

Case Study: Tauranga, New Zealand

The New Zealand trial assessment was performed in three suburbs of Tauranga City, a medium sized city of approximately 100,000 residents but with one of the fastest population growth rates in the country. Three areas (Greerton, Merivale and Gate Pa) were selected for the study with a combined estimated population of 11,250 residents, according to 2001 census data (CENSUS, 2006). The three areas are adjacent to each other and are located south of Tauranga City Centre as shown in *Figure 1*.

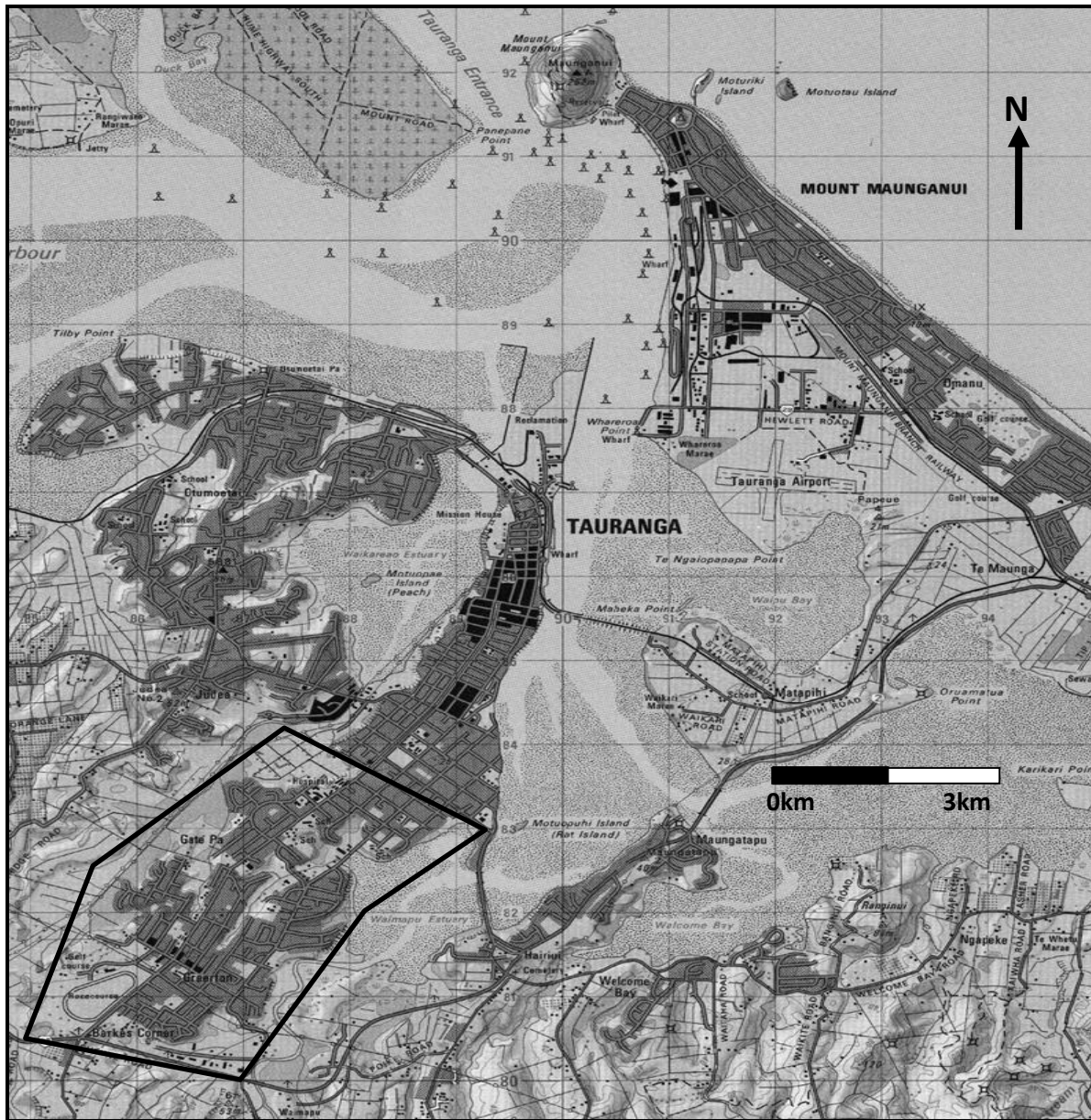


Figure 1: Tauranga City Map with Study Areas Outlined

There are three bus routes that serve the study areas and various parks, schools, supermarkets, and workplaces available to the residents.

From observation of the paths and roads within and surrounding the study areas, it was determined that walking was safe but only limited cycling was safe as shown in *Table 1*. Cyclists and pedestrians were observed accessing their activities during the assessment.

Table 1: Roads unsafe for cycling

Index	Roadname	Unsafe Reason
1	Matthew St	Narrow with parking on both sides of the road
2	Seventeenth Ave	Narrow with parking on both sides
3	Seventeenth Ave	Parking on both Sides
4	Seventeenth Ave	Parking on both sides
5	Nineteenth Ave	Narrow with parking on both sides
7	Brook St	Industrial, Very busy
8	Page St	Industrial
9	Courtney Rd, Twenty-second	Narrow, Industrial, Very Busy
10	Chadwick Rd	Industrial
11	Alach St, Sherson St	Industrial
12	Chadwick Rd	Narrow and very busy
13	Maleme St	Industrial, very busy
14	SH 29	Very busy SH
15	Chadwick Rd, Oropi Rd	Very narrow and busy

The 2001 census data used for this report shows that 12% of the adult (18 to 65 years old) Tauranga population are students and 10% are unemployed. Employment is found to be distributed throughout the study areas, with major employers being the hospital and some industrial work sites. These locations provide over 2000 jobs. Following the TES method (original version), workers travel to the closest

available work sites. Because there is enough employment inside the study areas, no-one is required to travel outside the study areas for work.

A visual and aerial inspection of the location of residences within the study areas was performed. It was assumed all residents were evenly distributed amongst the available housing in the study areas. Cars were distributed to houses that could not feasibly walk, cycle or use the bus for all required activities. For the study areas, (375 cars/1000 people) there were enough cars to allow all residents requiring a car to use this mode (CENSUS, 2006). The housing and activity locations were then plotted onto a map to allow trip distances to be calculated using the available modes according to the TES method. The following energy consumption data (KENWORTHY, 2003), (EECA, 1999) were used for the available modes:

- | | | |
|----|----------------|------------------------------|
| 1. | Walk and Cycle | 0MJ/km |
| 2. | Bus | 1.66MJ/pkm or 4.5LDE/p.100km |
| 3. | Car | 3.3MJ/km or 9.65Litres/100km |

Note: LDE = Liters of diesel equivalent - combined diesel and liquid petroleum gas (LPG)

Energy calculations were performed for all residents following the TES method. The results of these calculations over the combined three study areas are presented in *Table 2* and *Table 3*. The individual area's results are presented later in this section.

Table 2: Trip data for walking and cycling separated into “common activities”

Age Group	No.	Main Activity (5x/week) - School/University/Work			
		Walk		Cycle	
		Trips	Dist.	Trips	Dist.
0 to 2	520	0		0	
3 to 5	560	31	151	0	
6 to 10	880	196	257	0	
11 to 17	1190	89	108	221	741
18 to 64	4340	1276	250	1528	750
- students	1350	0	0	0	0
- unemployed	650				
65 and over	1760				
Total	11250	1592	241	1749	749
Food Shopping (2x/week)					
		Walk		Cycle	
		Trips	Dist.	Trips	Dist.
0 to 17	3150				
18 to 64	6340	602	232	1961	582
65 and over	1760	166	232		
Total	11250	768	232	1961	582
Recreation (1x/week)					
		Walk		Cycle	
		Trips	Dist.	Trips	Dist.
0 to 10	1960	312	236	0	
11 to 17	1190	187	236	289	545
18 to 64 ^b	6340	668	236	1481	545
65 and over	1760	278	236	0	
Total	11250	1445	236	1770	545
Weekly Totals					
		Walk (16.4%)		Cycle (21.6%)	
		Trips	Dist.	Trips	Dist.
Trips/Week	66737	10941	239	14437	678

^a “Dist.” = Average one way distance (m) to activity

Table 3: Energy and trip data for bus and car modes

Age Group	No.	Main Activity (5x/week) - School/University/Work							
		Bus (1.66MJ/pkm)				Car (3.3MJ/km)			
		Trips	Dist.	Energy	LDE	Trips	Dist.	Energy	Petrol
0 to 2	520								
3 to 5	560	247	2042	8477	230	279	1603	15123	442
6 to 10	880	268	1427	7469	202	416	890	12638	370
11 to 17	1190	393	2287	14700	398	487	1728	29940	876
18 to 64	4340	483	1500	12027	326	983	2000	64878	1897
- students	1350	633	4104	44549	1208	712	4104	94486	2763
- unemployed	650								
65 and over	1760								
Total	11250	2024	2524	87222	2364	2877	2276	217065	6348
		Food Shopping (2x/week)							
		Bus (1.66MJ/pkm)				Car (3.3MJ/km)			
		Trips	Dist.	Energy	LDE	Trips	Dist.	Energy	Petrol
0 to 17	3150								
18 to 64	6340	1389	2354	21489	1456	2373	1182	37625	1100
65 and over	1760	643	2354	9855	668	946	1127	14348	420
Total	11250	2032	2354	31344	2124	3319	1166	51973	1520
		Recreation (1x/week)							
		Bus (1.66MJ/pkm)				Car (3.3MJ/km)			
		Trips	Dist.	Energy	LDE	Trips	Dist.	Energy	Petrol
0 to 10	1960	822	1408	7956	539	826	1231	7171	210
11 to 17	1190	343	1500	3903	265	371	1164	3508	103
18 to 64 ^b	6340	1113	1411	12533	849	1200	1164	11336	331
65 and over	1760	733	1408	7148	484	744	1231	6436	188
Total	11250	3011	1420	31541	2138	3141	1198	28451	832
		Weekly Totals							
		Bus (25.8%)				Car (36.2%)			
		Trips	Dist.	Energy	LDE	Trips	Dist.	Energy	Petrol
Trips/Week	66737	17195	2290	150106	6626	24164	1831	297490	8699

a "Dist." = Average one way distance (m) to activity

b In the case of children traveling by car, parents accompany them using zero energy.

c "Energy" units = MJ/Week; "Petrol" units = Litres/week of petroleum, "LDE" units = Litres/week of diesel equivalent.

According to the TES shown in *Table 2*, 38% of trips can comfortably be performed by active transport (cycling or walking). This relatively low possibility for cycling and walking results in an overall moderate to high transport energy requirement. Of the motorised transport, in *Table 3*, which makes up 62% of all trips, about 42% of this share (26% of all trips) could be completed by bus following the mode rules in the TES. Several factors contribute to achieving this level of hypothetical TES mode share, such as bus

routes connecting the study areas to recreation reserves, schools and supermarkets; however the TES mode share could be increased if there were bus stops within 200 meters of most residents and common activities.

The summarised Transport Energy Specification for the study areas is presented in *Table 4*, which shows that an average of 39.79MJ/Person/Week of transport energy is required for urban and transport system functionality. This is equivalent to the energy required to power a 2kW electric heater for about five hours.

Table 4: The overall TES of the combined study areas

Transport Energy Specification Summary					
Car		Bus		Total	
MJ/Trip	12.3	MJ/Trip	8.73	MJ/Week	44759
L/Trip	0.36	LDE/Trip	0.39	%Energy Petrol	66%
MJ/Person/Week	26.4	MJ/Person/Week	13.3	%Energy Diesel	20%
L/Person/Week	0.77	LDE/Person/Week	0.59	%Energy LPG	13%
Cars/1000 people	375			MJ/Trip	6.71
Area					
Área (hectares)	772	hectares		MJ/Person/Wee	39.79
Density (ppl/hect)	14.5	ppl/hect			

The TES specifies that moderate to high transport energy is required for the urban layout of the study areas. Low population density (14.6 people per hectare), some unsafe cycle roads and the locations and number of supermarkets, schools and kindergartens contribute to this moderate to high energy requirement.

The TES summaries for the individual Tauranga study areas are given in the following subsections.

Greerton

Greerton has the lowest population density of the three study areas; however it also has the lowest minimum energy requirement. This infers that low population density is not the only important factor contributing to high transport energy. Greerton has activities within walking or cycling distance of many residents and is also well serviced by bus routes that connect residents to their activities. In spite of this, the energy requirement is still high. The TES for Greerton is presented below in *Table 5*.

Table 5: TES of Greerton

Transport Energy Specification Summary					
Car		Bus		Total	
MJ/Trip	11.58	MJ/Trip	7.06	MJ/Week	154667
L/Trip	0.34	LDE/Trip	0.32	%Energy Petrol	71%
MJ/Person/Week	26.22	MJ/Person/Week	10.77	%Energy Diesel	17%
L/Person/Week	0.77	LDE/Person/Week	0.49	%Energy LPG	12%
Cars/1000 people	375			MJ/Trip	6.23
Area					
Área (hectares)	336			MJ/Person/Week	36.99
Density (ppl/hect)	12.44				

Merivale

Merivale has the highest population density but performed the worst of the three study areas, partly due to no kindergartens in the area. The TES for Merivale is presented below in *Table 6*.

Table 6: TES of Merivale

Transport Energy Specification Summary					
Car		Bus		Total	
MJ/Trip	12.59	MJ/Trip	5.49	MJ/Week	86567
L/Trip	0.37	LDE/Trip	0.21	%Energy Petrol	80%
MJ/Person/Week	34.49	MJ/Person/Week	8.69	%Energy Diesel	12%
L/Person/Week	1.01	LDE/Person/Week	0.33	%Energy LPG	8%
Cars/1000 people	375			MJ/Trip	7.29
Area					
Área (hectares)	100			MJ/Person/Week	43.18
Density (ppl/hect)	20.05				

Gate Pa

Gate Pa performs in the middle of the three study areas and one of the reasons is due to bus routes not having bus stops within 200m of a supermarket. The TES for Gate Pa is presented below in *Table 7*.

Table 7: TES of Gate Pa

Transport Energy Specification Summary					
Car		Bus		Total	
MJ/Trip ^a	12.90	MJ/Trip ^a	11.47	MJ/Week	206363
L/Trip	0.38	LDE/Trip	0.51	%Energy Petrol	58%
MJ/Person/Week	23.44	MJ/Person/Week	17.31	%Energy Diesel	25%
L/Person/Week	0.69	LDE/Person/Week	0.78	%Energy LPG	17%
Cars/1000 people	375			MJ/Trip ^b	6.88
Area					
Área (hectares)	336			MJ/Person/Week	40.75
Density (ppl/hect)	15.07				