A2 Traffic data

A2.1 Introduction

Introduction

This appendix provides standard values for traffic composition (based on the vehicle classes listed below), vehicle occupancy and trip purpose. Guidance is also provided on measuring and estimation traffic volumes, traffic growth and speed.

These procedures can be used to provide traffic data for:

- the procedures in appendix A3 for estimating travel time
- in the absence of measured data or
- in the absence of data from calibrated and validated transportation models.

Use of measured data

Wherever practical, measured data shall be used in preference to the default values given in the tables.

In this appendix

This appendix contains the following topics:

A2.2 Traffic composition

Vehicle classes The definitions for vehicle classes are provided in table A2.1.

Road categories Road categories for the traffic data classifications in this appendix are provided in table A2.2.

Table A2.1 Vehicle classes

Vehicle classes	Vehicle class composition
Passenger cars	Cars and station wagons, with a wheelbase of 3.0 metres or less
Light commercial vehicles (LCV)	Vans, utilities and light trucks up to 3.5 tonnes gross laden weight. LCVs mainly have single rear tyres but include some small trucks with dual rear tyres
Medium commercial vehicle (MCV)	Two axle heavy trucks without a trailer, over 3.5 tonnes gross laden weight
Heavy commercial vehicle I (HCV I)	Rigid trucks with or without a trailer, or articulated vehicle with three or four axles in total
Heavy commercial vehicle II (HCV II)	Trucks and trailers and articulated vehicles with or without trailers with five or more axles in total
Buses	Buses, excluding minibuses

Table A2.2 Road categories

Road categories	Definition
Urban arterial	Arterial and collector roads within urban areas carrying traffic volumes of greater than 7,000 vehicles/day
Urban other	Other urban roads, carrying less than 7,000 vehicles/day
Rural strategic	Arterial or collector roads, connecting main centres of population and carrying over 2,500 vehicles/day
Rural other	Other roads outside urban areas

A2.2 Traffic composition, continued

Standard traffic composition

Table A2.3 provides standard traffic compositions. For larger projects or sites with unusual traffic characteristics, classification counts are required. Bus numbers are site dependent and are not included in the standard traffic composition.

Note that traffic composition data is not provided for strategic routes on the fringes of large population centres (ie, populations greater than 40,000). Such routes are characterised by predominantly rural strategic traffic mixes but with high commuter peaks more typical of an urban arterial road. On these routes individual surveys of traffic composition will normally be required. Also traffic stream compositions are likely to vary throughout the day, and the result of a single period survey may not accurately reflect the daily traffic composition – if this is the case more surveys through the day will be required.

Table A2.3 Traffic composition (%)

Road category and time period	Vehicle class				
	Car	LCV	MCV	HCV I	HCV II
Urban arterial					
Morning commuter peak	85	10	2	1	2
Daytime inter-peak	84	11	2	1	2
Afternoon commuter peak	84	11	2	2	1
Evening/night-time	85	9	2	1	3
Weekday all periods	85	10	2	1	2
Weekend/holiday	87	8	3	1	1
All periods	85	10	2	1	2
Urban other					
Weekday	86	8	3	2	1
Weekend/holiday	87	9	2	1	1
All Periods	86	8	3	2	1
Rural strategic					
Weekday	75	12	4	4	5
Weekend/holiday	83	5	5	4	3
All periods	78	10	4	4	4
Rural other					
Weekday	78	11	3	4	4
Weekend/holiday	84	6	4	4	2
All Periods	81	9	3	4	3

A2.3 Separating the project into its component sections

Procedure

Follow the steps below to separate the project into its component sections:

Step	Action
1	Separate the project into: • motorway sections • multilane roads. • two-lane rural roads. • other urban roads. • signalised intersections. • priority intersections. • roundabouts.
2	Identify any bottleneck locations

General guidance

Sections must be chosen so as to ensure conservation of vehicle movements (ie, the sum of the flows into a section must equal the sum of the flows out).

Section lengths may be divided into sub-sections when it comes to calculating vehicle operating costs.

Guidance for motorways and multilane roads

Each motorway section or multilane road section shall consist of a length of road with:

- uniform design speed
- one direction of travel
- uniform number of through lanes
- boundaries which generally extend between major interchanges where significant flows leave or join the section.

Guidance for two-lane rural roads

Each two-lane rural road section shall be at least 1km and not more than 5km in length.

The two-lane rural road section to be analysed may be longer than the project length.

A2.4 Dividing the year into time periods

Days of the year

Each year is defined as having 365 days comprising of:

- 245 weekdays
- 52 Saturdays
- 68 Sundays and public holidays.

Weekends and holiday periods cover Saturday and Sunday, all public holidays and two weeks over Christmas and New Year. These account for 120 days per year.

Time periods

The default weekday time periods are:

- morning commuter peak (0700 – 0900)
- daytime interpeak (0900 – 1600)
- evening commuter peak (1600 – 1800)
- evening/nighttime (1800 – 0700).

Saturdays and Sundays do not usually need to be divided into time periods unless there are substantial demands.

Procedure

Follow the steps below to divide the year into time periods:

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td>1</td><td colspan="2">Divide the year into the days specified above</td></tr>
<tr><td rowspan="4">2</td><td colspan="2">Divide each day type into time periods as follows:</td></tr>
<tr><td>If there…</td><td>Then…</td></tr>
<tr><td>are only very low levels of vehicle interaction throughout any day</td><td>no division of the day is necessary</td></tr>
<tr><td>is significant levels of vehicle interaction</td><td>divide each day into a number of time periods to allow analysis at different flow levels, such that:
operating conditions (such as proportion of traffic turning, percent working and vehicle composition) are essentially constant
the period is long enough to ensure sufficient total capacity is available, even though for some of the time the capacity is exceeded.</td></tr>
</table>

A2.5 Vehicle occupancy and travel purpose

Vehicle occupancy and travel purpose

Standard vehicle occupancy and travel purpose figures are provided in table A2.4. For large projects or sites with unusual traffic characteristics, vehicle occupancy surveys shall be conducted by roadside observation of the traffic stream in conjunction with classification counts. Vehicle occupancy counts shall include drivers and passengers.

'Working' refers to trips carried out in the course of paid employment, 'commuting' refers to trips between home and work, while 'other' refers to all other non-work trips (ie, other than commuting).

Travel purposes is a difficult characteristic to survey and recourse to the standard values provided in table A2.4 will be required in most cases. At present there is no accepted method of differentiating between work and non-work trips by observing moving traffic stream. Field surveys of trip purpose require roadside interviews. Survey results from urban transportation studies can be used where appropriate. The values in table A2.4 have been derived from the National Household travel survey.

A2.5 Vehicle occupancy and travel purpose, continued

Table A2.4 Vehicle occupancy and travel purpose

Road category	Car				LCV				MCV and HCV			
	Occupancy	Travel purpose %			Occupancy	Travel purpose %			Occupancy	Travel purpose %		
		Work	Commute	Other		Work	Commute	Other		Work	Commute	Other
Urban arterial												
AM Peak	1.4	10	50	40	1.4	65	20	15	1.2	90	5	5
Daytime inter-peak	1.3	30	10	60	1.4	65	5	30	1.2	90	0	10
PM peak	1.4	10	30	60	1.4	65	15	20	1.2	90	5	5
Evening/ night-time	1.4	10	5	85	1.4	65	15	20	1.2	90	5	5
Weekday all periods	1.4	20	20	60	1.4	65	10	25	1.2	90	5	5
Weekend	1.7	5	5	90	1.7	10	10	80	1.6	75	5	20
All periods	1.5	15	15	70	1.5	50	10	40	1.3	85	5	10
Urban other												
Weekday	1.4	20	20	60	1.6	65	10	25	1.2	90	5	5
Weekend	1.7	5	5	90	2.0	10	10	80	1.6	75	5	20
All periods	1.5	15	15	70	1.7	45	10	45	1.3	85	5	10
Rural strategic and rural other roads												
Weekday	1.6	40	10	50	1.6	75	5	20	1.3	90	5	5
Weekend	2.2	5	5	90	2.0	10	10	80	1.8	75	5	20
All periods	1.7	30	10	60	1.7	55	5	40	1.4	85	5	10

A2.6 Traffic volumes

Use of transportation models to predict traffic volumes

Wherever properly calibrated and validated transportation models are available in urban areas, they shall be used to assess the effects of the project on traffic volumes and predict future traffic volumes. As well as the normal validation required to ensure that the models are operating satisfactorily, they shall also be validated in the local area containing the project. Transportation models usually account for but do not separately identify normal and diverted traffic. In determining the do minimum traffic volumes, models shall be iterated from distribution to assignment until convergence is achieved. The same trip matrix shall then normally be used for evaluating the do minimum and the project options.

In highly congested project option networks, variable matrix methods (see appendix A11) need to be applied.

Traffic volumes

Traffic volumes are generally expressed in terms of annual average daily traffic (AADT) and average weekday, average weekend/holiday, average hour or average quarter hour volumes. The methods given below for determining traffic volumes based on traffic counts are derived from Transit New Zealand's *Guide on Estimating AADT and Traffic Growth.*

Method for estimating AADT

To estimate AADT from a sample count it is necessary to adjust the count data for a number of factors. Count data shall be checked for consistency and reasonableness and axle pair counts (eg, from tube counters) shall be corrected by applying an adjustment factor to convert from axle pair counts vehicle counts.

Daily counts for less than a week shall be adjusted by applying day factors (for the appropriate typical traffic pattern) to derive weekly average daily traffic. Weekly average daily traffic figures shall then be adjusted by applying the appropriate week factors to derive AADTs. If more than one week is counted, the AADT shall be determined for each week, and then averaged.

To determine day and week factors, the appropriate traffic pattern control group shall be identified from Transit New Zealand's *Guide on Estimating AADT and Traffic Growth*. Alternatively these factors may be derived from rigorous local traffic counting programmes.

Method for estimating weekday or weekend/ holiday volume

Weekday, Saturday and Sunday/holiday volumes shall be derived from AADTs by applying locally derived day factors where these are available, or the factors in Transit New Zealand's *Guide on Estimating AADT and Traffic Growth* if local data is not available. The Saturday and Sunday/holiday volumes so obtained shall be averaged to derive an average weekend/holiday daily volume.

A2.6 Traffic volumes, continued

Method for estimating hourly or quarter hourly directional volumes

Where traffic volumes are required for shorter time periods than a day, then these shall be obtained from directional counts.

Counts done to produce estimates of the AADT will usually have been obtained from traffic counters that record volumes by 60 or 15 minute intervals. Week factors shall be applied to these counts to obtain estimates of 60 or 15 minute traffic volumes.

For intersection volumes, manual counts of turning movements should be consistent with the requirements of NZS 5431:1973 clause 5.4.

Axle pair adjustment factors

Wherever possible measured data shall be used to determine the axle pair adjustment factors, but in absence of such data the following factors shall be used. To convert axle pairs to vehicles, multiply by the appropriate factor.

Axle pair adjustment factors

Road category	Axle pair adjustment factor
Urban	0.91
Rural	0.83

A2.7 Traffic growth rates

Traffic growth rates

Traffic growth rates shall be arithmetic growth rates (not geometric growth rates) and expressed as a percentage of the predicted traffic volume at the time zero.

Actual traffic counts at the site (or at adjacent sites) shall be used to determine current traffic growth rates wherever possible. This requires at least 4 counts in the last 6 years sufficient to estimate traffic volumes (or 7 or more counts in the last 10 years). This information shall be checked for consistency with traffic counts at nearby sites and with the default values provided in table A2.5. The traffic volume and the average traffic growth rate at time zero shall then be determined using linear regression to best fit the traffic volume data.

To estimate the traffic growth rate for several sites combined, traffic growth rates shall be calculated for each site for which count data are available, and a weighted average calculated (where the traffic growth rate for each site is weighted by its traffic volume at time zero).

It might not be appropriate to assume continuation of current traffic growth rates over the whole project analysis period. The current traffic growth rate shall be adjusted, as appropriate, to account for the influences described in appendix A2.8.

Default traffic growth rates

Where local traffic growth rates cannot be established reliably, the default values for the region and road category given in table A2.5 shall be used.

The default traffic growth rates given in table A2.5 were determined principally from counts taken over the period 1980 to 2000, taking into account factors such as trends in population growth, gross domestic product and car ownership.

The default traffic growth rates are provided for each region of New Zealand and the cities of Auckland, North Shore, Waitakere and Manukau within the Auckland Region.

A2.7 Traffic growth rates, continued

Table A2.5 Annual percentage arithmetic traffic growth for period 0-25 years

Region	Urban		Rural	
	Arterial % growth	**Other % growth**	**Strategic % growth**	**Other % growth**
Northland	3	2	3	2.5
Auckland Region	N/A	N/A	2.5	2.5
Auckland City	1.5	1.5	N/A	N/A
North Shore City	3	2	N/A	N/A
Waitakere City	3	2	N/A	N/A
Manakau City	3	2	N/A	N/A
Waikato	2	1	3	2.5
Bay of Plenty	2.5	2	2.5	2.5
Gisborne	1	1	1	1
Hawkes Bay	1.5	1.5	2	1
Taranaki	1.5	1	1.5	0.5
Manawatu-Wanganui	2	1.5	2	1.5
Wellington	2	2	2	2
Nelson-Marlborough	2.5	2	2.5	2.5
Canterbury	2	2	3	2.5
West Coast	N/A	2	N/A	2
Otago	1.5	1.5	2	1.5
Southland	1	1	1	1

Note: N/A means not applicable.

A2.8 Future traffic volumes

Future traffic volumes

In predicting future traffic volumes, normal traffic growth, diverted traffic, generated and redistributed traffic, and intermittent traffic shall be taken into account. The procedure adopted for estimating future traffic volumes must fulfil the requirement that demand is in approximate equilibrium with supply.

Normal traffic growth

Traffic growth rates determined in accordance with appendix A2.7 are considered to provide a sound basis for predicting future traffic demands provided there are no traffic restraints.

If there are capacity restrictions in the system then the traffic volume shall not exceed capacity available within the time period under analysis, taking into account the potential for trip diversion, peak spreading and trip suppression.

If the level of service is low, peak spreading should be considered. Appendix A11 provides guidance on the treatment of peak spreading.

If the site is upstream or downstream of a bottleneck and the bottleneck is not being relieved by the project, the volume at the site will be constrained by the capacity of the bottleneck, and therefore traffic volumes and traffic growth rate at the project site shall reflect this restriction on growth, subject to peak spreading.

In some situations changing land use patterns can significantly alter the traffic volumes at a site. For example the development of large supermarket in an urban area may cause a one off upward step in traffic volumes.

Diverted traffic

Diverted traffic to or from the route(s) served by the project occurs when:

- traffic re-routes from another route because the project (or another project on the route) now makes this the preferred route
- traffic re-routes to another route because a project on that route now makes it the preferred route
- capacity restraints at the project site or elsewhere on the route cause traffic to re-route to other routes
- capacity restraints on other routes cause traffic to re-route to the route.

These effects shall be taken into account in estimating future traffic volumes.

Induced traffic

In general it shall be assumed that projects do not induce any new trips or cause a redistribution to new destinations. If there are cases where the effect of excluding induced or redistributed trips seriously affects the evaluation, then a variable matrix approach should be adopted (see appendix A11).

Intermittent traffic

Intermittent traffic is traffic that will not occur over the full life of the project. Examples include traffic from forestry lots which produce a short term demand at logging time, or traffic generated by major construction project such as power station which produces traffic for duration of the construction period. In calculating future traffic volumes, intermittent traffic shall be taken into account.

A2.9 Travel times and speed

Travel times and speed

Travel time and/or speeds shall be measured where required. Suitable methods for measuring average travel times or speed depending on circumstances include:

- floating car survey
- number plate survey
- spot measurement of speed.

The floating car and number plates survey methods measure the average travel time over a length of road.

The floating car survey methods is relatively cheap and convenient method but will not readily differentiate the average travel times of light and heavy traffic. It is only suitable for higher traffic volumes in excess or 500 vehicles/hour/lane.

The number plate method is a larger undertaking but potentially more accurate and has ability to give data on the average travel times of individual or categories of vehicle. Several software packages are available for analysing number plate survey data as are electronic field-book programmes for facilitating the data input.

The average travel time over a section of road may not provide sufficient information for calculating vehicle operating costs if one or more speed change cycles occur within the section. Speed change cycles should be separately identified in urban areas where speeds reduce to below 20km/h and for rural areas where vehicles slow down for example to negotiate a sharp bend or at an intersection.

In such cases, spot measurement of speed will be required at a sufficient number of other locations to establish the average cruise speed for the road section and at the points of minimum speed. If vehicles stop at any point on the road section, then the average length of stopped time will also be required for the operating cost calculations. An alternative to spot measurements of speed will be to arrange number plate survey points such that they do not contain speed change cycles within their length.

When averaging the results of speed spot measurements, the space mean speed should be calculated using the following formula:

$$v = \frac{n}{\left[\frac{1}{v_1} + \frac{1}{v_2} + \frac{1}{v_3} + \frac{1}{v_4} + \ldots + \frac{1}{v_n}\right]}$$

where

v_i = spot speed measurement

n = total number of spot speed measurements

A2.10 References

1. F Tate, P Carpenter, M Mara, S Wilkie and Y Morgan, *Monitoring and Data Management Protocol: Environmental Indicators for Transport,* Ministry for the Environment New Zealand, 2004.
2. Transfund New Zealand, *Update and enhancement of traffic count guide*, Transfund New Zealand research report 202, 2000.
3. Transfund New Zealand, *Guide to estimates and monitoring of traffic counting and traffic growth,* Transfund New Zealand research report 205, 2000.
4. Transit New Zealand, *Guide on estimating AADT and traffic growth,* November 1994.
5. National roads board, *A methodology for conducting traffic surveys for use with TRARR analyses*, C R Bennett, roading directorate report RRS-005, October 1985.
6. NZS 5431, *Specification for traffic signals,* 1973.