mode split for each section, which has been tabulated as below:

Table 11 Average mode shift for each location

Site Ref	Private Vehicle	Medium Commercial	Heavy Commercial
11031	91.8%	7.6%	0.6%

11038	93.1%	6.6%	0.4%
11048	87.3%	10.3%	2.4%
11053	94.8%	5.1%	0.2%
21031	90.4%	6.9%	2.7%
21038	88.8%	9.5%	1.7%
21048	89.9%	7.1%	3.0%
21053	93.4%	6.2%	0.4%

5.1.4 AADT Calculation

The AADT calculation for each vehicle class was undertaken for the four key road sections. Based on the observed data, a linear regression model was used to identify the relationship between the traffic volume during different peak periods and the total daily traffic volume, which was formulated as follows:

$$AADT=\alpha*F_{AM}+\beta*F_{PM}$$

Where F_{AM} is the traffic volume during 2-hour AM period (7:00-9:00), F_{PM} is the traffic volume during 2-hour PM period (16:00-18:00), α and β are the coefficients to be determined. After fitting analysis with the line of best fit, the values of two coefficients for each vehicle type have been estimated as shown in the following Table 12.

Table 12: Coefficients

Travel Mode	α	β
Class 1: Private vehicle	4	3.7
Class 2: Medium Commercial	4.4	3.9
Class 3: Heavy commercial	4.9	4.3

Due to the lack of available data, the AADT analysis for SH1 - Linden (Tawa College) was based on total traffic volumes. The values of α and β for Tawa College was estimated at 6.1 and 6 respectively. Assuming the modelled results for 2031 follow the same AADT regression model, the AADT for each vehicle type has been calculated.

As discussed earlier, the forecast population growth is lower than observed. Accordingly, the lower bound calculation was factored up to better reflect the actual population growth in the future. It should also be noted that the traffic volume-based calculation is based on Do Minimum scenario assuming no rail investment, or Let's Get Wellington Moving investment. It is expected that this will be updated soon for updates to the WTSM, and development of sub-models interfacing with the area.

The model outcomes might also be changed to reflect current and emerging government policy changes. These include policy changes for the greater urban residential density provisions, and policy direction for VKT and emissions reduction, and mode shift. The model updates will reflect the likely interventions that may be required to deliver on this policy direction. Therefore, the upper bound calculation was factored down to better reflect the future potential car trips reduction along the Project.

6.0 Results

The total AADT as well as AADT separated by vehicle types for the 2031 forecast at each location are presented in Table 13 to Table 17. The results are expressed as a range to reflect the uncertainty in forecast assumption and the impact that other projects and policies might have on outcomes. As mentioned in 3.1.2, there are a couple of peak periods with abnormal ranges (highlighted red in tables), an inversion of range has been applied for these locations. Note also that capacity constraints at SH1 - Linden may impact the high end estimate of AADT >70,000 at the top of the range.

Table 13: SH1-Poplar Avenue (Mackays Crossing) 2031 Forecast

Mackays Crossing	2031		Private Vehicle		Medium Commercial Vehicle		Heavy Commercial Vehicle	
	Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher
AADT - NB	12,770	13,870	11,430	12,400	940	1,020	410	440
AADT - SB	14,380	17,480	13,110	15,930	1,180	1,420	100	120
Total	27,150	31,350	24,540	28,330	2,120	2,440	510	560

Table 14: SH1 – North of SH58 (Horokiri Ki Raro) 2031 Forecast

Horokiri Ki Raro	2031		Private Vehicle		Medium Commercial Vehicle		Heavy Commercial Vehicle	
	Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher
AADT – NB	10,360	12,520	9,110	10,960	1,040	1,310	210	250
AADT – SB	13,010	12,280	12,020	11,350	930	870	60	60
Total	23,370	24,800	21,130	22,310	1,970	2,180	270	310

Table 15: SH1 – South of SH58 (Waitangirua) 2031 Forecast

Waitangirua	2031		Private Vehicle		Medium Commercial Vehicle		Heavy Commercial Vehicle	
	Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher
AADT – NB	10,020	14,150	8,910	12,580	750	1,070	350	500
AADT – SB	12,320	13,640	10,610	11,760	1,360	1,490	350	390
Total	22,340	27,790	19,520	24,340	2,110	2,560	700	890

Table 16: SH1 – South of Waitangirua (South of Waio Hata) 2031 Forecast

South of Waio Hata	2031		Private Vehicle		Medium Commercial Vehicle		Heavy Commercial Vehicle	
	Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher
AADT – NB	8,890	12,830	8,260	11,930	590	850	40	60
AADT – SB	12,470	11,540	11,750	10,880	690	630	30	30
Total	21,360	24,370	20,010	22,810	1,280	1,480	70	90

Table 17: SH1 - Linden (Tawa College) 2031 Forecast

SH1-Linden	2031		Private Vehicle		Medium Commercial Vehicle		Heavy Commercial Vehicle	
	Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher
AADT - NB	32,750	33,300	30,580	31,110	2,030	2,060	130	130
AADT - SB	29,520	38,380	27,960	36,350	1,500	1,960	60	80
Total	62,270	71,680	58,540	67,460	3,530	4,020	190	210