
Attachment C: Contributions Supporting Analysis - Transport Unit of Demand Factors

1. Introduction

1. This document provides additional background information on the calculation of unit of demand factors for transport for non-residential development.
2. Transport planning recognises the relationship between travel behaviour and the physical, social and economic state of the urban environment. A key factor in forecasting future travel demands is trip generation.
3. Trip generation uses information on land use types, population demographics and economic conditions to determine the likely travel demand.¹
4. The document sets out:
 - how trip generation data for different kinds of activity is used to establish relative demand on the need to invest in transport infrastructure
 - presents some of the key trip generation statistics used
 - reports unit of demand factors for other councils.

2. Background

Existing Unit of Demand Factors

5. Council approved the use of legacy council unit of demand factors and supporting information to be included in the Contributions Policy 2012.
6. It was noted in the committee report that the unit of demand factors for non-residential were conservative and a review of all unit of demand factors and development types should be undertaken over time to ensure the factors are appropriate.
7. Variations were made when developing the Contribution Policy 2015 regarding residential development, based on type and size of dwellings.

Trip generation as the distribution mechanism

8. Trip generation is a key factor in determining how a development will affect the transport network. All trips have a beginning and end point and there are several factors that can differentiate the total and type of trip generated by a development type. For example, the number of end trips are sometimes a function of:

Home end

- Housing Unit type
- Household Size
- Age
- Income
- Accessibility
- Vehicle Ownership

¹ <http://onlinepubs.trb.org/Onlinepubs/hrr/1969/297/297-002.pdf>

Work end

- Type of Job
- Area of Workspace
- Occupancy Rate
- Other Job-Related Elements

Shopping end

- Number of Retail Workers
- Type of Retail Available
- Area of Retail Available
- Location
- Competition

9. Knowing that each individual development can be unique in the demand they place on infrastructure trip generation is still the main source of data used in transport planning and therefore an appropriate mechanism for sharing demand across the network by development types.

3. Calculating transport unit of demand factors

10. Transport demand factors are calculated using data on the daily volume of trips generated from each development type. Development types generating more trips are assumed to place more demand on the need to invest in transport infrastructure.
11. Research is available in New Zealand and overseas for a range of trip generations by different land use types. Information available for the New Zealand environment which is still relatively current has been given a higher weighting than the overseas data.
- RTA Guide to Traffic Generation V2.2 Oct 2002²
 - NZ Transport Agency Research Report 453 Nov 2011³
 - Trip Generation rates for assessment of development proposals (Parsons Brinckerhoff) Jan 2014⁴
 - RTA Guide to Traffic Generation Updated TDT 2013/04⁵
 - ITE Trip Generation Manual 9th Edition.⁶
12. Some trip generation data identifies the types of trip that is being undertaken:
- primary trips or non-pass by trips are a single direct trip from one location to another;
 - secondary/tertiary trips or pass by trips which have multiple stops on the same journey, including stopping at a location only because it is on the same route as your destination
13. When determining the level of demand a development type places on the network adjustments are made to raw trip generation data for non-residential development types for the following reasons:
- weighting to reflect that residential development is the population driver

² <https://www.rms.nsw.gov.au/business-industry/partners-suppliers/documents/guides-manuals/guide-to-generating-traffic-developments.pdf>

³ <http://www.nzta.govt.nz/assets/resources/research/reports/453/docs/453.pdf>

⁴ https://www.dpti.sa.gov.au/__data/assets/pdf_file/0011/322004/11542728-v1-DPTI_-_Trip_Generation_Rates_-_2014.pdf

⁵ <https://www.rms.nsw.gov.au/trafficinformation/downloads/td13-04a.pdf>

⁶ <https://www.ite.org/technical-resources/topics/trip-and-parking-generation/>

- type of trip being undertaken
 - transport scale economies.
14. The table provided in Attachment A shows raw trip generation data obtained from the research for a variety of activities organised into the development type groupings the council uses.

4. Development Types and Data Analysis

15. The demand on council services varies widely across different forms of non-residential activity. Non-residential developments, particularly Retail and Production/Distribution, can be used for a range of non-residential activity that have differing demands on infrastructure.
16. The nature of the activity undertaken within the different developments can vary over time. The council has therefore grouped non-residential development types into broad categories based on average demand.
17. Not all land use types are applicable to the Auckland environment or able to be used within the calculation methodology Auckland Council has established.
18. Some of the research only contains information from one location which is outside Auckland and does not show the same results as actual consent applications of the same or similar nature within Auckland; or the data has been deemed an outlier and removed from the overall average calculation.
19. The following sets out factors considered in determining the draft unit of demand factors to be included in the contributions policy 2019.

Residential

20. The average trip generation for residential dwellings set out below are consistent with the existing average trip generation for a standard dwelling⁷ of 10. No change to residential transport demand factors is proposed.

NZ Transport Agency Research Report 453 Nov 2011 (NZ)		
Land Use Type	Daily Vehicle Trips	Unit Factors
Dwelling (Outer Suburban)	8.2	Unit
Dwelling (Rural)	10.1	Unit
Dwelling (Suburban)	10.9	Unit
Average	9.73	

Retail

21. There is a large range of different types of retail land use. The type and volume of trips generated differ widely across retail types. and the types of trips and demand each place on the network are different. Not all the data is available or in a format consistent with other retail types within the NZTA report, for example restaurant traffic demand in the NZTA report is on a seat basis rather than floor size.

⁷ A standard dwelling is between 100m² and 249m².

	NZ Transport Agency Research Report 453 Nov 2011 (NZ)		Trip Generation rates for assessment of development proposals (Parsons Brinckerhoff) Jan 2014 (Australia)	
Land Use	Daily Vehicle Trips	Unit Factors	Daily Vehicle Trips	Unit Factors
Large Format Retail	45	100 m2 GFA	16.2	100 m2 GFA
Hardware Store			54.4	100 m2 GFA
Shopping Centre			55.7	100 m2 GFA
Restaurant	6.1	Seat	94.4	100 m2 GFA
Supermarket	129	100 m2 GFA	134.0	100 m2 GFA
Service Station	718	100 m2 GFA	189.4	Pump
Bar	92	100 m2 GFA		
Discount	100	100 m2 GFA		
Fast Food	362	100 m2 GFA		
Garden Centre	147	100 m2 GFA		
Gymnasiums	37.2	100 m2 GFA		
Markets	22	100 m2 GFA		
Produce	487	100 m2 GFA		
Shop	128.6	100 m2 GFA		
Shopping (CBD)	56	100 m2 GFA		
Shopping (Large - 10,000 m2 +)	84	100 m2 GFA		
Shopping (Medium - 4,000 - 10,000 m2)	101	100 m2 GFA		
Shopping (Small - 0-4,000 m2)	141	100 m2 GFA		

22. Markets, produce and service stations were excluded from the data used to generate an average as they are outliers whose inclusion could distort the outcome.

Production and Distribution

23. Research only provided two production and distribution land use types (Manufacturing and Warehouses).
24. The NZTA report showed a large outlier with the manufacturing land use. We investigated the report further and found that the data within the report was inconsistent.
25. In the trip generation table, the data stated 30 vehicle trips per 100m², yet in another section the data stated that average trip generation in New Zealand for manufacturing was between 1.0 to 1.5 vehicle trips per 100m².
26. Staff reviewed actual consent applications and traffic reports, including traffic studies for some production and distribution land uses. The data from this review showed that the trip generation was more in line with the RTA and New Zealand Warehouse factors rather than the manufacturing results.

27. As the data was inconsistent with all other research and the consent applications reviewed the choice not to use the manufacturing data and instead use the RTA trip generation and NZ Warehouse data was made.

	NZ Transport Agency Research Report 453 Nov 2011 (NZ)		Trip Generation rates for assessment of development proposals (Parsons Brinckerhoff) Jan 2014 (Australia)	
Land Use	Daily Vehicle Trips	Unit Factors	Daily Vehicle Trips	Unit Factors
Factories			3.2	100 m2 GFA
Manufacturing	30	100 m2 GFA		
Warehouses	2.4	100 m2 GFA	3.1	100 m2 GFA

Commercial

28. There was only one category for commercial land use types. This data was used in the unit of demand calculations.

	NZ Transport Agency Research Report 453 Nov 2011 (NZ)	
Land Use	Daily Vehicle Trips	Unit Factors
Commercial Office	26.1	100 m2 GFA

5. Vehicle trip weighting factors

29. Each of the trip generation types, non-pass by and other pass by places different demand on the need to invest in transport. Pass by trips to a location are not the principal drivers of demand for transport services but the secondary destination receives some of the benefit. Data is available in some of the research reports that shows the proportion of raw trips that are pass-by and which are non-pass by for land use.
30. The primary driver of the requirement to provide additional infrastructure, in particular transport infrastructure, is population growth. DCs are charged to development and the strongest connection to population growth is through residential development. Non-residential development creates demand on infrastructure and these developments benefit from regional and sub-regional transport investment. However, given the population growth driver the unit of demand factors for non-residential development are adjusted to reflect the residential origin of the trips. Therefore, a 50 percent reduction in primary trips is made to non-residential development types.
31. Pass-by trips are also weighted. The benefit of these trips is to at least three land uses e.g. home, shop and work. We don't have data on the number of stops made in each pass by trip so have conservatively assumed at least two and hence only attribute 25 per cent of the trip to that land use.
32. Non-residential development is generally much less dispersed than residential development and usually more closely aligned to public transport hubs. Economies of scale are made when providing transport infrastructure for non-residential development. Therefore, a further reduction of 33 percent is made to non-residential development types for efficient use of the network.
33. The formula combining the above calculations is set out below.

$$\begin{array}{l} \text{Total trips} \\ \text{non-residential} \\ \text{development type} \end{array} = ((\text{Primary trips} * 0.50) + (\text{Pass by trips} * 0.25)) * 0.67$$

6. Other council units of demand factors for non-residential transport

34. The tables below show the approach taken by other comparative councils to setting development contributions for the transport activity for non-residential (retail) developments.

Hamilton City Council

Commercial (non-retail)	2 HUEs per 100m ²
Industrial	0.9 HUEs per 100m ²
Commercial (retail) ≤ 1,000m ² GFA	3.5 HUEs per 100m ²
Commercial (retail) 1,001 to 3,000m ² GFA	3.5 to 2 HUEs per 100m ²
Commercial (retail) 3,001 to 6,000m ² GFA	2 to 1.5 HUEs per 100m ²
Commercial (retail) 6,001 to 10,000m ² GFA	1.5 to 1.2 HUEs per 100m ²
Commercial (retail) > 10,000m ² GFA	1.2 HUEs per 100m ²

Queenstown Council

Industrial	0.94 HUEs per 100m ²
Commercial	2.83 HUEs per 100m ²
Hospitality	2.13 HUEs per 100m ²

Wellington City Council

All non-residential	2.38 HUEs per 100m ²
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Christchurch City Council

Central City Business Zone	0.99 HUEs per 100m ²
Business 1 (Local Centre/District Centre Fringe) Zone	2.09 HUEs per 100m ²
Business 2/2P (District Centre core/Business parking) Zone	3.2 HUEs per 100m ²
Business RP (Retail Park) Zone	2.24 HUEs per 100m ²
Business (General industrial) Zone	0.42 HUEs per 100m ²

7. Proposal

35. No change to residential transport demand factors is proposed at this stage.

36. The following are the proposed transport unit of demand factors.

Development Type	Transport Unit of Demand Factor
Detached dwelling unit / duplex	0.8 HUE per unit at 0m ² - 99m ² GFA 1.0 HUE per unit at 100m ² – 249m ² GFA 1.2 HUE per unit at 250m ² and over GFA
Attached dwelling unit – low rise	0.7 HUE per unit at 0m ² - 99m ² GFA 0.9 HUE per unit at 100m ² – 249m ² GFA 1.1 HUE per unit at 250m ² and over GFA
Attached dwelling unit – medium to high rise	0.6 HUE per unit at 0m ² - 99m ² GFA 0.75 HUE per unit at 100m ² – 249m ² GFA 0.9 HUE per unit at 250m ² and over GFA
Retirement unit	0.3 HUE per unit
Aged care room	0.2 HUE per room
Small ancillary dwelling unit	0.6 HUE per unit
Accommodation units	0.45 HUE per unit
Student Accommodation	0.22 HUE per room
Retail, hospitality, recreation and personal services	2.79 HUE per 100m ² GDA ⁸

⁸ Gross development area.

Commercial	0.73 HUE per 100m ² GDA
Education and health	0.37 HUE per 100m ² GDA
Production and distribution	0.1 HUE per 100m ² GDA
Any non-residential use not specified above	1.0 HUE per 100m ² GDA

8. Attachment A: Trip Generation Data

The table below shows the raw trip generation data for a variety of activities organised into the development type groupings the council uses.

Land Use	Development Type	RTA Guide to Traffic Generation V2.2 Oct 2002 (AUS)		NZ Transport Agency Research Report 453 Nov 2011 (NZ)		Trip Generation rates for assessment of development proposals (Parsons Brinckerhoff) Jan 2014 (Australia)		RTA Guide to Traffic Generation Updated TDT 2013/04 (AUS)		ITE Trip Generation Manual 9th Edition (US)	
		Daily Vehicle Trips	Unit Factors	Daily Vehicle Trips	Unit Factors	Daily Vehicle Trips	Unit Factors	Daily Vehicle Trips	Unit Factors	Daily Vehicle Trips	Unit Factors
Hostel	Accommodation units			2.5	Bed						
Hotel	Accommodation units			6.4	Room	8.0	Unit			8.17	Room
Motels	Accommodation units	3	Unit	3	Unit	4.3	Unit			5.63	Room
Retirement Home (Continuing Care)	Aged Care Unit			2.4	Bed					2.4	Unit
Commercial Office	Commercial	10	100 m2 GFA	26.1	100 m2 GFA	15.9	100 m2 GFA	11	100 m2 GFA	12.52	100 m2 GFA
Education – Preschool	Education and Health			4.1	Child	4.8	Child			4.38	Student
Education – Primary	Education and Health			1.6	Pupil	1.4	Student			1.29	Student
Education – Secondary	Education and Health			0.4	Pupil	1.1	Student			1.67	Student
Education – Tertiary	Education and Health			1.4	Student					1.71	Student
Education - Junior/High School	Education and Health									15.11	100m2
Hospital Large	Education and Health			3.1	Bed						
Hospital Small	Education and Health			13.5	Bed	17.1	bed			11.43	Bed
Hospital	Education and Health									14.23	100m2

		RTA Guide to Traffic Generation V2.2 Oct 2002 (AUS)	NZ Transport Agency Research Report 453 Nov 2011 (NZ)	Trip Generation rates for assessment of development proposals (Parsons Brinckerhoff) Jan 2014 (Australia)	RTA Guide to Traffic Generation Updated TDT 2013/04 (AUS)	ITE Trip Generation Manual 9th Edition (US)	
Medical Centre	Education and Health		79.4	Prof Staff		8.01	Employee
Road Transport Terminals	Non-Residential	5					
Factories	Production and Distribution	5		3.2	100 m2 GFA	7.35	100 m2 GFA
Manufacturing	Production and Distribution		30			4.11	100 m2 GFA
Warehouses	Production and Distribution	4	2.4	3.1	100 m2 GFA	3.83	100 m2 GFA
Apartment	Residential		6.8	5.4	Dwelling	4.58	Unit
Dwelling (Outer Suburban)	Residential		8.2			7.4	Dwelling
Dwelling (Rural)	Residential		10.1				
Dwelling (Suburban)	Residential		10.9		10.7		Dwelling
Dwelling Houses	Residential	9		9.1	Dwelling	9.52	Dwelling
Medium Density Residential Flat Building	Residential	4-5					
Medium Density Residential Flat Building	Residential	5-6.5				6.59	Unit
Bar	Retail		92				
Car Tyre Retail	Retail	10				26.77	100 m2 GFA
Discount	Retail		100			61.67	100 m2 GFA
Fast Food	Retail		362				
Garden Centre	Retail		147				
Gymnasiums (Metropolitan Area)	Retail	20					
Gymnasiums (Sub-Regional Metropolitan Area)	Retail	45					

		RTA Guide to Traffic Generation V2.2 Oct 2002 (AUS)	NZ Transport Agency Research Report 453 Nov 2011 (NZ)	Trip Generation rates for assessment of development proposals (Parsons Brinckerhoff) Jan 2014 (Australia)	RTA Guide to Traffic Generation Updated TDT 2013/04 (AUS)	ITE Trip Generation Manual 9th Edition (US)
Gymnasiums	Retail		37.2	100 m2 GFA		36.4
Hardware Store	Retail			54.4	100 m2 GFA	100 m2 GFA
Large Format Retail	Retail		45	100 m2 GFA	34	100 m2 GFA
Markets	Retail - Other	18	22	100 m2 GFA	18	100 m2 GFA
Produce	Retail - Other		487			
Restaurant	Retail	60	6.1	Seat		94.76
Service Station	Retail		718	100 m2 GFA		100 m2 GFA
Shop	Retail		128.6	100 m2 GFA		Pump
Shopping (CBD)	Retail		56	100 m2 GFA		
Shopping (Large - 10,000 m2 +)	Retail		84	100 m2 GFA		
Shopping (Medium - 4,000 - 10,000 m2)	Retail		101	100 m2 GFA		
Shopping (Small - 0-4,000 m2)	Retail		141	100 m2 GFA		
Shopping Centre	Retail			55.7	100 m2 GFA	45.96
Shopping Centre (0-10,000 m2)	Retail	121			121	100 m2 GFA
Shopping Centre (10,000 - 20,000 m2)	Retail	78			78	100 m2 GFA
Shopping Centre (20,000 - 30,000 m2)	Retail	63			63	100 m2 GFA
Shopping Centre (30,000 - 40,000 m2)	Retail	50			50	100 m2 GFA
Supermarket	Retail		129	100 m2 GFA		131.51
Tennis Courts	Retail - Other	4-5				32.23
						Court

