Transport and community on the southeastern shore of lake Rotoiti

May 2021

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Introduction

A few weeks ago my daughter and I were driving from Gisborne Point (Komuhumuhu) to Hinehopu when we came across a crash – a truck had hit a car. The driver of the car was deceased. The driver of the truck was distraught. He had set cruise control to 80, the speed limit, and did not have enough time to stop when the car pulled out in front of him from a side road.

This crash reminds me of a similar tragedy on the lake Rotoma road a few years ago. A young girl (daughter of a friend of a friend of the author) was killed crossing the road by a motorbike following behind a truck (Akuhata, 2014). Police apparently attributed the death to ‘human error’ (*Three Fatal Crashes “Human Error” - Police - NZ Herald*, 2014).

Recently the Lake Rotoiti Community Association presented a submission to Rotorua Lakes Council and Waka Kotahi NZ Transport Agency on the speed limit of State Highway 30 (SH30) along the southeastern shore of lake Rotoiti. The submission recommended reducing the speed limit for the section of road between MooseLodge and Hongi’s Track to 60kph in order to ‘mitigate the significant dangers faced by road users of this area’ (Lake Rotoiti Community Association, 2021).

The aim of the present paper is to support the Lake Rotoiti Community Association’s submission with data and to contribute to the argument. The purpose is to analyse some of the human and environmental effects of State Highway 30 along the southeastern shore of lake Rotoiti.

Figure 1. Komuhumuhu Pā at Gisborne Point, on the southern shores of Lake Rotoiti. Oil on canvas by Charles Bloomfield, 1901.[1]

Methods

The report draws on open data, local knowledge, the published literature and a recent assessment of the cultural impacts of the East Rotoiti/Rotoma Sewerage Scheme (*Website*, n.d.).

Traffic volumes

The volume of traffic and the proportion of heavy vehicles for the years 2018 – 2021 was obtained from Waka Kotahi NZ Transport Agency State Highway Traffic Monitoring open source data (*State Highway Traffic Monitoring*, n.d.). The online system included data from 2018 – 2021 (17 May 2021). Data for the years 2000 – 2018 were obtained from Waka Kotahi traffic data booklets and state highway traffic volumes [https://www.nzta.govt.nz/resources/state-highway-traffic-volumes/].

The collection point was a telemetry site on SH30 Lake Rotoma (ID number 03000188, GPS 6342175 / 2825756). This site is on Lake Rotoma, about 8 km east of Lake Rotoiti. This was the closest site with data telemetry data available from the year 2000. Data completeness was high with 363 collection days in 2018.

[1] Blomfield, Charles, 1848-1926. Blomfield, Charles, 1846-1926 :Gisborne Point, Lake Rotoiti. 1901. Ref: G-556. Alexander Turnbull Library, Wellington, New Zealand. /records/33846005 https://natlib.govt.nz/records/33846005

To corroborate the accuracy of the data comparison was made was another (much less complete) dataset from a regional non-continuous collection point 500m East of Okahu Lane (ID number 03000160) which is about 7 km west of Lake Rotoiti. Data from this site were available from 2018. Data completeness was low with 28 collection days in 2018.

Crash data

Road traffic crash statistics were obtained from the New Zealand Crash Analysis System (CAS). CAS data were available from the 1999/2000 year to the 2019/2020 year. Google Maps was used to find the coordinates of the Rotoiti road for correlating with CAS data.
Coordinate boundaries were as follows:
Northeastern coordinate: 38°01'50.2"S 176°29'46.0"E
Southwestern coordinate: 38°03'34.0"S 176°25'28.2"E
Google maps uses the World Geodetic System (WGS) 1984 geographic coordinate system (datum) WGS84 (G1762). CAS uses the New Zealand Transverse Mercator (NZTM) system. The online converter provided by Toitu Te Whenua Land Information New Zealand was used to convert WGS to NZTM coordinates (Online Conversions | Toitū Te Whenua Land Information New Zealand LINZ coordinate converter).

Dwellings

Counts of houses and Marae along the road were obtained from Google Maps starting SH30 near Moose Lodge in the west (38°02'52.7"S 176°24'34.2"E) and running to the eastern end of Hongi’s track (38°02'07.9"S 176°30'33.6"E).

Results

Traffic volume analysis

Traffic volumes increased from 2000 – 2021 (Figure 2). The average number of vehicles driving along the road each day ranged from 2696 in the year 2000 to 3719 so far this year. Heavy traffic volumes also progressively increased over the last 20 year period. The average number of heavy vehicles driving along the road each day ranged from 269 in 2001 to 406 in 2017.

The proportion of heavy traffic to total traffic remained relatively steady ranging from 9.7% to 12.2% with an average of 11.1%. Throughout the country the proportion of heavy vehicles was <10% in 66% of monitoring sites, thus local traffic was in the upper one third of heavy vehicle use.

By time of day, traffic volumes start to increase at 5 a.m. and drop off after 7 p.m. Heavy traffic traffic volumes peak and remain fairly constant between 8 a.m and 5 p.m. (which includes school drop-off and pick-up hours) at about one truck every 2 minutes (Figure 3).

Figure 2. Daily average traffic count by year for heavy and light vehicles.

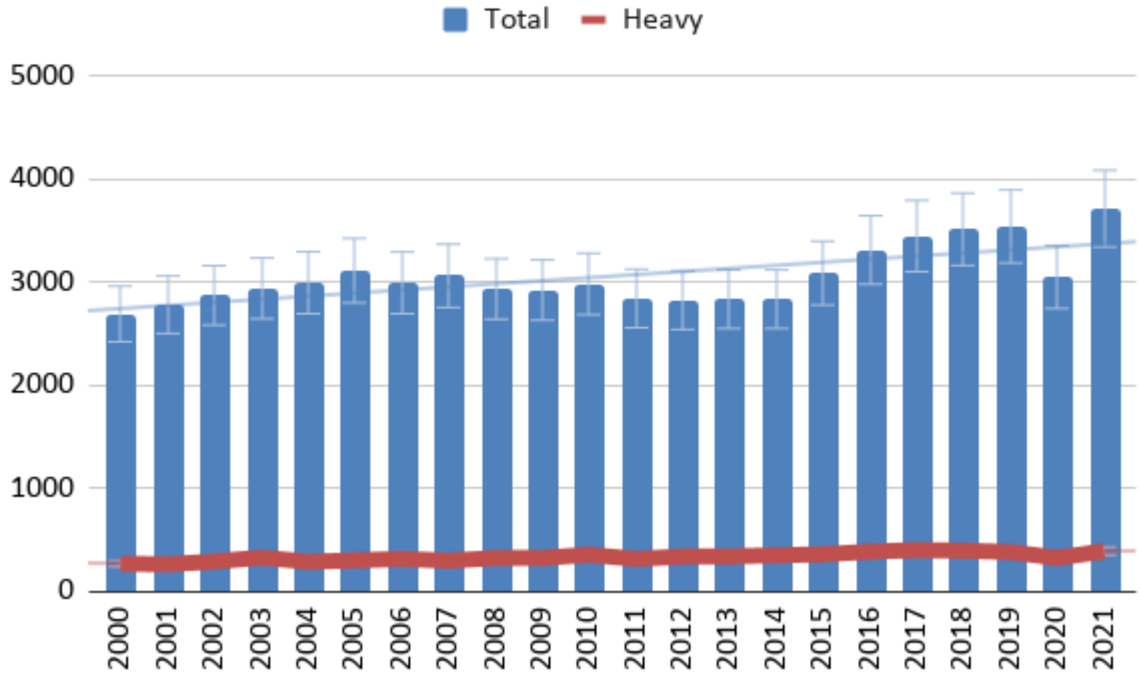
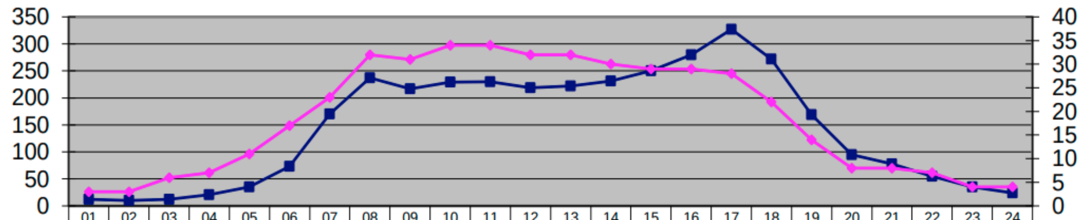


Figure 3. Average weekday hourly traffic. All traffic in blue (scale on the left). Heavy traffic in pink (scale on the right). From the NZTA 2018 National Telemetry Site Traffic Profile report, page 22.[2]



	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Hourly All	12	10	12	21	35	73	170	237	217	229	230	219	222	231	250	280	327	272	169	95	78	55	35	24
Hourly Heavy	3	3	6	7	11	17	23	32	31	34	34	32	32	30	29	29	28	22	14	8	8	7	4	4

Traffic volumes as measured at the Okahu Lane site west of Lake Rotoiti (i.e., on the road between Rotoiti and Rotorua) were higher than at the Lake Rotoma site (Table 2).

2 https://www.nzta.govt.nz/assets/resources/state-highway-traffic-volumes/docs/2009-2018-national-telemetry-site-profiles.pdf

Table 1. Numerical data on daily average traffic count by year for heavy and light vehicles from the Lake Rotoma monitoring site.

Year	Total	Heavy	% heavy
2000	2696	273	10.1
2001	2786	269	9.7
2002	2877	295	10.3
2003	2945	334	11.3
2004	3000	293	9.8
2005	3117	306	9.8
2006	2999	321	10.7
2007	3067	303	9.9
2008	2940	329	11.2
2009	2928	330	11.3
2010	2987	361	12.1
2011	2847	320	11.2
2012	2828	344	12.2
2013	2840	345	12.1
2014	2839	356	12.5
2015	3094	365	11.8
2016	3318	391	11.8
2017	3452	406	11.8
2018	3518	400	11.4
2019	3546	387	10.9
2020	3057	330	10.8
2021	3719	396	10.6

Table 2. Numerical data on daily average traffic count by year for heavy and light vehicles from the Okahu Lane site.

Year	Total	Heavy	% heavy
2018	4688	449	9.6
2019	5212	581	11.2
2020	4680	426	9.1
2021	4963	558	11.2

Road traffic crash analysis

During the 20 year period there were 92 vehicle crashes in the area (Figure 4) of which nine resulted in serious injury (Figure 5) and another one was fatal (Figure 6). Note that the dataset did not include the fatality that occurred earlier this year.

Figure 4. Crash spots (blue and white dots) from the CAS data map.

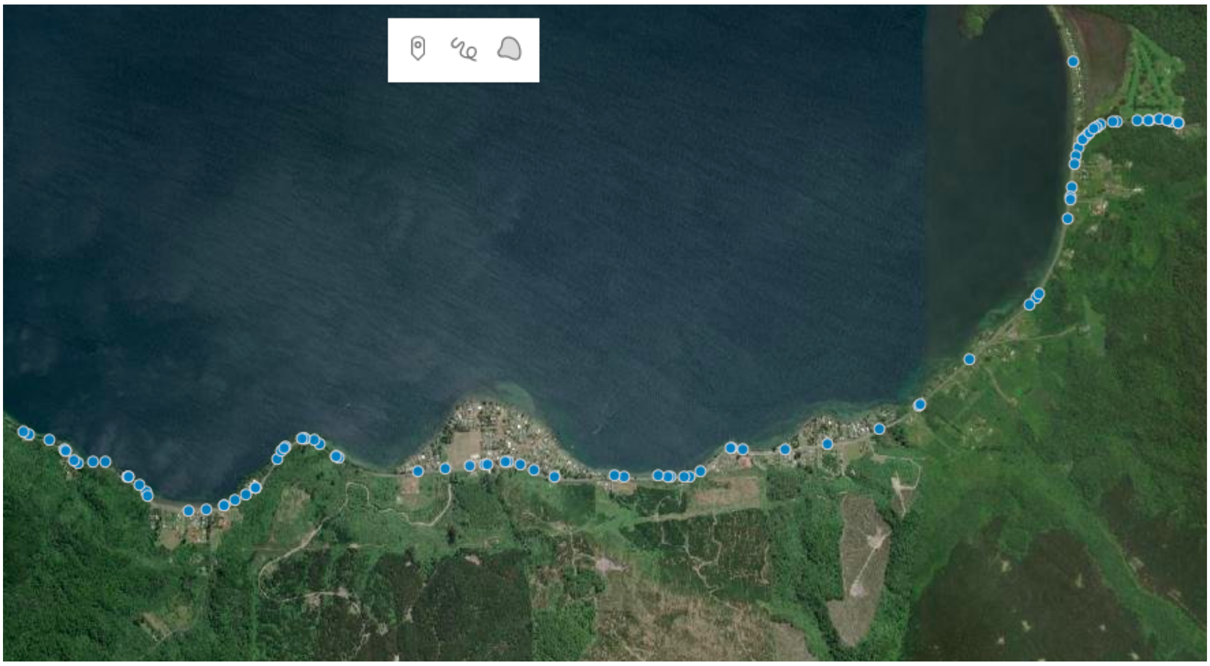
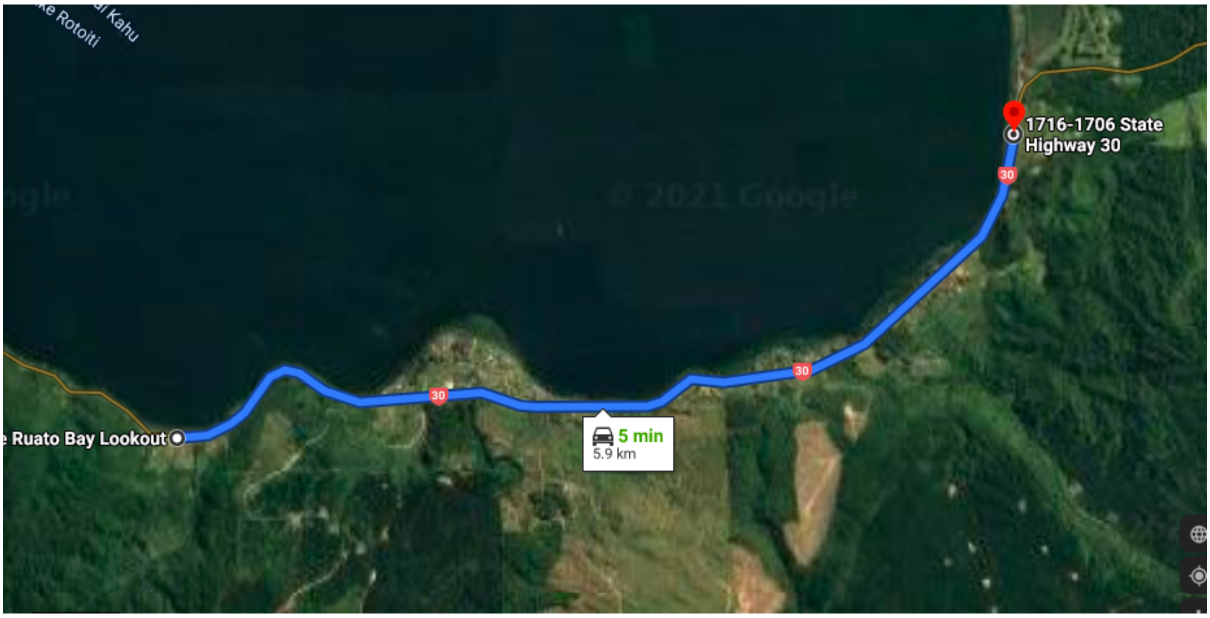


Figure 5. Serious crashes (white and black dots). Note the western-most serious crash site was also a fatal crash (see Figure 6).

Figure 6. Fatal crashes (white and black dots). Note one at each end of the blue line. The fatal crash at the eastern end was witnessed in 2021, not in the CAS dataset.



Community residences

The estimated number of homes and other community houses was 369 (Table 3). This included five Marae, the school (Figure 7), the store, the golf club and the rugby club. The driveways of many of these houses open directly onto SH30 while others come off streets that open onto the highway. These streets include:

1. Te Urumahue Road
2. Wharetoroa Drive
3. Aoturoa Avenue
4. Emery Road
5. Tamateatutahi Street
6. Kawiti Street
7. Tautara Road
8. Te Puakanga Road
9. Tamatea Street

The Marae, from west to east, are:

1. Ruato Marae
2. Punawhakareia Marae
3. Taurua Marae
4. Te Waiiti Marae
5. Tapuaeharuru Marae

Table 3. Number of houses from Hauparu Bay to Tapuaeharuru Bay, estimated from Google Maps.

Location	**Number**	**Notes**
Hauparu Bay	30	
Western Okataina Walkway	4	
Ruato Bay	30	Includes Ruato Marae
Punawhakareia Bay + Te Urumahue Road	35	Includes Punawhakareia Marae and the rugby club
Komuhumuhu – Gisborne Point, north of SH30	110	
South of SH30 at Gisborne Point	9	
Tāwhatarere Bay	122	Includes Taurua Marae, Te Waiiti Marae, Emery Store, Te Kura Kaupapa Māori o Te Rotoiti school, and Emery Road
Tapuaeharuru Bay	53	Includes Tapuaeharuru Marae, the golf club and NZ Log Cabins

Figure 7. Google street view of Te Kura Kaupapa Māori o Te Rotoiti school.

Discussion

Over the past century a dramatic change has occurred in the path along the southeastern shore of Lake Rotoiti. A track linking villages has morphed into a busy highway carrying trucks and cars at speed through the middle. There is a growing dichotomy between the road acting to connect people and the road acting to fragment the community. Trucks rumble past homes, the school, the store, meeting places and cultural heritage sites. Traffic passes within metres of pedestrians and cyclists on a walkway with no hard separation from the road. Running along the lakeside and through the community, the road acts as a fragmenter of the natural and human habitat.

The Lake Rotoiti Community Association's proposal to lower the speed limit is a simple first step to help what is really a systemic problem of transport in Aotearoa. Road traffic contributes to air pollution, climate change, roadside soil and water contamination, fragmentmentation of communities, human death and disability from road trauma, deteriorates public health by impeding active transport and public transport, and is environmentally uneconomic.

Figure 8. Hinehopu Watercolour by Thomas Ryan, circa 1918. [3]

[3] Thomas Ryan, Public domain, via Wikimedia Commons, https://commons.wikimedia.org/wiki/File:Thomas_Ryan_-_Hinehopu,_Lake_Rotoiti.jpg

Speed is a major determinant of road safety

Travel speeds are an important factor in road traffic crashes. A chart published by the Global Road Safety Partnership shows that the stopping distance when travelling at 80 km/hr is 20 metres (> 50%) more than when travelling at 60 km/hr (Figure 10).

As speeds increase the chance of a crash increases linearly while the chance of a fatal crash increases exponentially (Figure 11). This is dramatically demonstrated in the case of motor vehicle versus pedestrian injuries. When the impact speed is below about 25km/hr the risk of death is 5 — 10% but as the impact speed increases beyond 30 km/hr the risk of death increases exponentially (Figure 12). The exponential relationship between speed and fatality also holds for cyclists and cars (Figure 13). In the fatal collision earlier this year a truck ran into the side of the car. Figure 13 shows that the change of death in side impacts is greater than in head on collisions.

New Zealand is sometimes referred to as a leader in the Safe Systems approach in which the responsibility for road safety shifts from the people using roads to the people designing them. In the case of Lake Rotoiti, increasing volumes of traffic passing through a community at an unsafe speed can hardly be considered a safe system. Te Ara ki te Ora Road to Zero Strategic Plan states, ‘our vision is a New Zealand where no one is killed or seriously injured in road crashes’ [https://www.transport.govt.nz/area-of-interest/safety/road-to-zero/]. Too often, however, these plans involve rhetoric with little substance, a top down approach with inadequate leadership and little community empowerment. It is interesting that in Sweden, where Vision Zero originated, the Swedish Traffic Safety Council for Active and Sustainable Mobility is now calling for ‘a new goal for traffic and health that looks beyond Vision Zero. A new goal should lead to traffic that saves lives and improves quality of life in addition to reducing traffic fatalities and injuries by promoting active mobility in the form of cycling and walking [https://movingbeyondzero.com/moving-beyond-vision-zero/].

Figure 10. From WHO Global Road Safety Partnership doc page 7 .

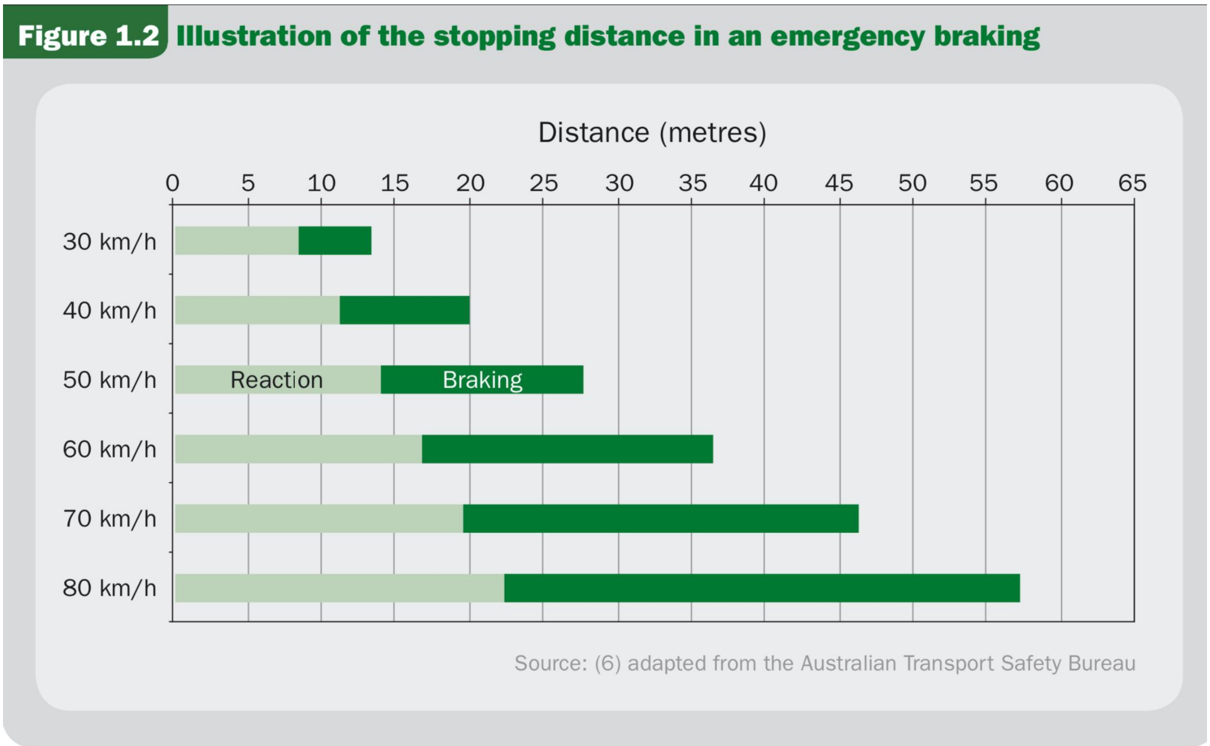


Figure 11. From WHO page 9.

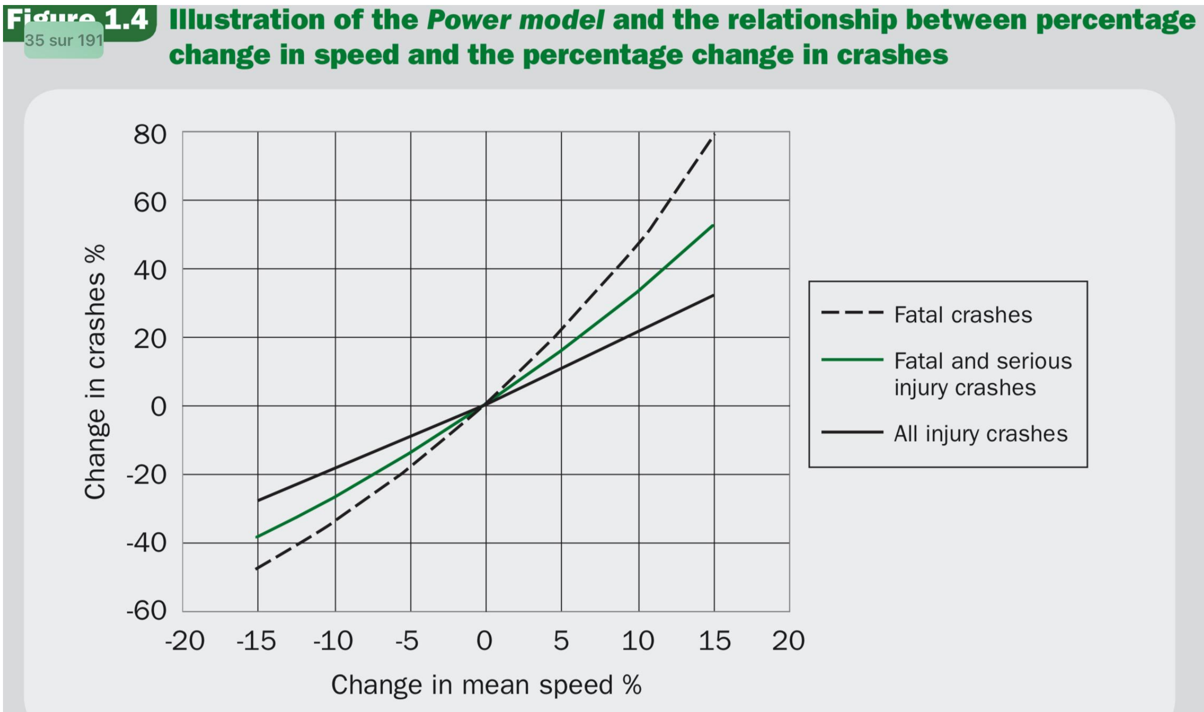


Figure 12. From WHO page 5.

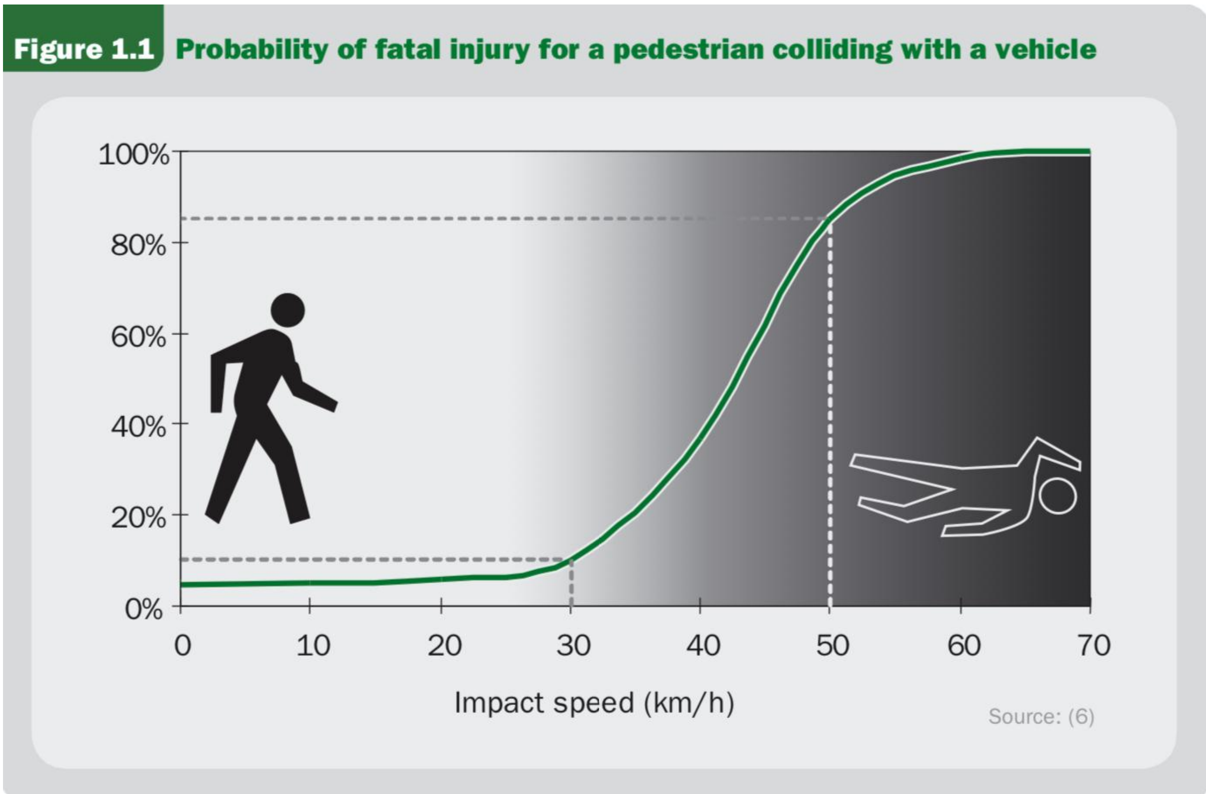
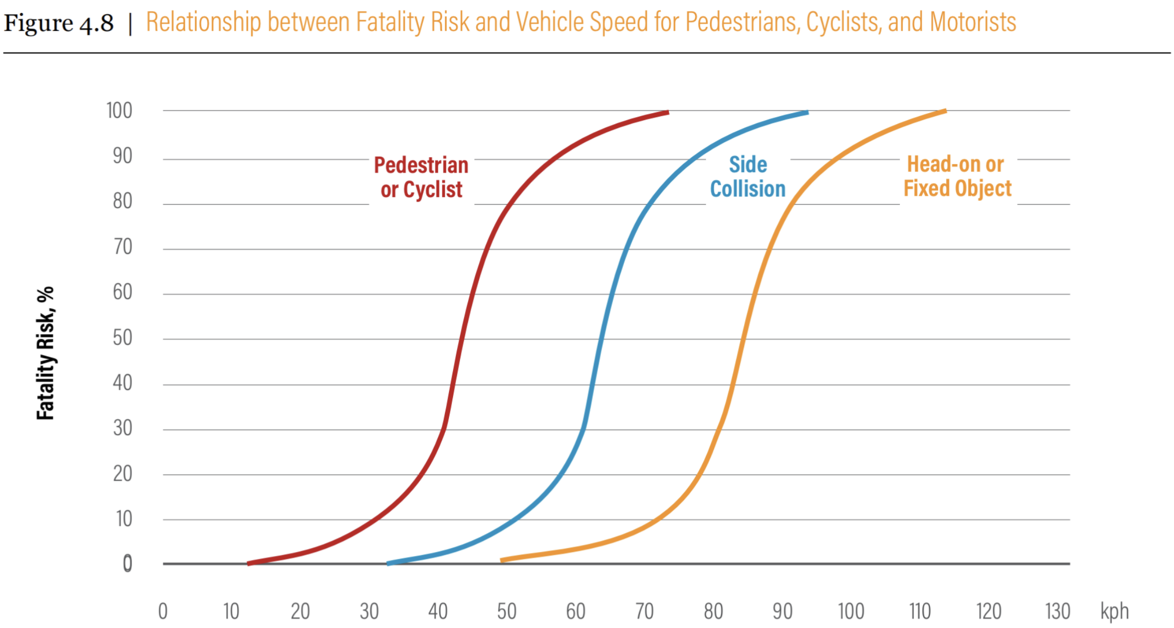


Figure 13. Speed versus injury. Safe system doc page 45.



Children in policy

Key to the communities of tomorrow are the children of today. Children in all Policies (CAP-2030) is a global movement that aims to 'put the health and wellbeing of children and adolescents at the centre of national and global efforts to achieve sustainable development' (https://cap-2030.org/the-science/). CAP-2030 uses science, advocacy and coalitions to make the world healthier, safer and more equitable for children (https://cap-2030.org/what-we-do/). It is based on a Lancet report authored by Helen Clark and others, entitled: 'A future for the world's children? A WHO–UNICEF–Lancet Commission' (Clark et al., 2020). This shows that children's safety and future must be central in road transport decisions too.

The Lake Rotoiti road has been used by school children for at least 150 years. In 1871 a school was built on the north-eastern end of Lake Rotoiti for the local children. In 1904 the school was moved to its current location at the boundary of Te Tautara and the original Haroharo block and in 1996 changed its name from Rotoiti School to Te Kura Kaupapa Māori o Te Rotoiti (Te Rangiunuora Ngāti Rongomai Ngāti Tarawhai and Ngāti Mākino, 2016). This shows that children have been using the path along the southeastern shore of the lake for more than 150 years. Unfortunately the road today is far too dangerous to allow children to walk or bike leaving car and bus as the only alternatives to them.

Another critical dimension of our children's future is climate change. Transport is a major contributor to greenhouse gas emissions and air pollution. Elimination of internal combustion engines with a transition to electric with or without hydrogen vehicles will help reduce emissions but will take some time. Reducing speed limits would have an immediate effect in reducing emissions while the transition takes place.

Active and public transport

Children commonly travel by walking and cycling when circumstances allow. Active transport by walking and cycling benefits all ages and the environment (Fishman et al., 2015; Patterson et al., 2020). In a study in the UK, Celis-Morales et al. showed that 'cycle commuting was associated with a lower risk of CVD, cancer, and all cause mortality' (Celis-Morales et al., 2017; Dinu et al., 2019a). Other studies from China (Fan et al., 2019) and Sweden (Eriksson et al., 2020) have shown similar results. One meta-analysis showed that active transport was associated with a lower rate of cardiovascular disease and death; cycling itself was associated with a 25% reduction in cancer mortality and a 24% reduction in all cause mortality (Dinu et al., 2019b). Another meta-analysis concluded that 'active commuting decreases mainly all-cause and cardiovascular mortality, with a dose–response relationship' (Dutheil et al., 2020). Therefore, communities need to have safe access to cycle lanes and footpaths free from the fear of being run over by cars and trucks.

Investment in road infrastructure undermines active and public transport by making car use more attractive, leading to more cars, leading to more congestion, and pressure to build yet more roads in a reinforcing loop (A. Macmillan & Mackie, 2016). A much better approach for our children and their future is to invest in active and public transport while disincentivizing car use.

Environmental economics

In a world facing the triple threat of environmental degradation, social inequalities and pandemics, environmental accounting is essential. The economics of transport must include social and environmental as well as financial elements – the triple bottom line.

Social considerations include health, safety, recreation and connectedness. Health considerations include the adverse health effects of road noise, access to walking, running and cycling in a peaceful environment free from fear of being run over, and air quality. Safety has been discussed above. Connectedness of the local community involves the ability to use the road for active transport, public transport or motor vehicle safely. Other social considerations include the considerable cultural capital in the region as outlined in a recent report on the area (*AN ASSESSMENT OF CULTURAL IMPACTS REGARDING THE PROPOSED EAST ROTOITI/ROTOMA SEWERAGE SCHEME*, n.d., *An Assessment of Cultural Impacts Regarding the Proposed East Rotoiti/Rotoma Sewerage Scheme*, n.d.).

Lake Rotoiti represents a key element in the environmental dimension. Roadside soils can be contaminated with heavy metals including cadmium, copper, lead, nickel and zinc. Recent evidence shows that these enter the food chain (De Silva et al., 2021; *The Value of a Hapu Perspective to Municipal Water Management Practice: Mauri and Its Potential Contribution to Sustainability Decision Making in Aotearoa New Zealand*, n.d.). If Aotearoa New Zealand transitions out of internal combustion engines contamination will continue to arise from brake wear, tyre wear and road wear. A long-term view would suggest that even if runoff of these pollutants into the lake environment is low, over time pollution will build up and the environment will suffer. Other environmental considerations include the effect of road runoff on the waters of the Waiiti stream, the effect of traffic on local flora and fauna, air pollution and contributions to greenhouse gas emissions.

Economic considerations include commuter times, heavy road transport times, and economic costs from energy use, brake and tyre wear from accelerating, decelerating and turning corners at speed. Environmentally friendly solutions can be financially advantageous. With regard to cycling, Macmillan showed that ‘the public health costs and benefits are dominated by the cost of injuries and the all-cause mortality benefits of cycling physical activity. Compared with these, infrastructure costs and other benefits are small. Overall savings range from the hundreds of millions of NZ dollars (RCN) to the tens of billions of NZ dollars’ (Alexandra Macmillan, 2012).

Decision making is highly influenced by the ‘mental model’, ‘frame of mind’, or ‘world view’ of the decision makers. The Mauri Decision Making Framework developed by Dr Kepa Morgan is a tool for taking into account different world views by analysing four dimensions: environmental, cultural, social, and economic (*The Value of a Hapu Perspective to Municipal Water Management Practice: Mauri and Its Potential Contribution to Sustainability Decision Making in Aotearoa New Zealand*, n.d.).

Strengths and limitations of this study

This paper adds some data to support the proposal to reduce the speed limit. The data is limited in several ways. Counts of houses were only estimates based on the aerial view provided by Google Maps. Crash analysis data may not be complete and did not include the recent crashes (one fatal) on the road. Traffic volume data were only available from 2018 precluding a meaningful trend analysis. Data were collected only on certain days of the year increasing statistical variance. Although anecdotally traffic on the road makes a lot of noise and when large trucks go past the roadside houses shake like in a small earthquake, no open source data were available on road noise and vibration.

Conclusions

Figure 9. Cars on Whakatane Road, Lake Rotoiti, Rotorua District, 2 Jan 1956 [National Library NZ].

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