NZ TRANSPORT AGENCY WAKA KOTAHI

TECHNICAL NOTE

Cycle Count Scaling Spreadsheet

TN003 June 2016

1. Introduction

This technical note describes the scaling methodology and use of the cycle count scaling spreadsheet developed by Abley Transportation Consultants for the NZ Transport Agency. The tool has been developed in the context of the Urban Cycleways Programme (UCP) to assist Road Controlling Authorities with meeting cycle monitoring requirements. The tool is also applicable to non-UCP cyclist and/or pedestrian count data. The tool is developed to scale short and long term continuous automatic count data. For short term counts spanning less than two weeks, or for sites where no comparable long term data is available use existing guidance in the Cycling Network Guidance, which is available online at www.nzta.govt.nz/cng.

Information on cycle monitoring requirements, methodologies and reasons for scaling count data is available in the CNRPG. This guidance recommends count durations, frequencies, technology types and monitoring requirements. In terms of UCP monitoring and reporting requirements, this tool is applicable to the UCP project reporting through TIO following the implementation of the facility. The tool is not applicable to manual counts undertaken to satisfy wider network monitoring requirements.

The primary inputs to the tool include automatic short term counts at the site being analysed (reporting station) and a nearby long term count (calibration station). Using trends in the long term data, the short term count is scaled by the spreadsheet tool to estimate the average number of cyclists per day, weekday peak and weekend peak.

The following technical note is separated into two key sections:

- Scaling Methodology describes the technical details of how the tool calculates different metrics.
- User Guidance describes how to use the tool and the components of the user interface.

This tool will also be supported by a 'How to Video' that forms part of wider guidance on cycle monitoring and reporting requirements. The video will be available later in 2016.

2. Scaling Methodology

2.1 Overview

This section describes the calculations undertaken to adjust a short term cyclist count to represent an average annual cyclist count. This is achieved through analysing data from a continuous long term (11-12 months of data) count station (calibration station) at a site with similar characteristics to the short term count station. This allows influences such as the season, local events, local weather, school holidays etc. to be adjusted for when generating an annual average value.

By way of example, consider a short term site which was surveyed during the month of July 2015 and a nearby long term site which was surveyed for the full year. Figure 2.1 illustrates how the scaling function works at a high level. Sections 2.2 to 2.4 explain how each cyclist metric is calculated with reference to this example.

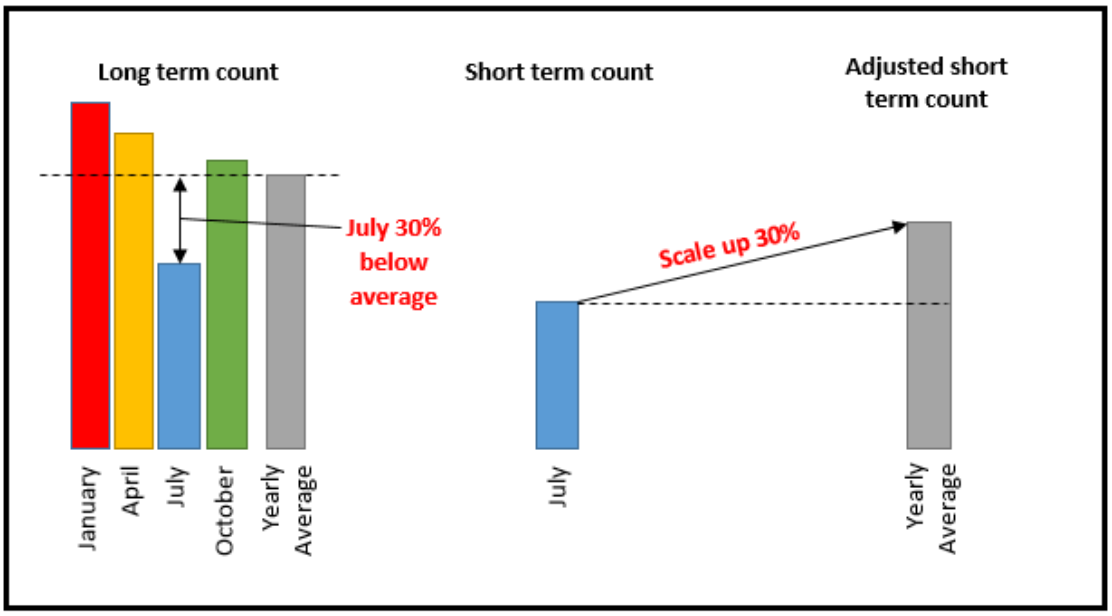

Figure 2.1 Illustration of the scaling function

2.2 Average daily cyclists

The average number of daily cyclists is estimated using the following process.

1. The average number of daily cyclists at the short term count site is calculated (Short Term Average).
2. The average daily number of cyclists at the long term count site over the same period as the short term count site is calculated (Calibrated Short Term Average).
3. The average number of daily cyclists at the long term count site over the entire count period (normally a year) is calculated (for example, across all of 2015) (Calibrated Annual Average).
4. The Scaling Factor is calculated by dividing the Calibrated Annual Average by the Calibrated Short Term Average.
5. The scaled average daily cyclists at the short term count site is calculated by multiplying the short Term Average by the Scaling Factor.

2.3 Average peak cyclists and weekend peak cyclists

The approach used to estimate the average number of weekday morning peak cyclists (those traversing the short term count site between 7am and 9am weekdays) and the average number of weekend peak cyclists (those traversing the short term count site in the peak 4-hour period during the weekend) is very similar to the approach used to estimate the average daily number of cyclists. The data entry from the user is simply filtered by the spreadsheet tool to include only counts in the weekday peak or weekend peak period.

2.4 Coefficient of determination (R^2)

The coefficient of determination is a measure of the goodness-of-fit between the daily profiles. Specifically, it is calculated by comparing the shapes of the average daily profile at the long term site (calibration station) and the average daily profile at the short term site.

The correlation between each average hourly or 15-minute count is used in the correlation function. Figure 2.2 shows an example of average short and long term counts by hour of day. The coefficient of determination calculated for these data is 0.76 as shown in Figure 2.3 reflecting the fact that the relative changes in cyclist numbers over a typical day correlate moderately well between the long term site and short term site. A coefficient of determination less than 0.7 would indicate that the short and long term daily profiles are not sufficiently well matched for scaling purposes.

Despite having a coefficient of determination of over 0.7, the example shown in Figure 2.2 and 2.3 features a short term profile and long term profile with different peaks and with the relativity between the morning peak and evening peak flows being notably different (that is morning is higher in long term and evening is higher in short term site). Ideally, users would seek to include a long term count with a profile as close to that of the short term count as is possible.

Conversely, in a scenario where the coefficient of determination is lower than 0.7 it is possible that the scaling spreadsheet may still be suitable for use. However, it is recommended that further investigation into differences in daily patterns is undertaken, for example the prevalence of commute versus school versus recreational trips using time of day assumptions. Where alternative long term count data exists this could be tested to understand the best long term data for scaling a specific short term site.

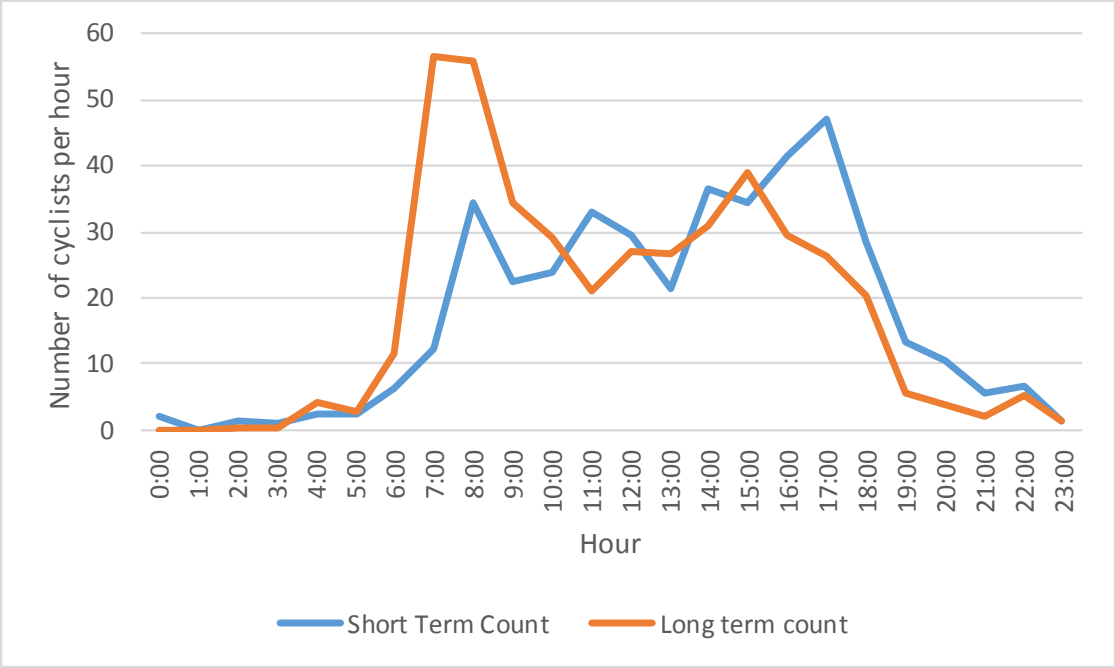

Figure 2.2 Example of average short term and long term hourly counts by hour

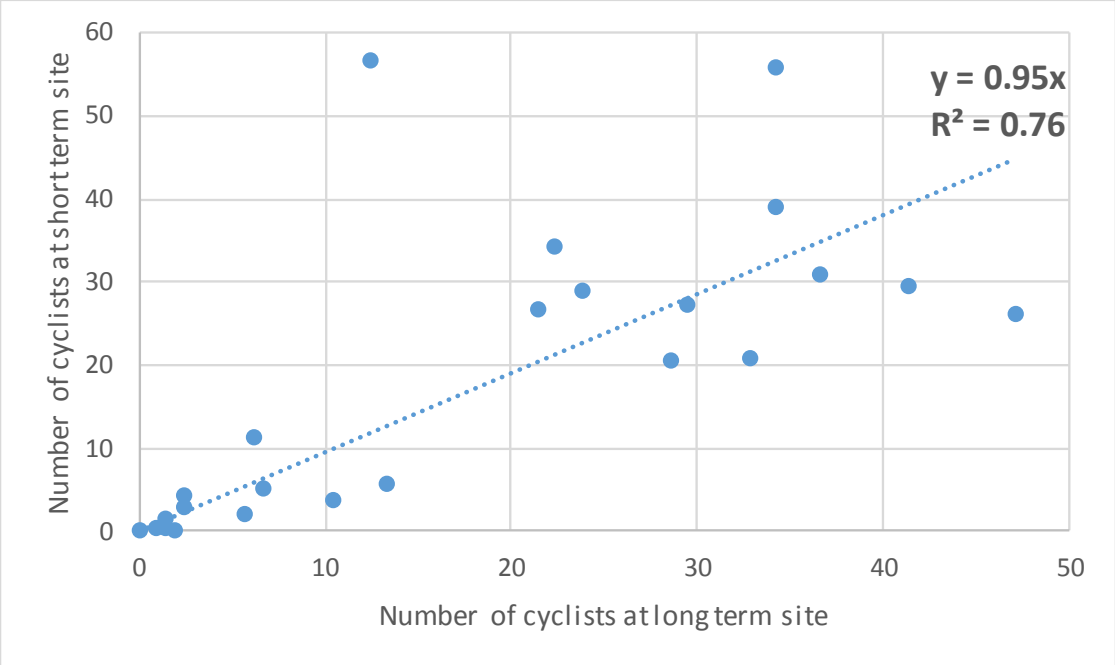

Figure 2.3 Example of correlation between short term and long term hourly counts

3. User Guide

This section provides guidance for using the tool. The tool has three tabs including:

- The 'Overview' where the results and initial input fields are displayed. Inputs required by the tool include:
  - site information,
  - the time interval which counts are recorded in (e.g. 15 mins, hourly)
  - short and long term count start and end times and dates, and
  - weekend peak time period.
- 'Calibration Data Entry' where the user enters the long term cycle count data
- 'Short Term Data Entry' where the user enters the short term cycle count data.

3.1 Count data

The user is required to supply both:

- Cycle count data at a short term site (i.e. the count to be scaled)
- Cycle count data at an appropriate long term count station (calibration station).

Guidance for selecting an appropriate long term count station to calibrate a short term site is provided in the CNRPG. In general, the short and long term count stations should be similar in terms of the level of protection provided to cyclists, location (i.e. experience the same weather and seasonal patterns and be recording similar cyclist types i.e. proportion of school vs commute vs recreational users. The coefficient of determination explained in Section 2.4 is a useful metric for determining the compatibility of two sites. Where the coefficient of determination is lower than 0.7 other continuous long term count stations in the district should be trialled to find a better fit between long and short term data sets.

3.2 Count Intervals and Duration

The count interval can be daily, hourly or every 15 minutes. The short term and long term counts must have the same intervals. All hour entries are in 24-hour time format.

The tool can process up to 366 days' worth of short term and long term counts. At least 11 months of long term data must be supplied and at least two weeks' worth of short term data must be supplied.

The input format for count data is a single column. Counts for each interval should represent a two-way total. Where data is extracted from the counter separately by direction the data should be manipulated into a total two-way count before inserting in the spreadsheet tool (except where the facility is one-way only).

3.3 Data entry

Before any data is entered by the user, the 'Clear all cells' button on the Front page should be pressed. Provided that the user has input the correct details for their count site, both the short and long term counts can be easy pasted into the columns highlighted in blue on each tab.

Where known technology errors exist in the count data (e.g. the count site did not record data for an extended period of time during the count period) cells should be left blank over the period in which the error occurred. This is a manual adjustment that should be made by the user. The annual profile on the 'Overview' tab can be used to assist with identifying errors.

3.4 Outputs

Once all inputs and counts have been entered correctly, the spreadsheet runs the scaling process in the background and calculates the following outputs on the 'Front page':

- The unscaled average daily cyclists (ADC-7), weekday peak cyclists and weekend peak cyclists at the short term count site
- The scaling factor for daily cyclists, weekday peak cyclists and weekend peak cyclists
- The annual average daily cyclists, weekday peak cyclists and weekend peak cyclists
- The coefficient of determination to represent the goodness-of-fit of the scaling model (R^2).

The unscaled average daily cyclist values and scaling factors can be input directly into the Transport Investment Online cycle monitoring reporting form.

Two graphs are also provided. The first shows the average daily count profile at the long term count site, the short term count site and the short term count once counts are scaled. The second graph shows the annual profile at both the short term and long term count sites.

3.5 Notes and warning messages

Notes for the user are displayed below the outputs block on the 'Front page'.

Two types of warning messages ae displayed below the notes block:

- **Warning errors** (displayed in orange) such as gaps in long term data. Gaps in data should be identified and cell inputs left blank during period of error
- **Fatal errors** (displayed in red) such as the length of short term counts being shorter than 14 days. Fatal errors cause all outputs to be blacked out.

3.6 Summary

The spreadsheet tool provides outputs that can be directly input into the cycle monitoring form in Transport Investment Online cycle monitoring form. The tool is also useful for scaling other short term cycle counts that are not reported to the NZ Transport Agency.