

## **1. INTRODUCTION**

The Waikato Regional Transport Model consists of two four-step and three three-step modeled periods. On occasion it will be necessary to present daily traffic results and also annualised traffic results. A factored Average All Day Traffic (AADT) model is produced as part of the WRTM and uses the factors reported in this report to convert from the period models to AADT flows. Annualisation factors are required for any economic analysis applying the New Zealand Transport Agency criteria as outlined in the Economic Evaluation Manual.

By analysing local traffic volume profiles it is possible to determine appropriate expansion factors to determine daily and/or annualised traffic volumes, travel totals and economic outputs from the three period models. Each of the modelled periods produce two-hour traffic outputs as follows: AM Peak is 7-9am; Interpeak is 11am-1pm; and PM Peak is 4-6pm.

## **2. CALCULATION OF ANNUALISATION FACTORS**

Factors have been calculated to convert two-hour period model outputs into daily and annualised outputs, for both urban areas and for regional areas based on surveyed traffic count profiles for the Waikato region.

A total of six regional sites and six Hamilton urban sites have been selected and the traffic profiles tabulated for weekdays (i.e. as a five day continuous count average), Saturday and Sunday. In each case care has been taken to select arterial routes, which provide a cross-section of traffic demand across the Hamilton urban area and across the Waikato Region. Traffic counts that have been used to develop the profiles are seven days of continuous data outside of school and public holidays.

The count sites are as follows:

- Victoria Bridge (Urban)
- Ulster Street north of Richmond Street (Urban)
- Ellicott Road east of Waimarie Street (Urban)
- Boundary Road east of Heaphy Terrace (Urban)
- Te Rapa Road north of Avalon Drive (SH1N.00546) (Urban)
- Cobham Drive east of Cambridge Rd roundabout (SH1N.00557) (Urban)
- SH2.00141 (Region)
- SH1N.00509 South of Tahuna Overbridge, Rangiriri (Region)
- SH1N.00620 Lichfield Telemetry site south of Baldwin Rd (Region)
- SH29.00043 west of Waikato/BoP Region boundary (Kaimai Ranges) (Region)
- SH27.00065 South of Matamata Airport entrance (Region)
- SH3.00066 800m past SH37 (Waitomo) (Region)

Traffic counts show that urban sites experience a more pronounced peak in traffic volumes at AM and PM peak times whereas regional sites produce more consistent traffic flows throughout the day. Accordingly, annualisation factors have been calculated separately for urban and regional areas. Figure 1 and Figure 2 below show recorded traffic volumes aggregated across the six urban and six regional sites throughout the day. Because of the marked differences in the traffic profiles as set of different factors are calculated for application to urban and regional projects.

A combination of tidal flow conditions and relatively high traffic volumes dictate the length of the peak periods. In Hamilton and the Region the peak periods are considered to be two hours long. Subsequently, given that the modelled periods are also two hours in length, the typical weekday has one modelled AM Peak and one modelled PM Peak period.

With 245 typical weekdays per annum, the factor for converting AM and PM peak to AADT then becomes  $(245/365=)$  0.671 and the annualisation factor is 245 in each case. All other weekday hours, all Saturday, Sunday and public holidays assume the interpeak model.

It has been assumed that public holidays generally follow the Sunday traffic profile and subsequently 50 'typical' Saturdays (given that 2 Saturdays per annum are typically public holidays) and 70 Sundays (i.e. including all public holidays) are assumed in the analysis. By aggregating traffic volumes across the off-peak weekday hours and adding the 50 Saturdays and 70 Sundays, these can be dividing by the weekday modelled 11am-1pm flow across the sites, to evaluate the interpeak factor. This has been done separately for the urban and regional count sites. The resultant annualisation factor is 2005 for Hamilton urban area and 2310 for the Region. By dividing these figures by 365, the AADT factors for the interpeak are 5.493 and 6.330 respectively.

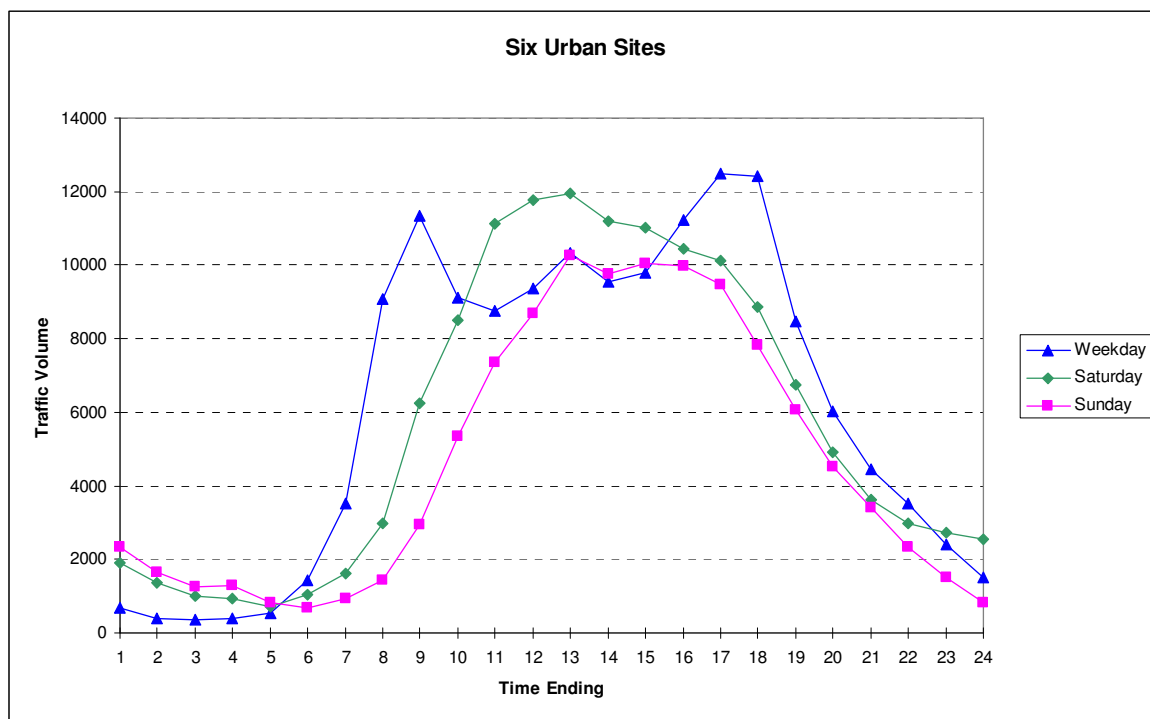
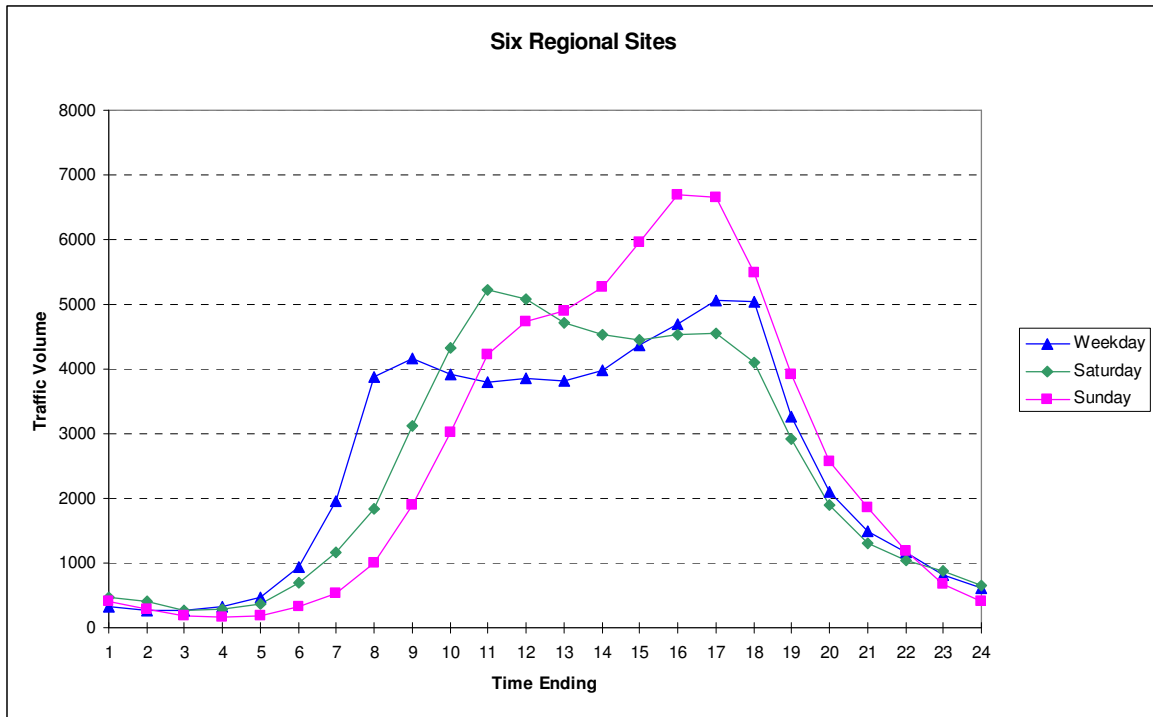


Figure 1 –Urban Traffic Volume Daily Profiles



**Figure 2 –Regional Traffic Volume Daily Profiles**

Factors to convert from the modelled two hour weekday periods to Annual Average Daily Traffic (AADT) volumes are summarised for Regional and Urban applications in Table 1, and corresponding annualisation factors for economic assessment are presented in Table 2. For general applications that may be a mix of both urban and regional traffic behaviour, it is suggested that an average of the results in Table 1 and Table 2 can be applied.

Period	Regional	Urban
AM Peak	0.671	0.671
Interpeak	6.330	5.493
PM Peak	0.671	0.671

**Table 1 – Modelled Period to AADT Factors**

Period	Regional	Urban
AM Peak	245	245
Interpeak	2310	2005
PM Peak	245	245

**Table 2 – Modelled Period Annualisation Factors**

Similarly, Average Annual Weekday Traffic (AAWT) volumes can be calculated. In this instance there is one peak period per day and the factor for the interpeak captures the remaining 20 hours of the typical weekday. The resultant factors are included in **Table 3**.

Period	Regional	Urban
AM Peak	1.000	1.000
Interpeak	5.535	5.167
PM Peak	1.000	1.000

**Table 3 – Modelled Period to AAWT Factors**

It is plausible that annualisation factors can be determined with a greater weighting on peak periods. This may be done by multiplying all three the AAWT period factors by an AADT/AAWT factor and multiplying these by the 365 days per annum. In urban areas the AADT is 95.4% of the AAWT and in regional areas the AADT equal to the AAWT. The resultant annualisation factors then become as published in **Table 4**. It may be considered more appropriate to use the factors in **Table 4** as opposed to those in **Table 2**, in instances whereby there was more confidence in or reliance required in the peak period modelling as opposed to the interpeak results (for example where predominantly peak period validation is undertaken).

Period	Regional	Urban
AM Peak	365	348
Interpeak	2020	1799
PM Peak	365	348

**Table 4 – Alternate Modelled Period Annualisation Factors**

It is recommended that prior to applying these annualisation factors to economic analysis for specific project work, localised counts should be considered. If the traffic profiles in the local area differ from the Urban and Regional profiles presented in this Technical Note, a localised set of annualisation factors should be calculated and applied for that project.

### 3. APPLICATION OF FACTORS IN FOUR STEP MODEL

The Waikato Regional Transport Model includes four step models for the morning peak and interpeak periods but not for the evening peak model. The expansion and annualisation factors published in the previous section for the morning and interpeak models are directly applicable to the four step equivalents. However, it is necessary to establish a method of impressing the impact of a mode shift on the evening peak model. In doing this, full annualisation and subsequent economic analysis can be completed for four-step options.

To a large extent travel patterns in the evening peak are the inverse of travel patterns in the morning peak, with a similar quantum of travel but with the directionality of the tidal flow reversed. With regards to public transport, the decision to use this mode of transport for work-related and education-related trips in the morning, largely dictates the need to use the same mode in the evening for the return journey home.

On this basis it is proposed that changes in travel patterns and mode shifts in the morning peak, four-step model be used to estimate changes in mode shift in the evening peak in multi-modal applications.

This requires the following steps:

1. Determine percentage change in number of vehicle driver trips in each mode split in the AM Peak model (i.e. Home Based Work, Home Based Education, All Other Private Trip Purposes) between the relevant do minimum and option models.
2. Aggregate the do minimum evening peak private trip purposes to form three matrices (i.e. a Home Based Work, Home Based Education and All Other Private Trip Purposes)
3. Apply the %age change from step 1 to each of these three aggregated private trip purposes for the evening peak option model. Note this change should only be applied in the geographic region in which the change in mode split has occurred (e.g. if bus services in Hamilton changed then only apply to Hamilton zones).
4. Rebuild the evening peak trip matrix for assignment by aggregating the three modified private trip matrices and including commercial and external trips.
5. Reassign resultant trip matrix to three-step evening peak model.
6. Use the factors in **Table 1** through **Table 4** above (as considered appropriate) and apply these to the outputs of the morning and interpeak four step and evening peak three step models to establish daily flows or annualised outputs.