



# Guide to Christchurch City Council S-Paramics Modelling

---

Job No. 100

Issue No 2.0 (6 July 2007)

---

Standardised S-Paramics Modelling

## About This Standardised S-Paramics Modelling

Reference: 100  
Title: Guide to Christchurch City Council S-Paramics Modelling - Standardised S-Paramics Modelling  
Prepared by: Shaun Hardcastle  
Updated by: Matthew Hickson/Katherine Eveleigh  
Reviewed by: Shaun Hardcastle

<b>Issue</b>	<b>Date</b>	<b>Revision Description</b>
1.0	19 Oct 2006	Draft for discussion
1.2	9 Nov 2006	Issue 1.2 for external distribution
1.3	19 Jun 2007	Issue 1.3 for consideration
1.4	29 Jun 2007	Issue 1.4 for consideration
2.0	6 July 2007	Issue 4.0 for external distribution

# Table of Contents

- 1 Use of this Guide ..... 3
  - 1.1 Introduction..... 3
  - 1.2 Asset ..... 4
  - 1.3 Guide Convention ..... 4
  - 1.4 Software Versions..... 4
  - 1.5 Additional Media..... 5
  - 1.6 Feedback and Suggestions..... 5
- 2 File Structure ..... 8
  - 2.1 Recommended Directory Structure..... 8
  - 2.2 External Directories ..... 9
    - Demands ..... 9
    - Digital Media ..... 9
    - Models..... 10
    - RCA Signal Data..... 10
    - Standard CCC Model ..... 10
  - 2.3 Internal Directories..... 10
    - 3DObjects ..... 10
    - Log ..... 10
    - Period Specific Files ..... 11
    - Signal Data ..... 11
  - 2.4 Directory Overview ..... 12
- 3 Standard Model Files ..... 13
  - 3.1 Behaviour..... 13
  - 3.2 Buses ..... 14
    - Bus Routes and Schedules..... 14
    - Bus Stops ..... 14
  - 3.3 Categories..... 14
  - 3.4 Configuration ..... 16
  - 3.5 Controllers ..... 17
  - 3.6 Detectors ..... 18
    - Location and Shape ..... 18
    - Naming..... 19
  - 3.7 Measurements ..... 19
  - 3.8 Nodes ..... 20
    - Introduction ..... 20
    - Prefix ..... 20
    - TCS..... 21
    - Methodology..... 21
    - Recommendations - Creation ..... 22

- Recommendations - Editing ..... 22
- Summary ..... 22
- 3.9 Periods ..... 22
- 3.10 Units ..... 23
- 3.11 Vehicles ..... 23
- 3.12 Version ..... 24
- 3.13 Vshapes ..... 24
- 4 General Modelling Guidelines..... 24
  - 4.1 Use of the Standard Model ..... 24
  - 4.2 Bounding Box ..... 24
  - 4.3 Model Development Notes ..... 25
  - 4.4 Annotations File ..... 25
  - 4.5 Bus Stop Dwell Times..... 25
  - 4.6 Links ..... 25
    - Periodic Differences ..... 25
    - GA Look Next ..... 26
  - 4.7 Priorities ..... 27
    - Priority Controlled Intersections ..... 27
    - Signal Controlled Intersections ..... 28
  - 4.8 Profile Smoothing ..... 28
  - 4.9 Waypoints ..... 29
  - 4.10 Zone Inclusion ..... 29
  - 4.11 Matrix Estimation ..... 29
    - Survey File Input File ..... 30
- 5 General Network Construction Guidelines ..... 33
  - 5.1 Zones Connections ..... 33
  - 5.2 Right turning bays ..... 33
  - 5.3 Using Restrictions ..... 36
  - 5.4 How to Cordon a Large Model and extract demands..... 37
    - Demands Extraction without Route Choice ..... 37
    - Demands Extraction with Route Choice..... 37
    - Network Cordon ..... 37
- 6 Calibration Report Requirements ..... 38
  - 6.1 Mandatory Calibration Requirements ..... 39
  - 6.2 Optional Statistical comparison..... 50
- 7 Peer Review Process ..... 57
  - 7.1 Peer Review Process ..... 64
- 8 Acknowledgments..... 65
  - 8.1 Additional Media..... 65
  - 8.2 baseplus ..... 65

Appendix A : Model Development Notes (version 3.4)  
 Appendix B `` Model Check Files

## Glossary

### Glossary, Definitions and Abbreviations

**A Model** – is the directory that contains all the model data files and is what is selected and launched through SPx. This directory contains the sub directories required to run the model and store inputs and outputs.

**baseplus** – New Zealand Traffic Consultancy

**baseplusFUSE (FUSE)** – Communications software developed by **baseplus** that interfaces a Paramics model with SCATS.

**batch** – collect data from a simulation model run

**CBD** – Central Business District.

**CCC**– Christchurch City Council

**DAT** – Data Analysis tool within S-Paramics Suite of software to analyse model output

**FHWA** – Federal Highway Administration from America, governing body for Highways in the US.

**Flexilink** – A method of coordinating a group of signalised intersections using synchronized clocks and fixed time plans stored in each signal controller.

**GPS** – Global Positioning System

**ITS** – Intelligent Transport System

**ME** – Matrix Estimation, a process of estimating a demand matrix based on observed inputs on turns and/or links.

**Microscopic Traffic Simulation** – The modelling of individual vehicles with a start and end point coded, allowing the vehicle to interact with other vehicles, the road network infrastructure and obeying many rules of the road.

**Paramics** – Microscopic Traffic Simulation software developed by SIAS known as S-Paramics

**Paramics Audit** – A report written by an experienced Simulation Modeller that addresses the model structure, application and use. Findings from the audit are 'nice to haves' on a low level to 'compulsory changes' at the high end.

**PROM** – Programmable Read Only Memory. The computer chip that contains a signal controller personality.

**PTIPS** (Public Transport Information and Priority System) – Software developed by RTA to interface with SCATS that tracks the position of buses and requests priority at traffic signals.

**RCA** - Road Controlling Authority.

**RTA** – Roads and Traffic Authority (NSW), the developers of SCATS.

**run** – a collection period of a simulation model output usually collected through a batch process.

**SCATS** – Sydney Coordinated Adaptive Traffic System. The system used throughout Australasia to coordinate and monitor the traffic signals.

**SCATS Audit** – A report written by and experienced SCATS Engineer that comments on the operation and performance of SCATS and highlights any errors or omissions in the SCATS data.

**SCATS Central Manager** – Software that manages the connection of up to 64 SCATS Regions

**SCATS Region** – Software that manages and controls up to 250 separate traffic signal installations. Each site can run isolated or can be coordinated with other sites using one of several operating modes, including fixed-time and adaptive modes. The adaptive modes allow the cycle times, phase splits and offsets to be determined dynamically to suit the prevailing traffic conditions.

**ScatsAccess** – The Graphical User Interface for SCATS.

**Schema** – A database or protocol used to describe a process, in this guideline it is used as a term specifying desirable standards for model output reporting

**SIAS** – Developer of the simulation software suite S-Paramics.

**Signal Audit** – A report written by an experienced Signals Engineer that describes the safety and operational efficiency of an RCA's traffic signals. The Audit involves a site visit of each signal installation being audited and the report usually contains photographs and descriptions of the layout, hardware and signal phasing.

**Signal Controller Personality** – A unique program loaded into each traffic signal controller that defines the vehicle detectors, pedestrian buttons, signal phases, which lanterns to switch green, yellow or red at the different times and various fixed times such as the minimum green, maximum green, yellow, all-red, pedestrian walk and flashing clearance, etc.

**Signal Peer Review** – A brief report written by an experienced Signals Engineer that reviews the design of signal installation. The report comments on items such as layout, lane arrangements, signal lantern layout and arrangements, cycle and pedestrian facilities and signal phasing.

**Simulation Audit** – A report written by an experienced simulation modeller addressing the appropriateness and fit for purpose of a simulation model when compared to existing/observed data in reports and models.

**Simulation Peer Review** – A report and assessment by an experienced simulation modeller of an option or scheme model with comments on outputs and appropriateness.

**SLA** – Select Link Analysis, used to investigate a link in a model to determine how many trips from each zone pass through that link for both origin and destination.

**SPx**– S-Paramics explorer. This is the new module interface for SIAS Paramics (release 2006.1) which is based on a standard windows format and has additional bolt on tools that are used in this guide.

**SRMS** (SCATS Ramp Metering System) – software developed by RTA to control traffic flow onto a freeway or motorway using ramp signals.

**TAR** – Traffic Assessment Report.

**TCP/IP** (Transport Control Protocol/Internet Protocol) – A set of communication protocols for the transmission of data over a computer network.

**Traffic Signal Controller** – microprocessor based hardware that switches the traffic signal lanterns between green, yellow and red.

**Vehicle Detector** – a loop of wire embedded in the road surface that measures a change in inductance of a magnetic field as a vehicle passes over it.




**WinTraff** – Windows base software that allows the emulation of multiple (up to 250) RTA standard signal controllers.

## 1 Use of this Guide




### 1.1 Introduction

This guide is intended to assist an S-Paramics modeller undertaking work for Christchurch City Council (CCC). Its purpose is to ensure consistency, quality, connectivity and efficiency.

The provision of this guide should not be viewed as a restriction to the modellers' development of a model but rather as a means to undertake the following:-

-  Provide consistency and connectivity to all CCC models
-  Ease of review and familiarity with model construction and methodology
-  Provide guidance and best practice notes

This guides intended use is in development of an S-Paramics simulation model and its operation. In particular, it will offer guidance to those that are not familiar with the CCC model(s). This guide includes the following:

-  **Standard Model Structure and Development Guidelines:** Sections 2 and 3 include recommendations for standard directory structure and standard model files. This is followed by general modelling and network construction guidelines for the development of an S-Paramics simulation model. These guidelines are summarised in a 'Check List' format in Appendix B.
-  **Calibration Report Requirements:** Section 6 outlines requirements for the Calibration Report. In particular, the inclusion of model input assumptions (Section 6.1), mandatory calibration data (Section 6.2) and optional calibration and statistical data analysis (Section 6.3). These requirements are summarised in a 'Calibration Report Specifications' table, included as a template in Appendix C and as an example in Section 6.4.
-  **Peer Review Process:** The standard peer review process for a micro simulation model is defined as a flow chart in Section 7.

Whilst the guide is intended for use by consultants working on projects where CCC is the client (and is written accordingly), its use is also recommended for any S-Paramics projects within the CCC area, including projects where CCC is not the client but may be

involved in the approval of a project – e.g. where Paramics model is commissioned on behalf of developers to support resource consent applications.

## 1.2 Asset

---

The largest simulation asset that CCC own is the Christchurch CBD Model. Over time numerous consultants have developed, tested and analysed this data set such that it is evolving into a powerful tool.

It is envisaged that this CBD model will be further developed along with other project models outside the CBD. These models may be integrated at some point and hence the need for an approach that provides Paramics models within the CCC area of the desired quality and consistency.

As such the model standard files and all the recommendations made in this guideline are available by email request to [info@baseplusworld.com](mailto:info@baseplusworld.com); alternatively you can download the password protected version through the secure web site at [www.baseplusworld.com/mainpages-EN/guide.htm](http://www.baseplusworld.com/mainpages-EN/guide.htm).

## 1.3 Guide Convention

---

There are varying levels of guidance and advice. Some are simply good tips that may save time at the point of inclusion or later on in the modelling process, some are immovable and non-negotiable factors, and thus need to be treated, effectively, as "Standards" rather than "Guidelines". The level of application has been implied with the use of key words such as 'tip', 'recommended', 'strongly recommended' and 'non-negotiable'.

## 1.4 Software Versions

---

This guide is written for Paramics Version 2005.1a. Refer to section 3.12 for advice on subsequent versions of Paramics. It is recommended that the latest version of SPx and Dat manager be employed (currently 2007.1).

If you require software upgrades contact [info@baseplusworld.com](mailto:info@baseplusworld.com) for copies of this software or contact SIAS at [Paramics@sias.com](mailto:Paramics@sias.com).








It is envisaged that this guide will be updated when significant variations occur in the next software release or advised best practice is adjusted.



## 1.5 Additional Media

---

This document is not intended to be a definitive guide to simulation modelling using Paramics. We recommend the following background and supplementary reading in regard to simulation model development. All of the following documents, except the Microsimulation Consultancy Good Practice Guide, are available for download from the secure CCC Standards web page, [www.baseplusworld.com/mainpages-EN/guide.htm](http://www.baseplusworld.com/mainpages-EN/guide.htm)

-  SIAS – The Microsimulation Consultancy Good Practice Guide
-  SIAS – Reference Manual and Training Manual
-  Austroads – AP R 286 06 – The use and application of Microsimulation Traffic Models
-  DRMB Interim advice Note on using Simulation Models
-  FHWA – Vol 1 – Primer, Vol 2 – Methodology, Vol 3 – Guidelines
-  TFL – January 2003 – Guidance Note on Microsimulation
-  baseplus – baseplusFUSE user and reference manual

## 1.6 Feedback and Suggestions

---

This is the third issue of this guide, and as anticipated it is more useful now through its practical application and user feedback. The main modifications to the document have been the inclusion of Calibration Report requirements and peer review process.

It is anticipated that this document will become more relevant over time with further application, feedback, modification and re-issue.

As the software and functionality evolves, the guidance and methodologies may also change. It is therefore important that your queries and feedback are received by CCC so as to ensure that all parties that use this document are both familiar and satisfied with the guidance offered.

Users of this guide are therefore encouraged to provide comments, suggestions for improvement and other feedback, in writing, to [paul.roberts@ccc.govt.nz](mailto:paul.roberts@ccc.govt.nz).

### 1.7 General Project Overview

The consultant shall adhere to the general good practice overview of a typical model project unless otherwise agreed with the Project Manager, as shown is the following diagram.

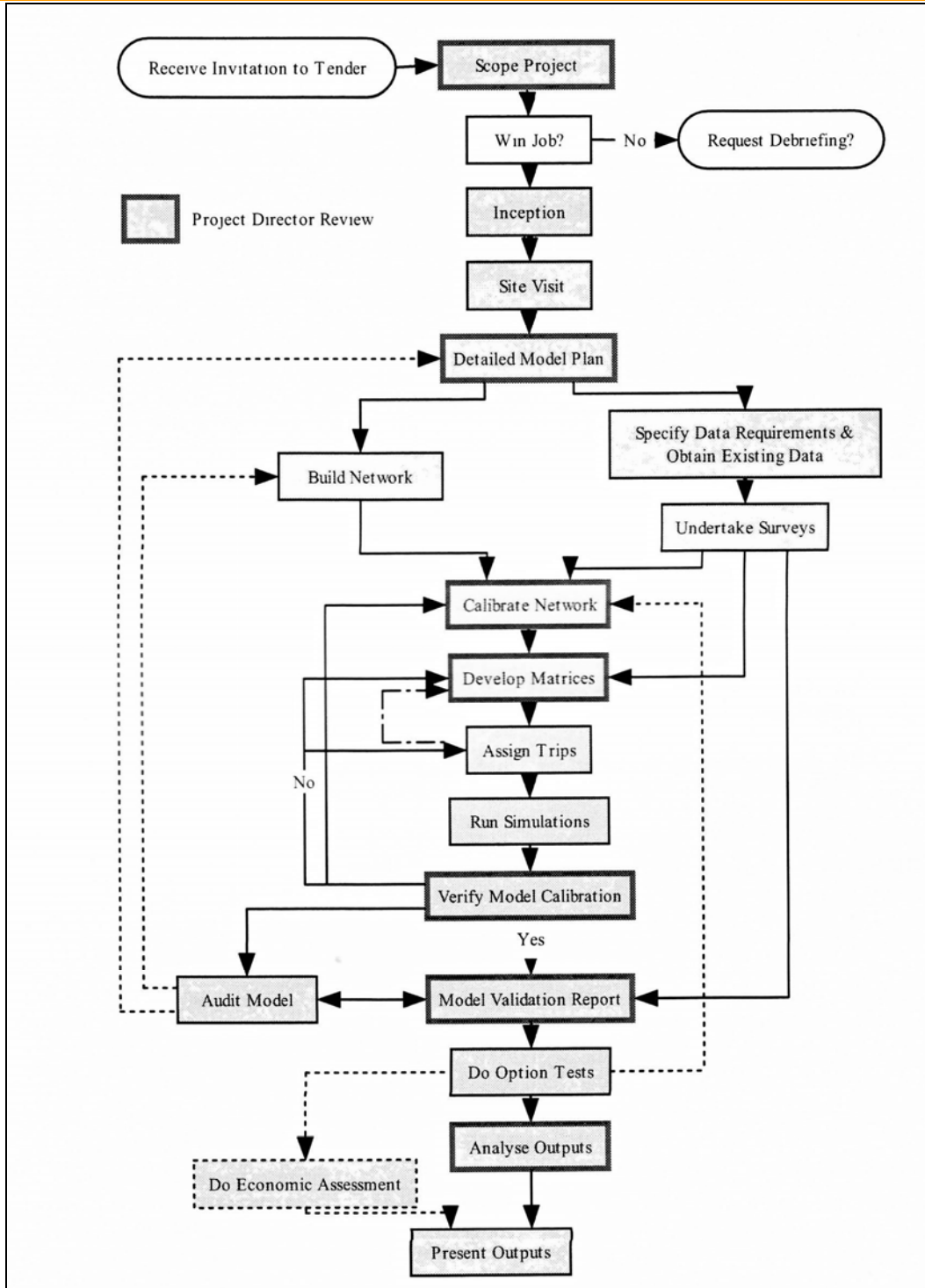


Figure 1: Overview of an S-Paramics consultancy project<sup>1</sup>

<sup>1</sup> Ref: The Microsimulation consultancy good practice guide, 2005 SIAS Limited, Fig 1-2

To achieve this good practice overview the steps in planning the model construction should be undertaken as shown in Figure 2.

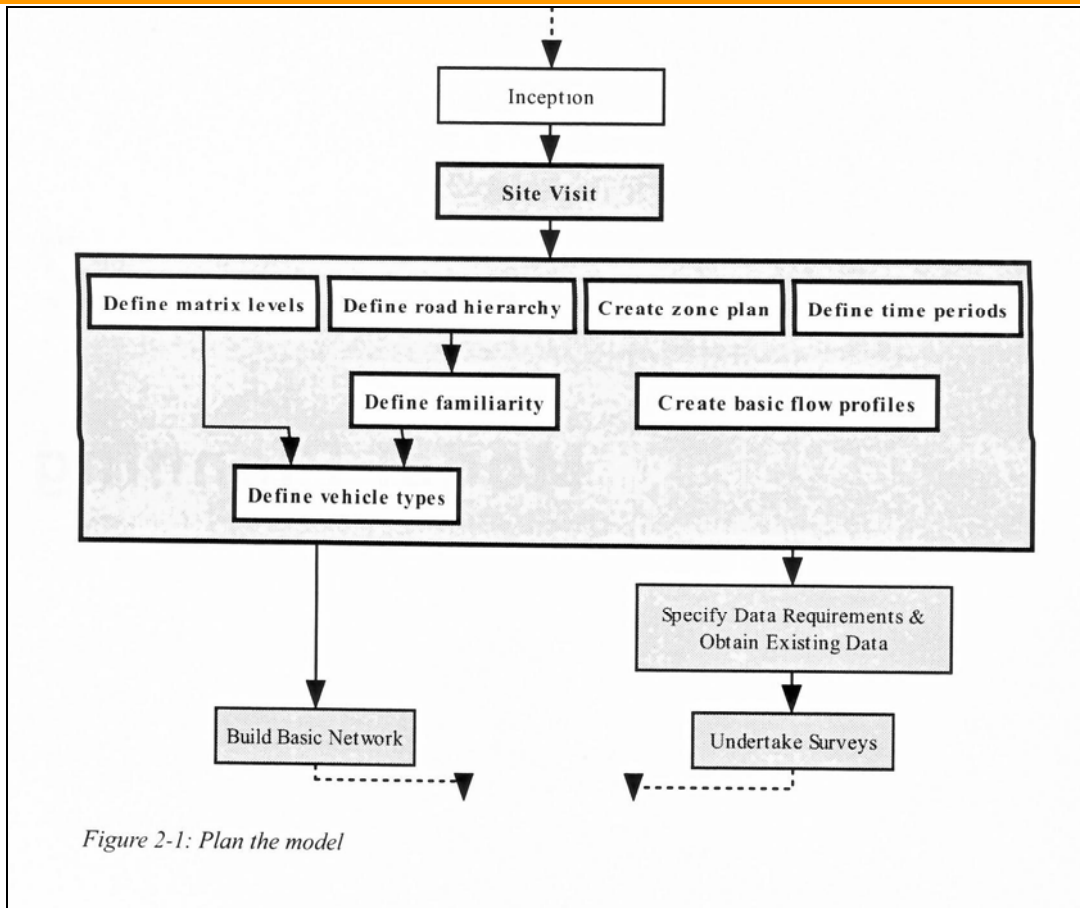


Figure 2: Plan the Model<sup>2</sup>

<sup>2</sup> Ref: The Microsimulation consultancy good practice guide, 2005 SIAS Limited, Fig 2-1

## 2 File Structure

### 2.1 Recommended Directory Structure

Although not all modellers have the same desire to create multiple levels of directories and have data files buried away ten levels down from the root directory, it is strongly advised that you adhere to the following directory structure to ensure that models transfer and join efficiently.

There are two levels of directory structure, the first is the 'external to' model directory, the second is the 'internal to' model directory.

The 'external to' directories house information on demands, digital media, models, RCA Signal Data and the Standard CCC model. These five directories contain information that is relevant to all models but can be either explicitly linked or do not require linking.

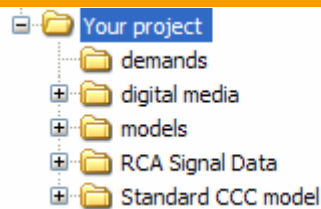


Figure 3: External Directory Structure and Naming

The internal directories to a model directory contain four directories, 3DObjects, Log, period Specific Files and Signal Data. The idea behind having most inputs associated with the model is that when you transfer the model from one location to another that all the input files travel with the parent model directory. Within each of these internal directories are other sub directories which are discussed below.

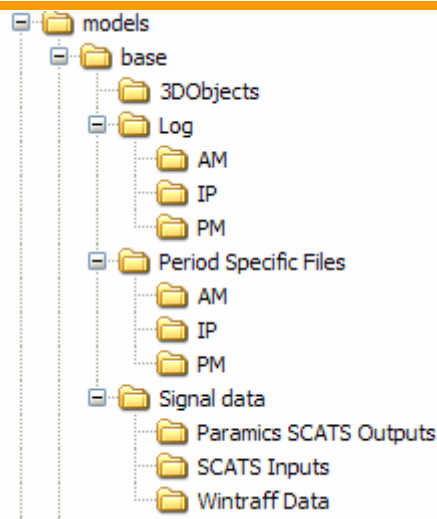


Figure 4: Internal Directory Structure and Naming under 'model'

## 2.2 External Directories

### Demands

This folder is where the demands for the project are stored in either spreadsheets or text files. Usually the ME models and reports are stored here. It is useful to have the demands file under the project close to the model applications.

### Digital Media

When constructing a model the first element to source before construction is usually the aerial mapping or digital media from which your existing base model will be created. The aerials are often provided by CCC or can be purchased from Terralink for use in modelling. The file sizes are extremely large and require the alterations as described in the SIAS user manual for managing and importing aerials.

The result can be large files that can through the textures and annotation file be located anywhere in the drive. Over time, best practice has been that these files sit at the level above the models.

It depends on how many levels of sub levels you may have above your model directory of course, but it should be located in a common place so that all models can access them. It is recommended that the aerials folder be located directly under the 'models' directory, to ensure the link to the aerials folder is retained if the entire 'models' directory is transferred to a different drive. If, however, this link is broken, then the link description defined in the textures file will need to be modified to ensure access to aerial files is retained.

## Models

Under this general directory the parent models are stored, so all model data for each scenario can be transported, saved and perhaps version-controlled easily. It is under the sub directories of this folder that the model scenarios are stored, of which each scenario contains the 'internal directories'.

### RCA Signal Data

External signal data received from the RCA should be stored in this location retained in its 'raw' status. From here copies can be made of the personalities, SCATS files and databases and adjusted in accordance with the guidelines set out in the baseplusFUSE manual. The sub levels below the RCA signal Data directory are relevant to the SCATS files ('SCATS inputs'), the personalities ('Wintraff Data'), the RCA SCATS outputs ('RCA SCATS outputs'), where the SM and VS SCATS should be placed, and finally other files ('other'), where all other data like Traffic control sheets and diagrams should be placed.

### Standard CCC Model

The standard CCC model is top level so as to remain unchanged by the project modelling and is provided so that a model difference can be taken from this model to the constructed models to check the configuration, behaviour, categories and vehicles files to ensure that they meet the requirements of a CCC model.

## 2.3 Internal Directories

---

### 3DObjects

To counter the advice of centrally locating your large digital media SIAS have hard wired all 3Ds objects into a directory under the model directory. Recently the 3Ds of Canterbury and vehicle files have been stored for the CBD model and are available for use for CCC projects. The tiles are not of sufficient quality from which to model from but provide an excellent presentation backdrop.

Better quality 3Ds aerials may be available for particular projects, which are of sufficient quality to be coded from. This might thus negate the need for any aerials folders. This must be decided upon on a project by project basis.

### Log

When you collect statistics, Paramics hard wires the outputs to a folder called 'Log' and then 'run-00X'. X being the next digit incrementally increasing from the number 1. Because of the periodic coding for the standardised model there is a need to either make

copies of the model thus negating the use of a single model or rename the log runs based on what period you have modelled.

The analysis package within the S-Paramics software suite is referred to as the DAT manager. This useful utility only reads sub directories under the 'log' directory of the model that is loaded in DAT, so having any more tiered structure would make it incompatible to use DAT with.

### Period Specific Files

Because the model is split into periods for morning, inter and evening peaks you may want to work on each individually. There is a way of manually changing the measurements and configuration file every time that you want to change periods to either open the model in that period or batch that model to get a run out. However to reduce the manual input and simplify and speed the process there are period specific files held in the AM, IP and PM directories under the Period Specific Files folder. Under this directory are three batch files which copy the content of the relevant directory time period to the mother directory thus ensuring on start up that the model is in the correct period.




### Signal Data

The Signal Data folder is a model specific folder that contains all the input and output files relevant to the various 3<sup>rd</sup> party software components that allow S-Paramics and SCATS to communicate.

For more detail read the baseplusFUSE user and reference manual on what each of these files are and where they should be held.

It is recognised that all models may not have adaptive signals or signals at all in the model. In which case, these directories could be removed.

There are three sub directories under signal data, namely

-  Paramics SCATS Outputs which is contains your model SCATS SM outputs
-  SCATS inputs: which are the holding area for your model and include the System files for SCATS, the graphics database and changes to the system files documents.
-  Wintraff data: holds the personalities for the signals in your model.

## 2.4 Directory Overview

In summary the model directory structure that both supports the model externally and internally is required to effectively store the inputs and outputs for a S-Paramics simulation model. Figure 3 demonstrates a typical directory structure for a single multi period model called 'base' and one option 'option 1'. There can of course be multiple scenarios under this models directory with another level of directories including 'opening year', 'future year 2011', 'option with bypass' etc.

It is strongly recommended that an approach of minimising your copies of your largest files but retaining portability of your model is adopted.

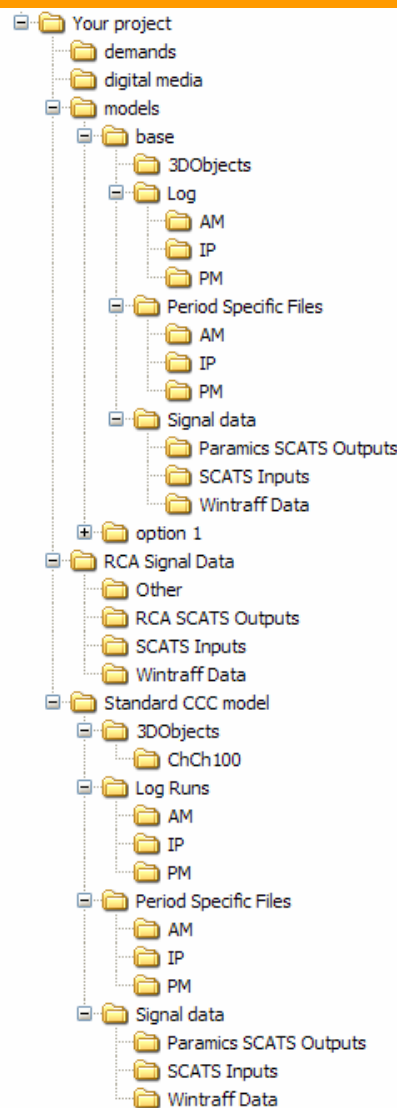


Figure 5: Overall Directory Structure



### 3 Standard Model Files

The standard model files are the S-Paramics model input files based on the Christchurch CBD model developed for CCC. The following is a list of the recommended starting points for model development. If the standardised model and directory structure has been used then the files will require no further editing.

It is strongly recommended that the files are edited within S-Paramics however it is noted that experienced users (who as good practice dictate, make backups of the files before editing) can edit the files with a text editor or within Excel (although the latter is not recommended as excel converts low numbered node to link descriptions as time-format).

The following sections only discuss files where standard CCC conventions are used.

#### 3.1 Behaviour

The 'aggression' and 'awareness' parameters are contained in the behaviour file. The default distribution factors of '1 4 11 21 26 21 11 4 1' are to be retained for both parameters. Varying these parameters changes how individual drivers react to the road infrastructure and more notably each other. They are abstract keys assigned to each vehicle, each one based on an independent normal distribution. In other words, there are no measurable or recorded values for these parameters.

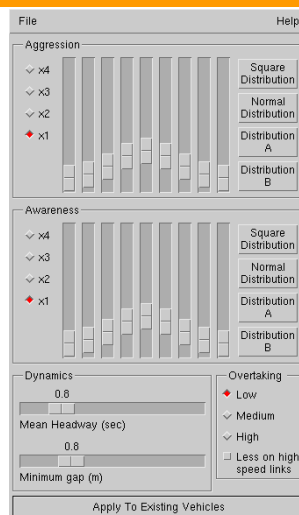


Figure 6: Aggression and Awareness Parameters

The driver behaviour representation is controlled by two factors, namely the aggression and the awareness proxies. These factors during the development of the core software were calibrated at time step 2. The time step is how many times a second the vehicle drivers make decisions. The majority of the core working behind these factors and the

data used to calibrate was observed from the European DRIVE commission study. None of these parameters should be changed without due care, documentation and prior agreement.

## 3.2 Buses

---

### Bus Routes and Schedules




Bus routes and schedules are readily available from the Environment Canterbury web site: <http://www.metroinfo.org.nz/> .

In estimating the departure time from the first stop in your model, the closest stop to the start should be used.

The name of the buses should use the following convention; the name of the route followed by an 'i' for inbound and 'o' for outbound which are relative to the central major hub. For the orbitor and metrostar use 'c' for clockwise and 'a' for anti-clockwise.

### Bus Stops

All the Christchurch bus stops have numbers and it is recommended that these stops be assigned to the appropriate model stops. Furthermore, the type of bus stop used needs to be appropriate to each particular site. Three bus stop types can be used in the model as defined below:

-  Classic – used for low frequency stops. The bus stop is defined at a single point, where following buses are queued until they reach the specified bus stop location point.
-  Fixed – used for high frequency stops where buses can stop at any of defined points along a platform. The bus stop is defined by several points and a bus may wait at any of them.
-  Dynamic - used for high frequency stops where buses can stop at any point along a specified length of platform. The busstop is defined by a length, where buses may wait at any point along this length.

## 3.3 Categories

---

The categories file contains speeds, major / minor, costs factors, colours of the road (for auditing and checking), overtaking parameters, the numbers of lanes and lastly the speed. The only other parameter that is not used in the category file is urban or highway. Because of the definition of highway based on UK driving rules, it is strongly

recommended that 'highway type' is not used for coding normal links. It may be used on a zone connector to improve the loading operation of cars onto the network, but only there.

For the Christchurch CBD, 24 categories have been coded, as summarised in Table 1 below. Grouped in lanes of 4, the speeds range from 55 kph to 20 kph. The ranking goes from 55 kph major arterial distributor roads to 20kph for quiet, traffic-calmed, low attraction access roads.

Application of these categories is strongly recommended to any model development as categories are one of the hardest matches (with the exception of node numbers) to do.

Where the modeller considers that the cost factors or other parameters may be inappropriate CCC require a "duplicate" of an existing category to be taken and modified accordingly. For example, if a Major 55kph was appropriate but a Cost Factor of 0.9 deemed more appropriate, then the modeller should create category 29 (or higher) from category 1-4. This will assist in auditing non-standard elements of models.

Any additional categories created should be reported to CCC and consideration will be given to inclusion with subsequent issues of the standard categories file.

Category	Cost Factor	Major/ Minor	Speed	Description	Colour
1 -4	0.8	Major	55	Main Distributors(Bealey, Moorhouse, Fitzgerald)	red
5 -8	0.8	Major	50	One Ways	orange
9-12	1.0	Major	45	Secondary Major	green
13-16	1.3	Minor	35	Access major	purple
17-20	1.6	Minor	25	Access minor, calmed	Light purple
21-24	1.8	Minor	20	Loading, access only	yellow
25-28	1.0	Major	40	Special Speed Zone for Schools	pink

Table 1: Category Classification




The above classification reflects the practical function of the road rather than the statutory hierarchy as presented in the regional plan for Canterbury and Christchurch. In particular, note that the major/minor description has no correlation to City Plan hierarchy, but rather affects the routeing behaviour for that link. In general sign posted routes should be composed of major links and other routes of minor links.

### 3.4 Configuration

---

The configuration file holds the key operational input parameters to the model operation.

The time step should be retained at '2'. The default release style of precise should be retained. A standard definition of queue criteria has been developed as follows:





-  General: Vehicle queued when: Speed 7 kph, gap 5 m, both toggled; Vehicle no longer queued when: Speed 7.5 kph, gap 6 m, either toggled
-  Other settings: min length 2, recurse 8, toggle off 'include signalised links in non signal queues'.
-  Multiple queues: Joining all the queues together toggled.

The mean headway should be set to 0.8.

A network minimum gap at 0.8 should be used for versions 2005.1A and earlier, and a value of 1.6 should be used for version 2006.1 and onwards. (Note that version 2006.1 is not currently recommended for us, see 3.12)

NZ left turn should be enabled.

The following signal settings should be used:

-  Signals red to green time should be set to 0.0 seconds [default 2.0]
-  Signal movement start delay should be set to 1.0 seconds
-  Signal movement stop delay should be set to 4.0 seconds
-  Signals green to red time should be set to 2.0 seconds

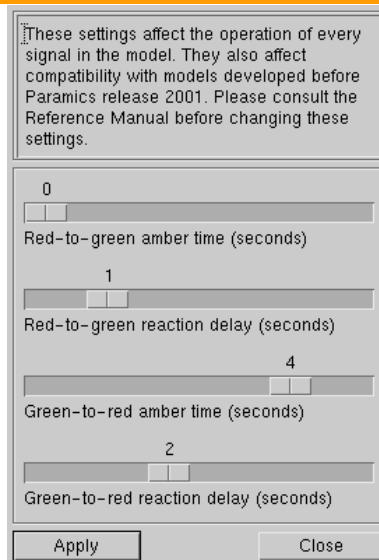


Figure 7: Recommended Signal Settings

Other parameters included in the configuration file, such as feedback period and coefficient, cost coefficients, start time, simulation time and the colours can change as per model development requirements but any variation to the standard model file must be highlighted within the calibration report, with reasons given. These parameters are further discussed in section 4.11 of this report.

The configuration file is one of the three periodic files held in the periodic file directories and should be edited in all three if any changes are to be made.

### 3.5 Controllers

The controllers file is set to have the SNMP port set to 2100 to ensure that the model is configured to talk to FUSE and then on to Wintraff and SCATS. This file has no bearing on operation of the model and should therefore be left intact.



Figure 8: Controllers File

### 3.6 Detectors

#### Location and Shape

Current best practice is to code detectors at 5.0 m in length and that the end of the detector is placed adjacent to the stopline.



Where an exit detector is present the end of the detector is 11 metres forward of the stop line, meaning that the start of the loop is 6 metres from the stop line exit. This is illustrated in the following example diagram.



Figure 9: Example Detector Layout at Intersection

The detector should be entered as a shape not on the link, this allows the detector to be placed anywhere in the model, not just along the link boundary. This is important for detectors over nodes that are not in the link.

In coding detectors for use with SCATS, the following is offered as good practice:

-  Ensure that the detector is completely within the link
-  Test each detector with vehicles to ensure that each vehicle is detected and no errors are reported on the detector

## Naming

The detector naming works on the principle of 'TCS number\_detector number', for example at TCS 201 and with detector number 7 the detector name is '201\_7'.

It serves as a check that if you enter the same detector name as the TCS number and detector then the two rows should be the same, this allows then for detectors to be checked quickly and also to be named differently if required.

### 3.7 Measurements

---



Although the periods change and so do the collection times, a standard measurement file is evolving to meet the requirements of most modelling requirements. It is still evolving as are the tools with which to analyse the outputs.

The most frustrating aspect is that if you require a 3 hour model link flow and a 1 hour link flow through DAT you must collect a 3 hour model and then run again to get the 1 hour, there is no method as yet of aggregating data in DAT. However, the 2007.1 version, due for release in July, is reported to have the functionality for time aggregation in DAT. The external method of using excel is achievable but it comes with its own set of problems.

CCC are currently investigating ways to standardise the measurements and reporting of Paramics, as are most consultants. The XLM schema (a standard or guideline template for reporting) prepared by the FHWA may provide guidance to this guideline and is currently being investigated.

The measurement file is one of the three periodic files held in the periodic file directories and should be edited in all three if any changes are to be made, unless it is simply that the collection time changes.

The following is a recommended minimum and by no means exhaustive list of statistics to be collated when running a model.

-  Snapshots; usually collated at 15 minute intervals
-  Turncounts: interval dependant on statistics that require collating; baseplus, as a standard collate these in five minute intervals and aggregate up to desired periodic intervals using excel.

Within the measurements GUI it is imperative to ensure that if bus statistics are required that the buses themselves are included in the output files. **File>>Buses** will enable the modeller to select or deselect the buses to be included in the output statistics.

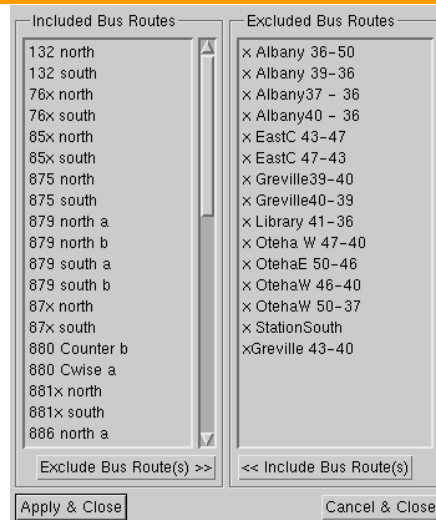


Figure 10: Bus Inclusion/Exclusion window

### 3.8 Nodes

#### Introduction

It is the intention to allow seamless merging of S-Paramics models created for Christchurch City Council. The nodes file is one of the core files that must be both uniquely referenced and be on the same co-ordinate system. Every modelling component starts with the node, from link, to kerb to stop line to mapping of signal movements.

#### Prefix

To enable seamless transition with unique referencing a prefix to the node is highly desirable so that it remains unique but also when opening files in Excel (particularly output) the lower node descriptions do not get converted to the time format.

The prefix could be as simple as a letter or combination of letters to assist with project identification. To manage the prefix database a HTML page is presented in the CCC standards area which contains all the approved CCC node prefixes at the outset of project, unless specified in the brief. Approval should be sought from CCC on the prefix to be adopted for a particular model.

NOTE: currently the web page is not created, however the following are reserved:



CCC project	Prefix for Nodes
CBD	a
Colombo Street Bus Priority	bpc
Papanui Road Bus Priority	bpp
Queenspark Bus Priority	bpq
Bealey Avenue	None required part of CBD with existing prefix 'a' as above
FerryMead Bridge	fm

Table 2: Node Prefix Table

## TCS

Another useful node naming convention is to name the signalised node the TCS (traffic control System) number, for instance the Tuam and Montreal intersections in the Christchurch CBD model is TCS 2, the nodes for this junction are nodes 2 and 2a. All the TCS junction names are represented in the CBD model as per the TCS name, so the traffic engineer who is familiar with the network can navigate quickly around the model.

In addition cross checking the signal mapping and movements as well as a systematic numbering system for signal nodes is highly desirable.

## Methodology

Retrospective naming of nodes is increasingly difficult based on the number of coded inputs, as stated in the methodology everything is referenced directly to the node or to the link which is referenced to the node. It is possible to achieve a retrospective prefix naming convention but numerous files must be edited, cross referenced and resolving the errors can be time consuming.

Rather than retrospectively fit the model a suggestion is made to create nodes unattached to another node, save the model and rename the node externally to S-Paramics using a suitable text editor. A spare node repository is suggested in the model form to allow mass renaming for use through model calibration.

## Recommendations - Creation

- 15 In the standardised model download create additional nodes without attaching them.
- 15 rename in a text editor all the nodes with a pre-agreed prefix
- 15 rename some of the those nodes with the actual TCS name (known before model creation)
- 15 Place your TCS nodes in the model, place the first pass nodes in the model.
- 15 Connect the nodes with the appropriate link classification.

## Recommendations - Editing

Without a prefix, splitting a link will create an automatically named node, this of course will not have a prefix. It is suggested then if a new node is to be inserted onto an existing link, then that link is deleted, a prefixed node (previously created) is placed and then re-connected to the existing prefixed nodes.

## Summary

It is accepted that the additional time in agreeing a prefix, checking that the prefix doesn't exist anywhere else, the creation and renaming of nodes and then manually placing them is time consuming. However, the time saving if and when the model is merged will become apparent. Please remember that the prefix naming is only required if ultimately it is to be merged.

## 3.9 Periods

---

The periodic files are related to the times of the day that require modelling. The periods file contains the period number, name and start time. It is recommended that you adhere to these periods as they match the CBD. Remembering that changes in the periods affects the following files: priorities.X, links.X, demands.X (where X denotes the period) and also affects how the profiles assignments work in the profile and matrix files.

	Start Time	Label	End Time	Duration
Period 1	06:30:00	AM Warmup	06:59:59	00:30:00
Period 2	07:00:00	AM Peak	08:59:59	02:00:00
Period 3	09:00:00	AM Flushout	09:29:59	00:30:00
Period 4	09:30:00		12:59:59	03:30:00
Period 5	13:00:00	IP Warmup	13:29:59	00:30:00
Period 6	13:30:00	IP Peak	15:29:59	02:00:00
Period 7	15:30:00	IP Flushout PM Warmup	15:59:59	00:30:00
Period 8	16:00:00	PM Peak	17:59:59	02:00:00

When carrying out coarse adjustments such as adding, splitting and deleting periods Paramics will adjust most existing periodic data within the model. However, such adjustments are made purely to ensure the consistency of the data and will not necessarily result in the desired periodic differences. Demand related data in particular will need corrected separately after such changes. It is recommended that periods be defined as early as possible in the modeling process.

Model Start Time: 3:06:30:00      Duration: 02:30:00      Apply      Close

Figure 11: Periodic Setup in S-Paramics

The periods file should not be edited externally. S-Paramics does a very tidy job of cleaning up surplus files and reporting differences between periods.

### 3.10 Units

The units file contains the preferred measurement system for that model. The recommended mode for New Zealand is metric and thus the units file should not change.

### 3.11 Vehicles

The standard vehicles file contains cars, cars with trailers, small, light and heavy good vehicles, B-Trains, Large Articulated vehicles, single deck buses of various colours to depict which Bus Exchange platform they use and even the Christchurch Tram. CCC believes this is a comprehensive vehicle type list and any variation to this file should be reported in the calibration documentation.

It is accepted that vehicle proportions may vary by destination. Such differences may be modelled through use of different matrices and consequent vehicle types which allow the use of vehicle destination restrictions. This is permitted within reason accepting that it dramatically increases the processing time due to the increase in number of routing tables.

The vehicle proportions attributed to each matrix total have been derived from other studies and it is permitted to change these percentages based on observed data or estimates with agreement of the CCC project manager.

### 3.12 Version

---

The latest S-Paramics version is currently version 2007.1, recently released in July 2007. However, it is advised that S-Paramics version 2005.1a be used for all modelling undertaken for CCC, until later versions have been fully evaluated.

It is recommended that SPx Version 2007.1 be used. In this version of SPx the Paramics version selected will, by default, be the version defined in the versions file of the model.

Users should be aware that BaseplusFUSE will run the Paramics version that is set in the baseplusFUSE configuration file, rather than automatically using the version of the model selected.

### 3.13 Vshapes

---

The associated vehicle shapes file allows for the vehicle shapes to be seen for presentational 3D shots and should not be adjusted unless you can find better car shapes than supplied!

## 4 General Modelling Guidelines

---

### 4.1 Use of the Standard Model

---

It is strongly advised that you start with the standardised model setup so all the parameters as described in this guide are set. If the model development has commenced copy and over write the files required, such as configuration, categories (with care!), vehicles and behaviour.

Then use the 'model difference' reporter in the SPx tools box and compare your model to the issued standard CCC model, this will report on all the differences between your model and the standard model. Focus on the vehicles, categories, configuration, and behaviour files.

### 4.2 Bounding Box

---

There exists a new tool named 'model mover' within the SPx software that allows whole models to be moved by whatever X,Y co-ordinate required. There are two methods that can be employed using this new tool in constructing the network.

1. Work with the co-ordinate system from the standard model, this way the reference to the CBD is absolute.
2. Work from 0,0 and then on completion move the model using this new facility to match the CBD.

The second method would result in a common point being identified then the new model translated to the X and Y. It is assumed that the new model would be orientated to the north as there is currently no rotational functionality in the model mover.

### 4.3 Model Development Notes

---

Appendix A contains the baseplus model development notes version 3.4 which are a prompt for the modeller to document non standard changes to model form, background information on the demands, study area, purpose etc. This provides the platform for a calibration report and if used early in the project development, a model scoping report.

### 4.4 Annotations File

---

The annotations file contains mainly detectors and road names. This file requires no standardisation, but it is recommended that a good description of the model is entered however to allow for easy identification.




### 4.5 Bus Stop Dwell Times

---

If the focus of the model is on public transport regarding buses, then it would be expected that the model will represent on-street bus operation as accurately as possible.

The aspect of bus stop dwell times may be particularly important if future scenarios involve changes to bus stop dwell times or change the way buses merge with the general traffic stream.

In this regard, consideration should be given to the following areas

-  What actions the surveyed bus stop dwell times include and exclude.
-  The time taken for buses to merge into the general traffic stream, and how this is modelled in S-Paramics.
-  Whether buses that do not stop at every bus can be coded to "pass by" the bus stop, as opposed to simply including the pass time of "zero" in the set of data that is averaged to make the bus stop dwell time.

### 4.6 Links

---

#### Periodic Differences

As one of the time dependant period files, the links file period 1 holds all the link data. Any subsequent deviations from "links.1" are stored in that relative period file. This is

particularly useful when modelling clearways or time dependant operation lanes, say for instance HOV or bus only lanes.

Often link attributes are unintentionally changed in periods other than period 1 when the change is intended to be applied to all periods. The modeller should regularly check periodic differences to ensure such errors are remedied and avoided. This is done through the **Editor** >> **Show Changes** as shown in the figure below

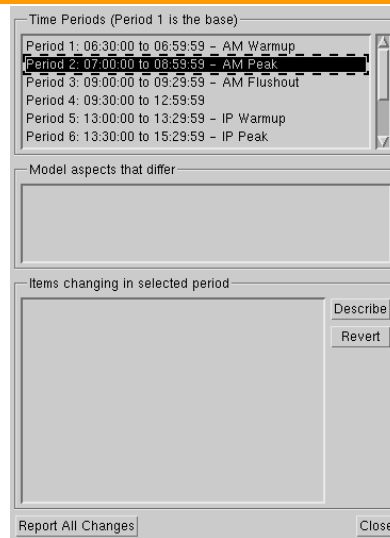


Figure 12: Periodic Differences Window

### GA Look Next

An often overlooked link flag is GA look next. GA look next should be used on links that are short links upstream from the minor approach on priority intersections.

The figure below illustrates where GA look next should be applied a simple T-intersection.

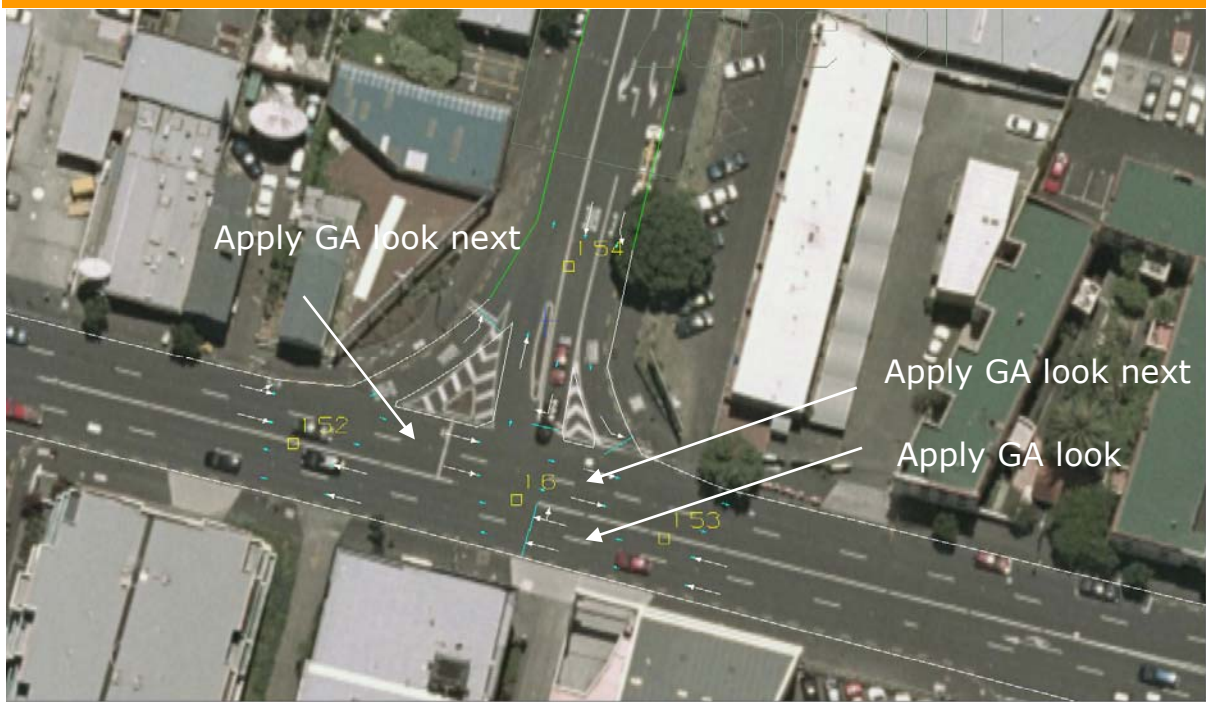


Figure 13: GA Look Next Function Example

#### 4.7 Priorities

##### Priority Controlled Intersections

It is imperative to ensure all intersections are given the correct priority, especially given the New Zealand Left Turn rule application. An example of a four arm intersection with priorities is presented in the figure below as a guide. Priorities for priority controlled intersections should not change between periods unless you have time dependant movement bans.

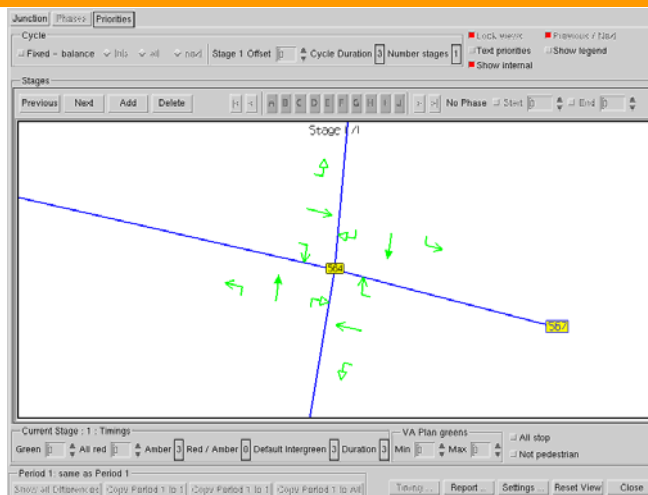


Figure 14: Four Arm Intersection Priority Example

## Signal Controlled Intersections

The use of baseplusFUSE within models replaces signalised nodes with flow controlled nodes. Such models no longer have signal phasing and timing data for SCATS controlled intersections in the priorities file.

The "all red" time should be reviewed in all models, or at signals in models that are not run with baseplusFUSE. Owing to a known bug in S-Paramics 2005.1 regarding amber gamblers it is appropriate to add two seconds to the "all red" time.

Although version 2006.1 is not recommended for use due to known bugs, it should be noted that the ambler gambler issue has been resolved in versions 2006.1 onwards.

### 4.8 Profile Smoothing

At its simplest there would be no profiles added to the model. This is not recommended. Each model should be profiled, that is the release of vehicles are controlled according to one or more profile calculated directly from the observed turn counts.

Generally observed turn count data consists of fifteen minute observations. Profiles created from this are then averaged to five minute profiles by dividing the fifteen minute percentages in to three. A more accurate method of smoothing could also be employed by interrogation of Metrocount data from observed link counts.

We recommend smoothing of these profiles, manually, to better reflect the release of the vehicles from over the fifteen minute period and from one fifteen minute period to the next. An example is provided below where the profile for the period from 7:30 am to 8:30 pm (shown in red) is smoothed.



Figure 15: Profile Prior to Smoothing





## Survey File Input File

As with other similar ME process, S-Paramics draws on both link flows and turn flows as targets to estimate to.

The user should generate a survey file template using the Matrix Estimator, and then specify the link flows and turn flows that the user wishes the Matrix Estimator to use as targets. Subsequent to this it is essential that the survey data is checked for discrepancies. Link count differences between junctions must be eliminated prior to the creation of the survey file.


## Prior Matrix Input File









S-Paramics has the ability to generate an entropised matrix. An entropised prior matrix is basically a yes / no matrix. The cells within the matrix are either zero or a selected integer, and therefore provide no information about the actual number of trips that will eventually be assigned to each cell of the final matrix other than whether or not there is or isn't any trips between the OD pair. However, Christchurch City Council strongly recommends this is used as a last resort. A prior matrix from a higher tier model should be employed and manipulated as necessary, but care must be applied when disaggregating such a prior matrix generated from windowing larger zone strategic model, particularly where zone connectors in the strategic model may represent external zones within the S-Paramics project model. If the OD trips require to be seeded before matrix estimation, then an integer value must be used. Hence this value will depend on the divisor, but as a minimum will need to equal the divisor.

## Routing File

The routing file (routing information file) tells the Matrix Estimator the proportion of OD demand that traverses each link and turn.

There are two possible routing file types that can be collected during a model run. These are the Pija file and the trips-linkdelay file. For more information on the Pija and trips-linkdelay file refer to Chapter 8 of the *Microsimulation Consultancy Good Practice Guide*. Christchurch City Council recommends the following points be adhered to when compiling the routing file:

-  An accurate Routing File cannot be collected until the modelled network is reasonably complete and accurate.

-  Matrix estimation should not be used to rectify deficiencies in model coding. It is imperative therefore that the ME process is only applied to a thoroughly checked network. If changes are made to the base network subsequently then the ME process shall be rerun to ensure compatibility of output matrices with input network capacity.
-  The pija file should be collected if no existing prior matrix is available.
-  Signal settings should be fixed as per IDM for each period, before collecting routing pija files. If B+Fuse is adopted then the model needs to be run in fixed time when doing matrix estimation. This can be achieved in B+Fuse by applying flexilink or fixed time plans in Scats. If the signals are not set to fixed time then the ME/Network capacity has two dynamic processes and the "solution" (matrix output) may not reflect true capacity if the signal settings change to suit.
-  However, for specific advice regarding routing file collection with B+Fuse, then refer to B+Fuse User Manual.
-  The number of vehicles specified when gathering a Pija should not be less than 100.
-  If feedback is enabled in the model the trips-linkdelay should be collated, feedback should not be enabled if using an entropised matrix.
-  By viewing the routes between OD pairs within ESV you can assess whether this is a realistic route based on local knowledge. Clearly if you have unrealistic route choice at the start, ME will not solve this.
-  Use the prior matrix as a demands file for the simulation run used to collect the routing file but limit the demand in the model to reduce the possibility of any grid lock occurring in that run.

### ***Constraints File***

The constraints file is optional within S-Paramics ME, however Christchurch City Council considers its inclusion as compulsory to prevent improbable distortion of the prior matrix.




### ***Running the Estimator***

Load the four files into the Matrix Estimator. Review the survey file inputs and the prior matrix and constraints in the GUI.

Set appropriate convergence criteria, and run the Matrix Estimator. Usually convergence criteria would be in the region of 100 – 200 iterations and for 100% of assignments to be within a GEH of 5 of the target value.

### ***ME Output Files***







The outputs of the ME process are the demands file and the report file.

-  The report file contains the GEH comparison for each run. First check which estimated counts have a zero value where there would be expected to be a value. These instances highlight that there is a routing, zone, or prior matrix issue as no vehicles are making that target count. This will have had a major effect on the ME process hence you would not further analyse the demand matrix. This needs to be addressed by checking the input files and then re-running ME. To resolve the issue being related to the prior matrix, then ensure all legitimate non-zero cells are seeded in the prior matrix.
-  Once all zero OD values are accounted for, the user should start to interrogate the new Matrix Estimator demands matrix. The major issue is to seek out large OD cell values. (The Matrix Estimator has the tendency to shorten trips to match target counts). If satisfied that there seems no major dump of trips to a particular cell, you can now load in the new demands matrix into ESV and run and assess. Comparison of Prior and Estimated Matrix trip length distribution histograms is good practice.
-  Note that Matrix Estimation is undertaken on a static run (i.e. a run with no route choice and no dynamic signal output) and therefore may not produce the same GEH comparison as your modelled run validation (particularly with large feedback models). There may still be calibration issues to perform to obtain robust base model matrices even after Matrix Estimating.

## 5 General Network Construction Guidelines

### 5.1 Zone Connections

The modeller should ensure the following coding techniques are used for zone connections:

-  The first node must be coded as a zone connector [link turns green when you depress "shift Z"].
-  If vehicles need to load at speed, the connection link should be coded as a highway link to control the speed and loading position of the vehicles. Code the link by toggling highway rather than using a highway category, to ensure attributes are consistent with the next downstream link
-  Zones and their corresponding nodes should be positioned to ensure queues do not extend back into zones.
-  At least one node is coded between the zone and any adjacent junctions.
-  Link restrictions should not extend back into zones.
-  Zone connection links should be long enough to accommodate the length of the longest vehicle type included in the model. The longest vehicles types in the Standard CCC model are B-Train at 15.40 m, and the Christchurch Tram at 23.00 m.

Where zones are connected to the model via more than one link, it is recommended that care is taken as to the proportion of vehicles that are assigned to each link using the link modifiers "*Release Rate*" and "*Release Rate Lock*".

### 5.2 Right turning bays

One of the areas of weakness in S-Paramics is that the signposts (hazards) do not overlap. If you have a junction approach with three lanes, the third being a right turn and this occurs for say 30 metres, on approach to that you have a 2 lane section. There are now two hazards, the first from the junction states, if you want to turn right at this junction you have to be in lane 3. The second, which occurs at the lane gain, states "widen". So on approach to the junction on the 2 lane section, the vehicle ONLY sees that there is widen coming up, the vehicle does not see the lane choice at the junction ahead. So the vehicle is perfectly entitled to be in lane 1 or lane 2. Refer to Figure 11 as the default case.

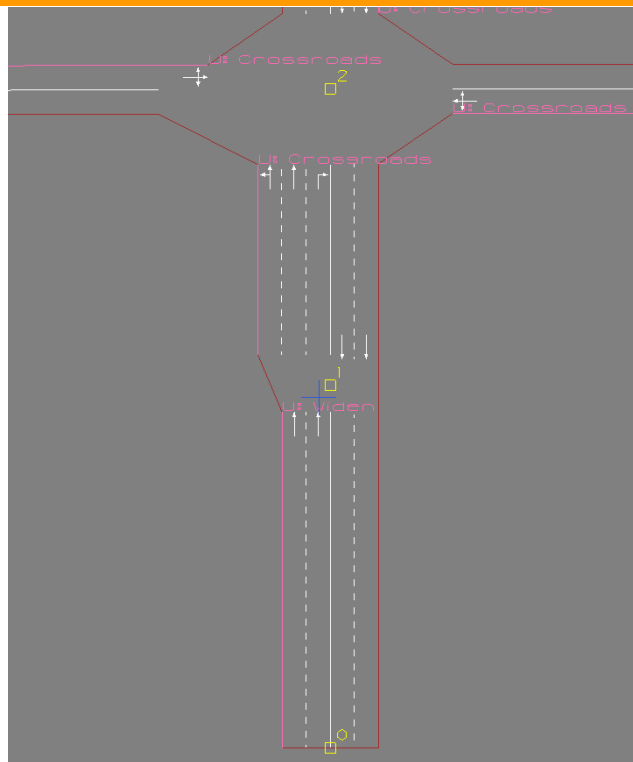


Figure 17: Default signposting

In a congested situation, the right turners should really be in lane 2 on approach to slip in to lane 3 at the junction.

The lane choices are critical, you could over ride by using a wide end and next lanes (refer to S-IAS S-Paramics user manual to see what effect these have). The end result is shown in Figure 18.

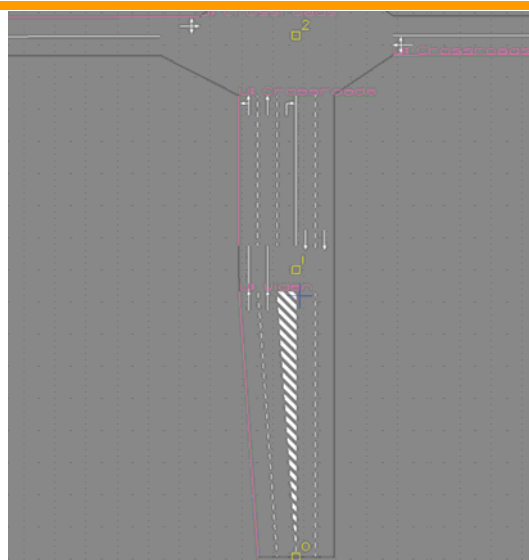


Figure 18: Next laned and wide end to influence lane choice

The result of a wide end and nextlanes is a right hand lane gain for the right turners and that you must use lane 1 from 1 over node 1 and lane 2 to lane 2. This still does not influence route choice because the aforementioned widen hazard is still stopping the junction hazard from getting down to node 0, thus allowing the right turners to get into lane 2 earlier.

There are two methods to over come this, split the right turn lane and lane closures;-

Splitting the right turn lane into a single lane thus forcing a decision point and removing the hazard for widen. See Figure 19 for the screenshot of a split link.

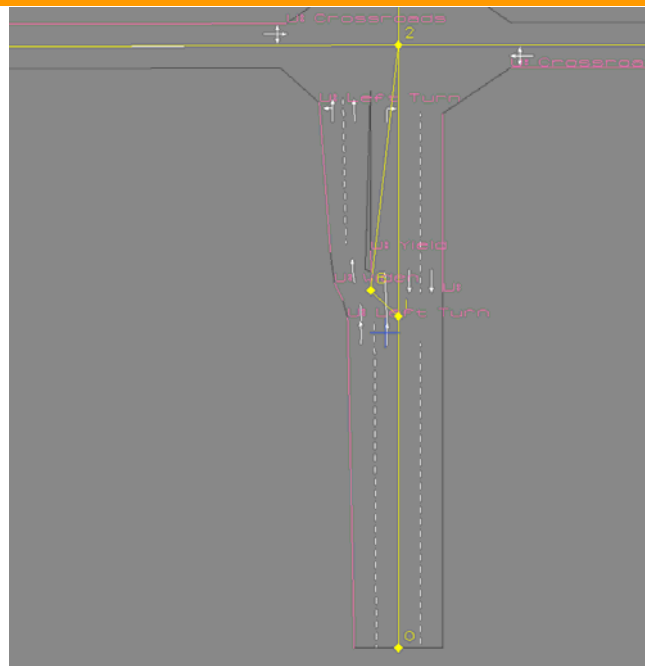


Figure 19: Split right turn lane

In Figure 19, the amount of additional coding is substantial, replacement of most stop lines and kerbs, creation of additional nodes and small links. The benefit is that the route choice, not lane choice now goes to node 0 which will result in all right turning vehicles being in lane 2 at node 0 and splitting off to the left if they go straight ahead or left at node 2.

The second method of adding a third lane to the two lane section to remove the hazard "widen" and close the lane and adjust the kerbs and stop lines so that visually it looks the same as a two lane section. This works well for either a left hand lane gain or right hand lane gain as both examples in Figure 20 demonstrate.

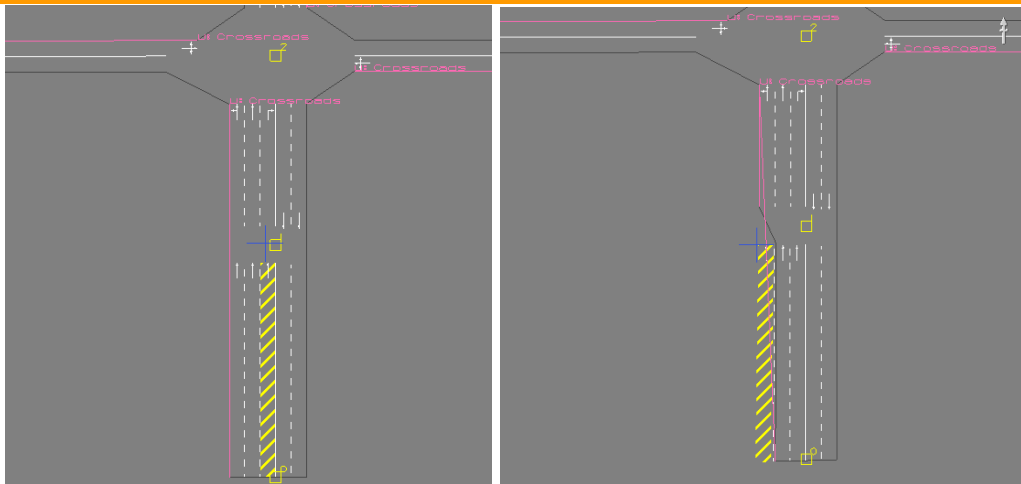


Figure 20: Addition and closures of lanes (left and right)

The benefit with the closed lane method is it is quick to code yet results in, much improved lane choice due to correct hazards rather than route choice imposed by a split link and the ability to choose a left or right hand lane gain, remembering that the defaults over a node are lane 1 to 1, lane 2 to 2 and lane 3 to 3.

In conclusion the method you adopt is reliant on the demand turning proportions, the lengths of approach and how readily you wish to adjust the model. Whichever is adopted it is better than not allowing the correct lane choice on approach to a junction, so it is recommended that the default widen does not prevent the junction hazard from informing the vehicles of what lies ahead.

### 5.3 Using Restrictions

Before attempting to add lane restrictions it is imperative that the causes of the inappropriate lane choice are taken into account. It is not recommended to use restrictions to influence lane choice at intersections.

However, it is permissible to use vehicle type restrictions to influence route and lane choice based on either destination or vehicle type. This practice overcomes the issues of lane choice raised in section 5.1 and the more strategic long approaches where it is observed and known that vehicles queue in a certain lane to make a certain movement even though alternative lanes are available.

This practice is achieved by dis-aggregating the matrix by specific destinations and assigning various vehicles types to those matrices. Then those vehicle types are restricted from using various lanes to influence destination lane choice. It can increase the processing time to re-calculate routes due to the increase in routing tables due to restrictions.



## 5.4 How to Cordon a Large Model and extract demands

You may be asked to use a large S-Paramics model and cordon out a small area for analysing a junction or smaller area. The key element is getting the demands out from that area with the larger assignment and route choice. There are two methods for extracting this demand information: One with route choice and one without, the easiest is the method without route choice and is described first. The method for restricting route choice outside of the area is discussed after the two demand methods.

### Demands Extraction without Route Choice

If no route choice is available, use paths to cover every path from every OD pair in each direction. Although time consuming to construct and name appropriately the information afforded to the modeller with the paths outputs is extremely useful. From this output you can derive travel time ranges, speeds and crucially the demands in various time slices and a huge bonus in determining the release profile from each zone.

Refer to the S-Paramics user manual for entering paths.

### Demands Extraction with Route Choice

Because there may be multiple routes between an OD, it is impractical to cover all possible routes for all origin and destinations in both directions. The only way to achieve the number of trips from each Origin to each Destination is to use Select Link Analysis (SLA) on each exit link from the network.

Undertaking SLA requires collection of the *vehicleroutes.csv* file. The common mistake made with this method is that the full path analysis collection isn't turned on. By default it's off because as you will see it's a disk space eater! Turn this on as follows:




```
Edit>>measurement>>full trip analysis.
```

This option toggled on, will generate a file called *vehicleroutes.csv*, this file could be used in the standard SLA (method 2) but has the ability to produce a set of bars for the trips between all origin and destination pairs which travel through the selected link(s). This can be checked and reviewed using the DAT manager; however you should use the output CSV file from which to generate the new OD matrix from.

Refer to page 15-53 in the S-Paramics 2005.1 user reference manual

### Network Cordon

Once the demands have been extracted from the area wide model, the network requires windowing. This includes the following:

-  Delete the existing zones, by simply deleting the zones file and reloading the model;
-  Enter the new zones;
-  Remove all external route choices from the model.

There exists multiple ways by which to restrict route choice, the most efficient is to delete everything other than the small area you are interested in, but then any options that you may want to test in the small area within the larger area have to be duplicated in the larger model separately. This method is not advisable.

The second method would be to disconnect the links around the periphery of the cordon area therefore removing any route choices, for wider area impacts with the changes, simply re-connect the broken links to the larger model. Again this can be troublesome and is not advisable.

The third and most efficient way is to create restrictions on external links to the wider model. One set of restrictions that is very quick to implement are closures but then all of the buses that may have used your cordon area now require re-coding. So an adaptation of this method would be not to use closures, but use bus only lanes, this method retains the bus routes from the larger model and allows them to pass through the cordon area without having to recode the buses. This however can be improved on again as it's time consuming to take out the bus only lane restrictions.

If you are to drop in and out of the cordon area to the larger model, it is strongly suggested that the modeller create a restriction that allows nothing but buses. That may seem on first reading the same as entering bus only links, however the important distinction here is that the restrictions file can be copied with that restriction lifted thus making it fairly slow to implement but very quick to remove and replace the restriction.

## 6 Calibration Report Requirements

Current standard practice in New Zealand for the Calibration and Validation of microscopic traffic simulation models is to meet the requirements of Land Transport New Zealand's Economic Evaluation Manual – *Volume 1: Worksheet 8: Transport Modelling Checks*.

In addition to these requirements, CCC has calibration measures which are to be included and adhered to. For clarification, as part of a project brief CCC will provide Reporting Specification Summary Tables, which define the mandatory measures to be included in the calibration and option report.

The rest of section 6 further describes these measures and provides illustrations and tables of examples for reporting calibration inputs, calibration criteria measures and option comparisons.

### 6.1 Mandatory Calibration Input

Christchurch City Council expects as a minimum requirement that microscopic traffic simulation calibration reports submitted should include the following information with respect to model input data.

#### Model Area

A model area diagram must clearly show the link and zone system against a suitable topographical or aerial background.

#### Matrix

If the ME process is adopted then a comparison graph should be included to show differences between the origin and destination trip ends in the prior and final matrix, as shown in the example below.

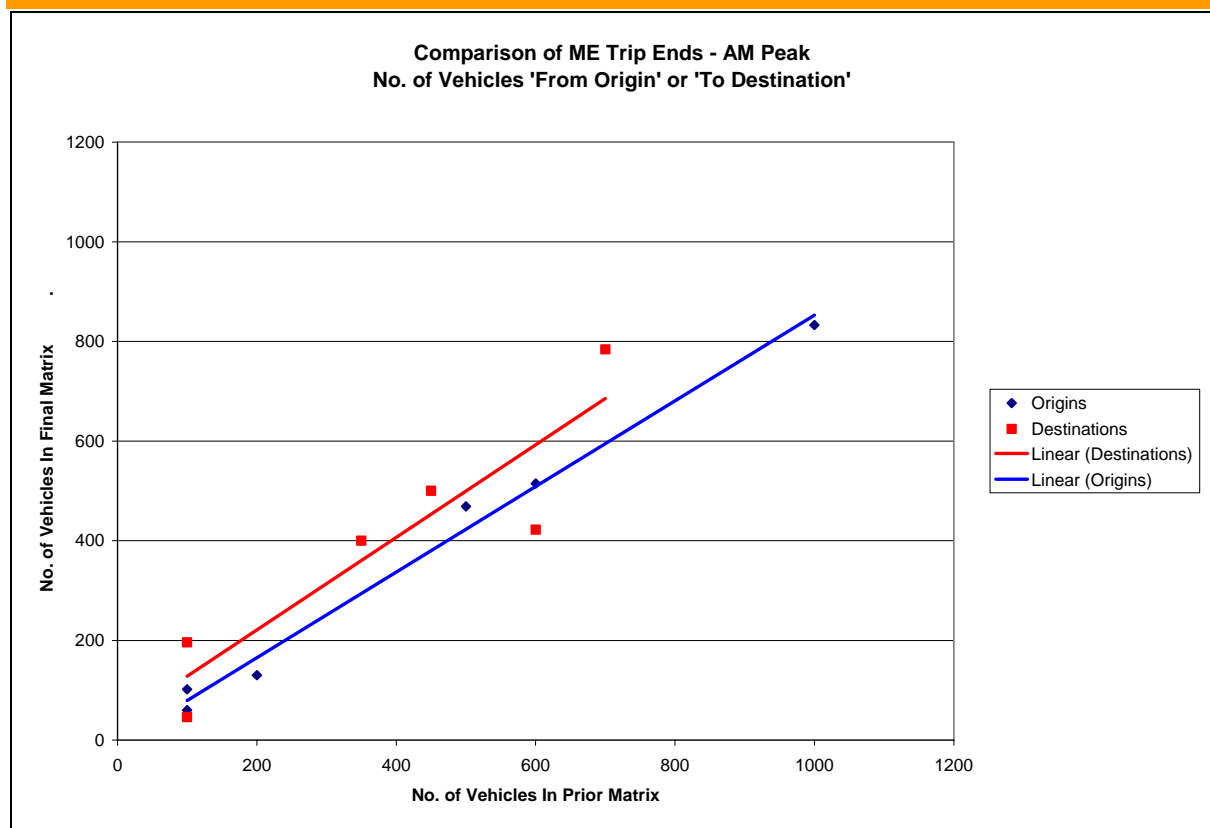


Figure 21: ME Process Comparison of Trip Ends

In addition, a comparison trip length distribution histogram will confirm how closely the Estimator has managed to fit the Estimated Matrix to the Prior Matrix distribution. In particular, this comparison will show if the ME process has skewed the matrix by overestimating the number of short trips. This histogram and summary table should be produced, using the Trips-All.csv file collected from model runs with the prior matrix and the estimated matrix, as shown in the following examples.

Phase	Prior	Estimated
Mean	2.45 km	1.90 km
Std Dev	0.40 km	0.60 km

Table 3: Prior and Estimated Trip Length Comparison

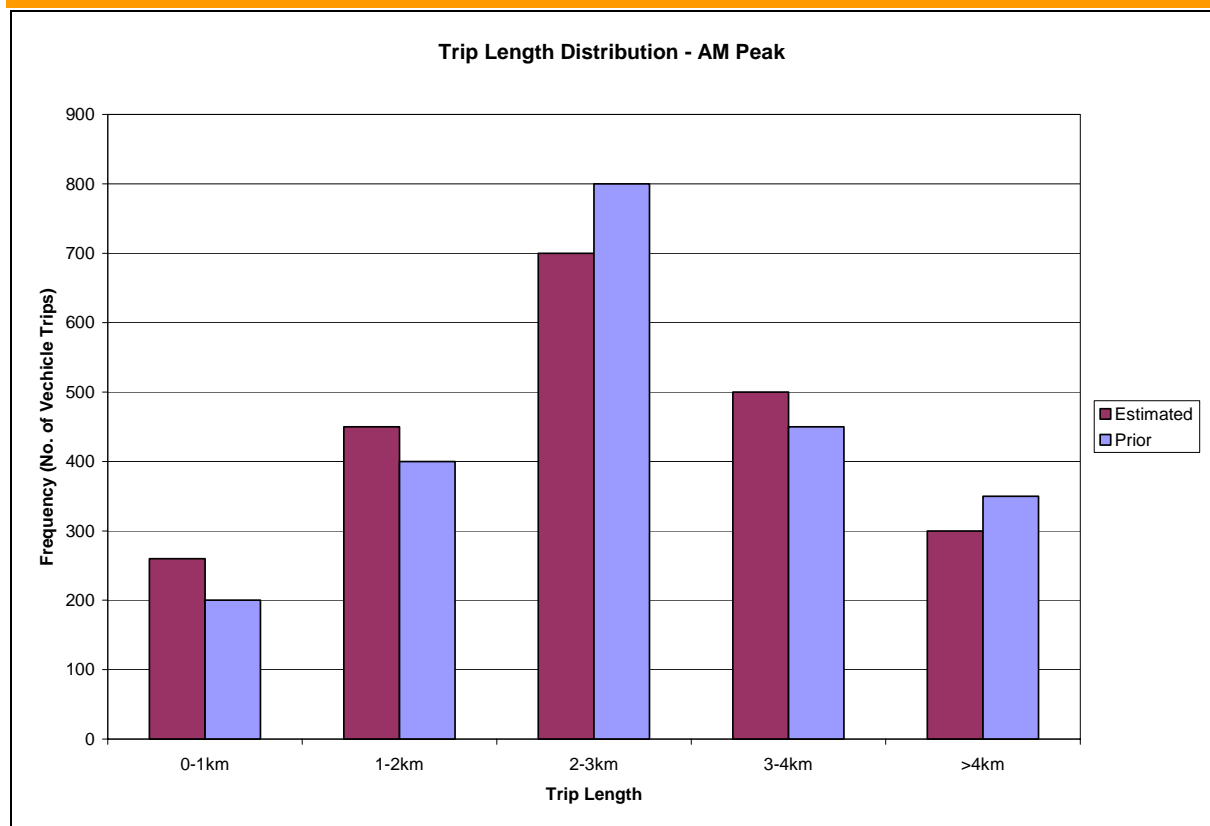


Figure 22: ME Process Trip Length Distribution Histogram

## Profiles

The calibration report should detail how demand profiles have been created and applied to the model. For each profile adopted, it should be graphed against relevant local data. Often local turning count data has been recorded in 15 minute intervals, hence the observed 5 minute observed profiles are assumed flat within each 15 minute period. The actual profile adopted however may require smoothing into 5 minute intervals, as described in section 4.8 and shown in the following example.

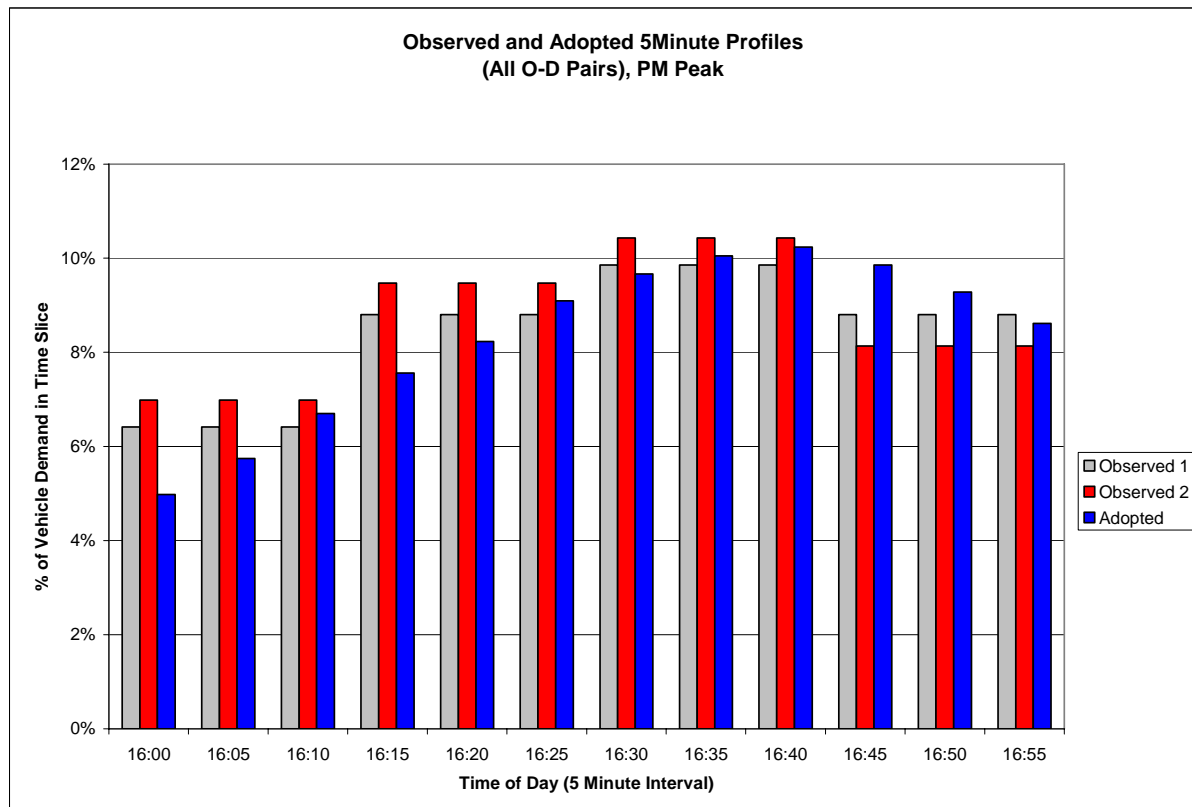


Figure 23: Profile Comparison

### Signal Timing

Where B+Fuse is **not** adopted in the model, signal timing data, in particular the phase split proportions should be compared to observed IDM or SM data as illustrated in the following summary table and figures.

Phase	Average Observed Split (sec)	Average Modelled Split (sec)
A	99.4	100
B	11.6	12
C	20.3	20

Table 4: Observed and Modelled Average Phase Splits

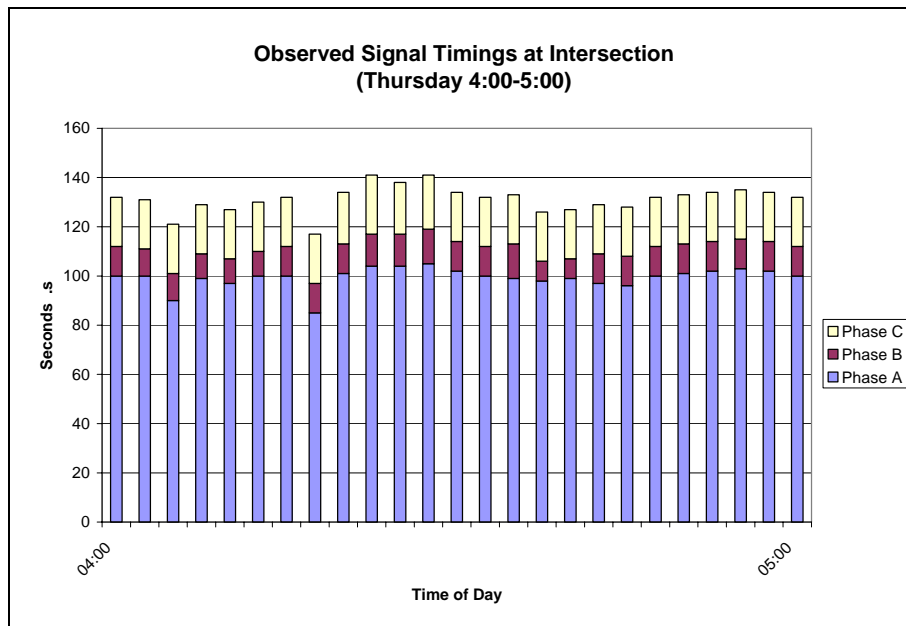


Figure 24: Observed Signal Timings

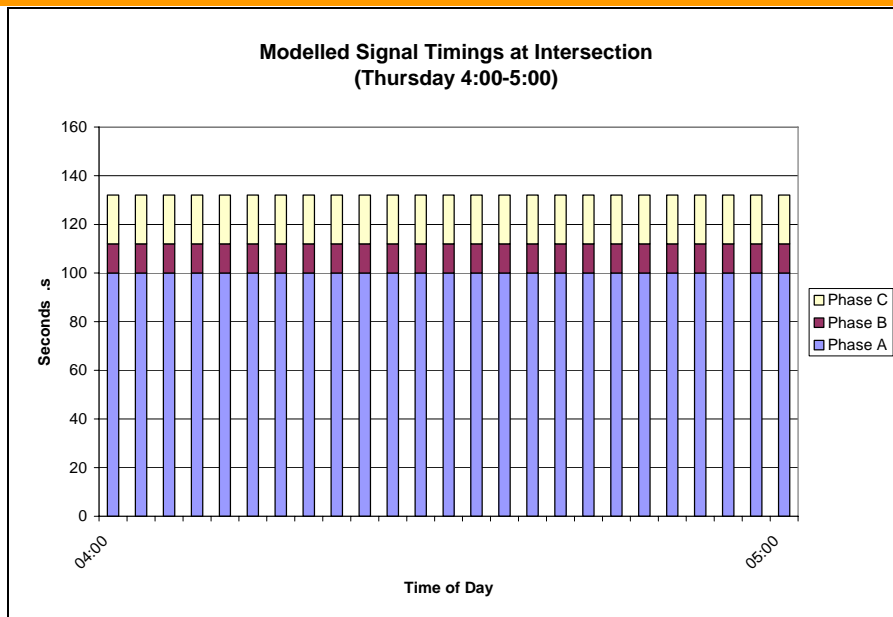


Figure 25: Modelled Signal Timings

Where B+Fuse is adopted, observed signal data should be compared to the model SCATS data, as discussed and illustrated in section 6.3 of this report.

## 6.2 Mandatory Calibration Requirements

Christchurch City Council expects as a minimum requirement that microscopic traffic simulation calibration reports submitted should include and adhere to the following Land Transport New Zealand, PEM criterion. However, CCC may choose to adjust these criteria targets as part of the project brief. These adjustments will be defined in the project brief reporting requirements, as further discussed in section 6.4 of this guide.

Criteria and Measures	Calibration Acceptance Targets	Calibration Results	
		Model Results	Target Achieved?
<i>Hourly Link Flows, Modelled versus Observed</i>			
Individual Link Volumes	100% with $\pm 20\%$	89% are within $\pm 20\%$	<b>x</b>
Screenline Volumes	$\pm 10\%$	$\pm 12\%$	<b>x</b>
R <sup>2</sup> value for modelled versus observed flows for all individual links	>0.85	0.95	✓
R <sup>2</sup> value for modelled versus observed flows for all screenlines	>0.85	0.92	✓
GEH statistic < 5.0 for individual link flows	>60% of cases	75% of cases	✓
GEH statistic < 10.0 for individual link flows	>95% of cases	90% of cases	<b>x</b>
GEH statistic < 12.0 for individual link flows	100% of cases	100% of cases	✓
GEH statistic < 4.0 for screenline flows	Most cases	92% of cases	✓
Percentage Root-Mean-Square Error (RMSE) for entire network	<30%	10%	✓
<i>Vehicle Kilometres Travelled (VKT)</i>			
If actual data available, measurements of modelled VKT should be within 5% of observed VKT		4.2%	✓
<i>Intersection Flows and Delays</i>			
Modelled turning flows	Within 30% of observed	78% are within $\pm 30\%$	<b>x</b>
Overall network statistics	COV < 5%	1.5%	✓

Table 5: Land Transport New Zealand, Project Evaluation Manual, Calibration Criteria

The following sections provide further detail or additional criteria to the calibration measures defined by Land Transport New Zealand. The sections are set out as a guide, in terms of the format of the required output and the recommended files from the S-Paramics output which the appropriate statistics should be extracted.



## Overall Network Statistics

(Data acquired from *stats-general.csv* files).

Provides a measure of the variation between the various model runs for a particular period. An example of the output is presented in the following. Typically a coefficient of variance of less than 5% is considered to be a good level of correlation.

AM Peak 7:30-8:30 am				
Log Run	Average Travel Time (s)	Total Distance (m)	Total Number Vehicles	Mean Speed (km/hr)
1	259	91,356,752	53,830	23.6
2	266	91,362,904	53,841	22.9
3	265	91,356,496	53,835	23.9
4	264	91,462,408	53,855	23.2
5	257	91,385,200	53,849	23.7
Mean	262	91,384,752	53,842	23.3
Minimum	257	91,356,496	53,830	22.9
Maximum	266	91,462,408	53,855	23.7
Range	9	105,912	25	0.8
Std Dev	4.0	44,973	10	0.4
COV	1.5%	0.0%	0.0%	1.5%

Table 6: Network Statistics Stability Example

## Turn Count Comparison

(Data acquired from the *turn-counts-roundabouts.csv*, *turn-counts-turns.csv* files).

Standard criteria for CCC models is for 90% of turning count volumes, greater than 50 vpd, to be within 30% of observed turning volumes. Comparisons between observed and modelled turning counts could be presented for each period by organizing the observed counts into ranges, by volume. This allows the data to be assessed with more emphasis placed on the higher volume movements. Scatter plots are also required showing that the R2 value. An example of both the table and chart are presented below.

AM Peak Period 7:30-8:30am			
Observed Turning Volume Range (vph)	Number of Counts in Range	Modelled Counts Within 30%	
		Number	%
>1,000	44	44	100%
500 - 999	65	61	94%
200 - 499	86	70	81%
100 - 199	112	90	80%
< 99	290	200	69%
<b>All Counts &gt;50 vph</b>	<b>497</b>	<b>445</b>	<b>90%</b>
<b>All Counts</b>	<b>597</b>	<b>465</b>	<b>78%</b>

Table 7: Turn Count Volume Calibration Example Table

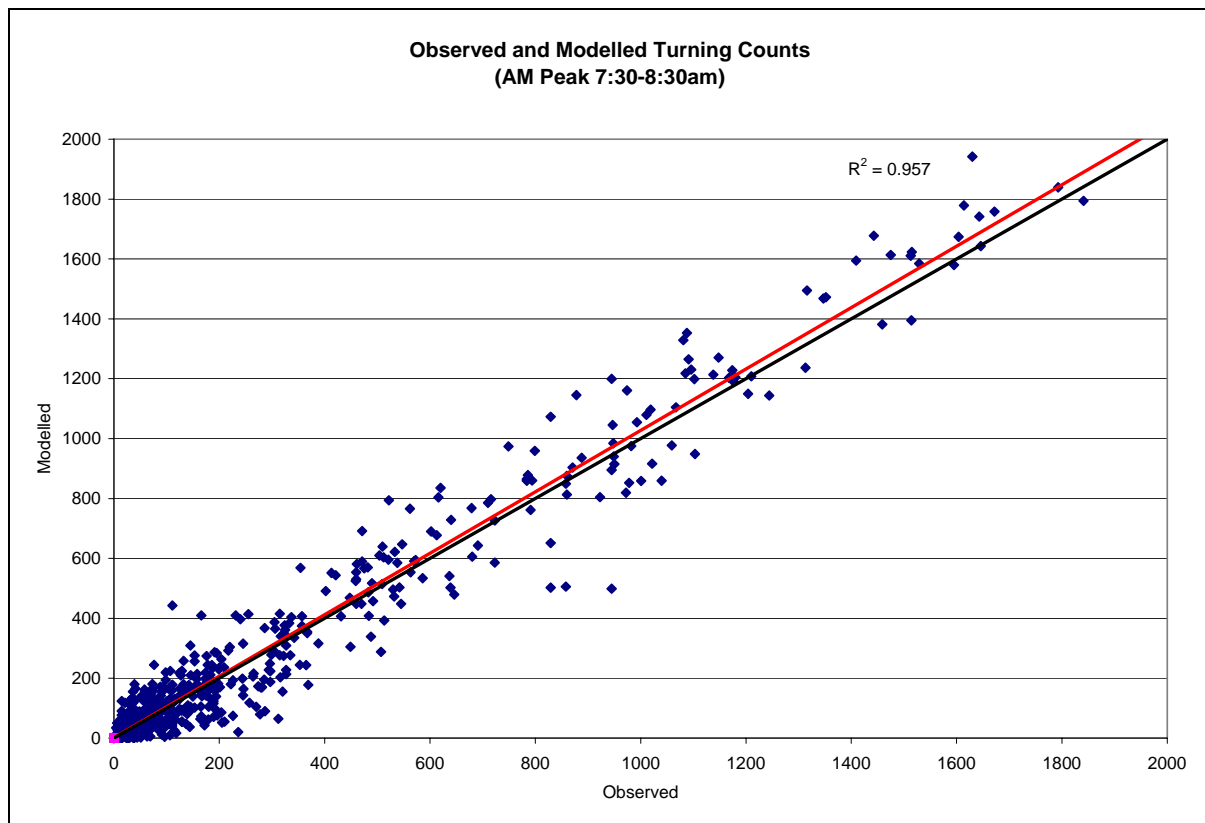


Figure 26: Turn Count Comparison Plot Example

## Link Volume Comparison

(Data acquired from *turn-counts-links.csv* files).

Summary link volume plots should be produced for each time period, comparing modelled and observed link volumes. Error tolerance for hourly volumes on major links (links carrying in excess of 15,000 vehicles per day in one direction) approximately  $\pm 20\%$ . An example of this is presented in both the following Table and Figure.

AM Peak Period 7:30-8:30am			
Observed Link Volume Range (vph)	Number of Counts in Range	Modelled Counts Within 20%	
		Number	%
>1,000	134	130	97%
500 - 999	110	99	90%
200 - 499	134	114	85%
100 - 199	64	56	88%
< 99	41	30	73%
<b>All Counts &gt;50kph</b>	<b>458</b>	<b>424</b>	<b>93%</b>
<b>All Counts</b>	<b>483</b>	<b>429</b>	<b>89%</b>

Table 8: Link Volume Calibration Summary Table

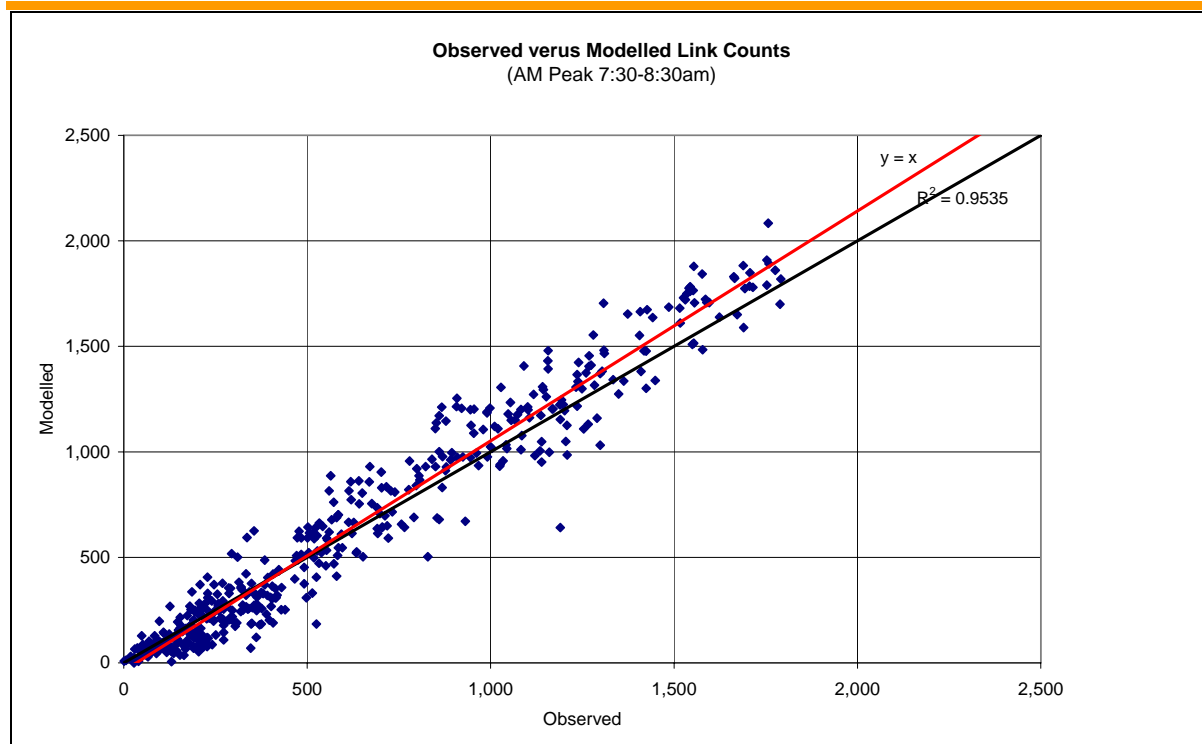


Figure 27: Link Volume Plot Example

Additionally, where individual observed and modelled link volumes are required these should be summarised in a table format, directionally for each link, as shown in the following example table.

Intersection Location	Approach	Observed (vph)	Modelled (vph)	Difference %
Fitzgerald / Tuam	S approach	644	702	9%
	W approach	192	204	6%
	E approach	283	372	31%
	N approach	1885	1881	0%
Ferry / Moorhouse / Wilsons	S approach	218	210	-4%
	W approach	219	247	13%
	E approach	1233	1361	10%
	N approach	355	367	3%

Table 9: Individual Link Volume Data

### Volume Bandwidth Diagram

(Data acquired from *turn-counts-links.csv* files).

A network diagram should be included to show the link flows, in bandwidths and volumes, for the observed and modelled link counts, and differences between these two data sets. Any comparative bandwidth diagrams shall adopt the same scale. An example of a bandwidth diagram, showing link flows at an intersection is shown in the following figure.

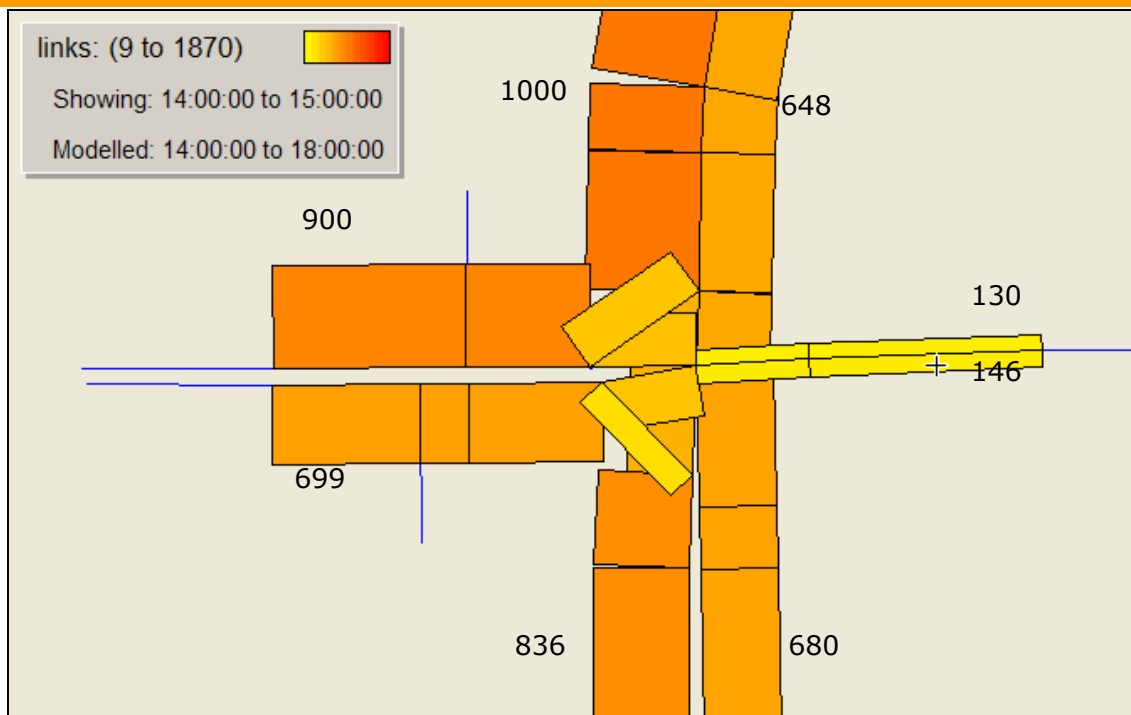


Figure 28: Intersection Bandwidth Diagram Example

### Screenline Counts

(Data acquired from *turn-counts-links.csv* files).

Depending on the network size, comparisons between the modelled link counts recorded across the screen lines in the network for each period should be presented. Ideally all or nearly all screen lines should have a GEH value less than four, for hourly volumes. It is recommended that screenlines containing high volume routes such as motorways or heavy arterials should be presented both including and excluding such routes. Total screen line flows should also be within 10% on all or nearly all screenlines. An example of the output required is presented in the following tables.

Screenline & Location		Northbound/Eastbound				Southbound/Northbound			
		Obs (vph)	Mod (vph)	Diff %	GEH	Obs (vph)	Mod (vph)	Diff %	GEH
1	South of Tuam St	4,697	4,729	-1%	0.5	5,831	6,041	-4%	2.7
2	North of Hereford St	3,488	3,694	-6%	3.4	6,247	6,735	-8%	6.1
3	South of Peterborough St	2,333	2,614	-12%	5.7	6,506	6,607	-2%	1.2
4	East of Montreal St	6,376	6,660	-4%	3.5	5,214	5,225	0%	0.2
5	West of Manchester St	4,204	4,329	-3%	1.9	5,949	5,957	0%	0.1
6	East of Barbadoes St	3,082	2,954	4%	2.3	6,898	6,946	-1%	0.6
% Route Mean Square Error (RMSE)				5%				4%	

Table 10: Screenline counts by direction example

### Accuracy and Acceptability Criteria

(Data acquired from *turn-counts-links.csv* files).

CCC may also request calibration criteria to be reported in terms of 'accuracy' and 'acceptability'. Where a count is considered accurate or acceptable, if the modelled count is  $\pm$  ('Multiplier'  $\times$   $\sqrt{\text{Observed}}$ ). The 'multiplier' used is dependant on the statistic being compared. Example criteria for link and turn counts columns are shown below:

#### Hourly Link Count Volumes:

Accuracy Criteria: At least 75% Model counts be within  $\pm 2 \times \sqrt{\text{Observed}}$

Acceptability Criteria: At least 95% Model counts be within  $\pm 5 \times \sqrt{\text{Observed}}$

#### Hourly Turn Count Volumes:

Accuracy Criteria: At least 75% Model counts be within  $\pm 3 \times \sqrt{\text{Observed}}$

Acceptability Criteria: At least 95% Model counts be within  $\pm 8 \times \sqrt{\text{Observed}}$

The results may be reported as follows:

Measure	Multiplier	Link Count Classification (vhp)					Calibration	
		<50	50-100	100-999	>1000	All Counts	Requirement	Achieved?
Link Counts								
% Accurate	2	60%	70%	90%	95%	79%	75%	✓
% Acceptable	5	87%	86%	98%	100%	93%	95%	✗
Turn Counts								
% Accurate	3	68%	60%	87%	92%	77%	75%	✓
% Acceptable	8	75%	72%	95%	94%	84%	95%	✗

Table 11: Percentage of Counts Considered 'Accurate' or 'Acceptable'

These measures are similar to GEH calculations, but the definition of accurate and acceptable are likely to be dependant on what is being measured and may be subject to change with agreement of the Project Manager.

### 6.3 Optional Calibration and Statistical Requirements

S-Paramics can output numerous additional statistics which could constitute part of the calibration process or indeed as a form of evaluation of options tested. These are not seen as mandatory (for all studies) by Christchurch City Council but rather statistics which may benefit the study and therefore should be considered. They may be specified as compulsory outputs for certain studies. The optional statistics presented here are not to be seen as exhaustive as an array of additional information can be gathered from S-Paramics - but these are perhaps the most widely utilised.

#### Queue Length Comparison

(Data acquired from *route-queue-summaries.csv* file)

Observed and modelled queue length comparisons are beneficial for critical intersections in the model network, where queue length variation is of concern. To establish the observed queue on site, a surveyor should follow the back of the queue and record their position every two minutes, as shown in the following example diagram.

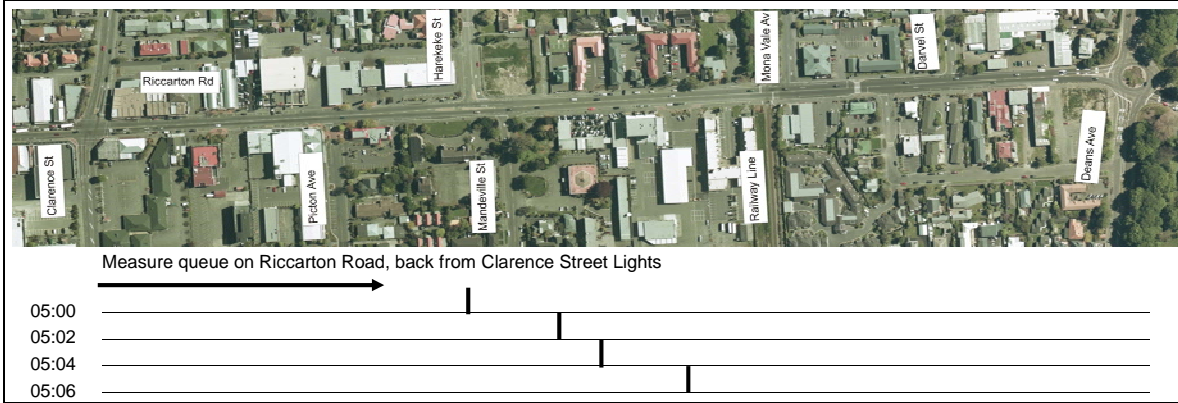


Figure 29: Queue Survey Template Example

The equivalent modelled queue should be recorded and compared as shown in the following graphs. For comparative purposes, it is essential that both graphs have the same scale and they include a reference to a fixed locality point, (e.g. Deans Ave Roundabout).

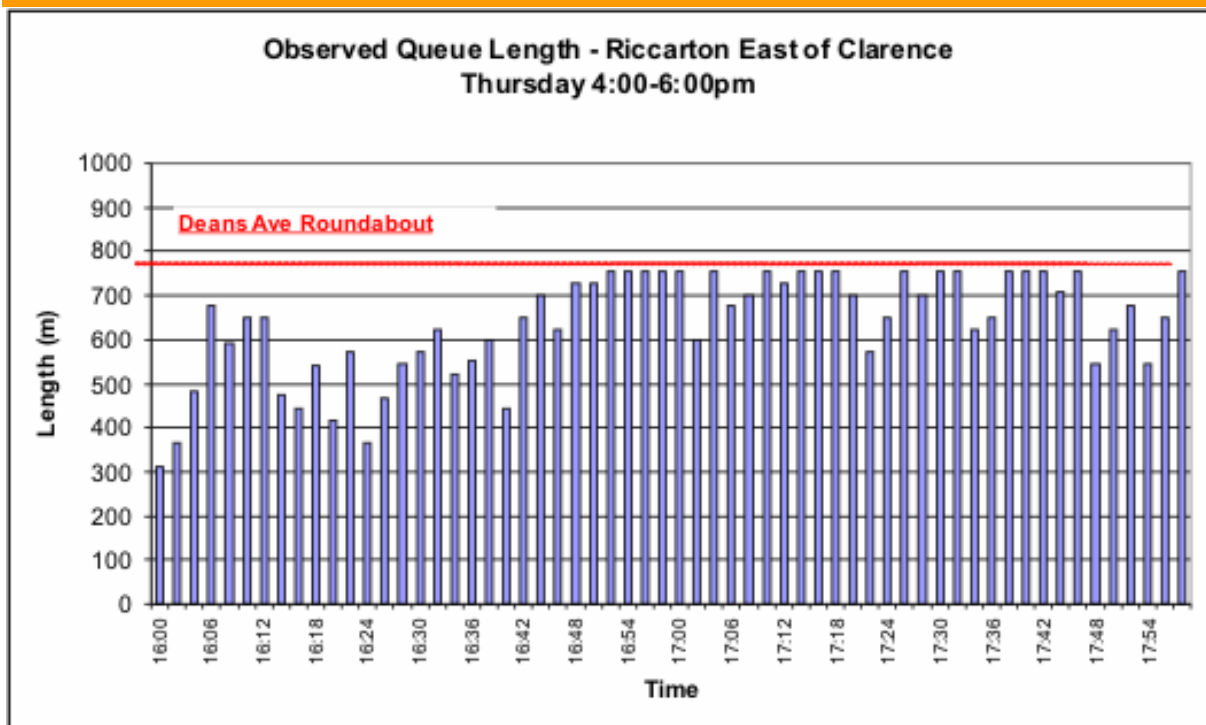


Figure 30: Observed Queue Length Plot Example



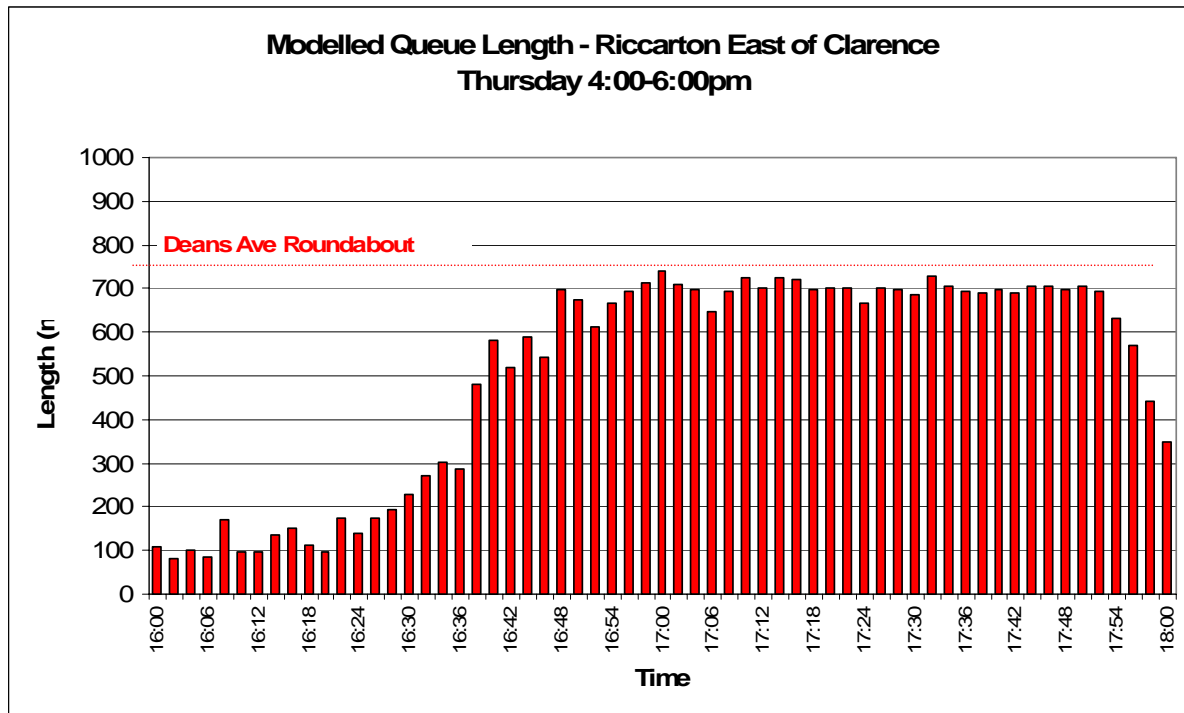


Figure 31: Modelled Queue Length Plot Example

### Journey Time Comparison

(Data Acquired from **vehicle-routes**, **turn-count-links**).

Cumulative Journey Time Plots (Time-distance graphs) are also a valuable tool for journey time comparisons for corridor models. They can be compiled for private vehicles or public transport routes. Charts can be used to illustrate the variation in journey times and the comparison of journey times between observed and modelled data or between the base and option models.

The following figure shows a comparison of average journey times between base and option model, and also the variation of journey time between runs for both the base and option.

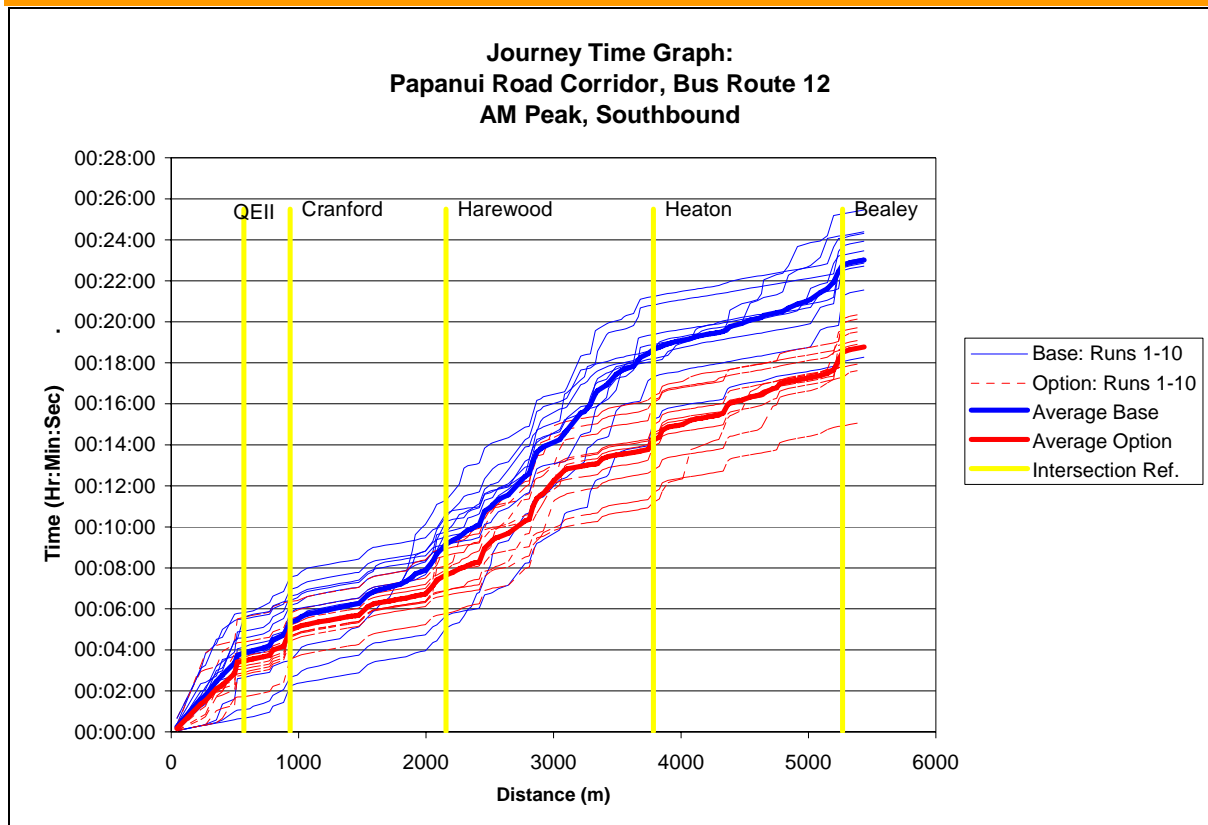


Figure 32: Distance Time Graph Comparison Example

Other simplistic journey time comparisons can also be made, in particular acceptability criteria.

For calibration purposes, where specified, base model journey times can be compared to observed journey times. Observed journey time data shall be collected by Floating Car Method with a minimum of 3 runs within a start time window of 15 minutes within the modelled period. The modelled data shall be compared to this by aggregating statistics over the same 15 minute period. The model shall be deemed to be adequately calibrated in this respect if the modelled journey time falls within one standard deviation of the observed time. An example table of this acceptability criterion is shown below.

Period	Observed (s)				Model (s)				Acceptable Fit?
	Mean	Min	Max	SD	Mean	Min	Max	SD	
0800-0815	53	50	58	4.2	55	51	57	3.5	✓
1730-1745	31	25	38	6.6	48	40	56	8.0	✗

Table 12: Journey Time Calibration Comparison (Private Vehicle)

### Level of Service (Delay)

(Data acquired from the *path ends.csv* file).

Drawing on the Highway Capacity measure of delay, as illustrated in the Table below, the level of service by intersection, approach arm, and movement can be determined. The method for determining level of service involves setting up paths within the model, relating to each movement, and recording the travel time of all vehicles travelling along the path. The minimum travel time for each path is deducted from the modelled travel time to give an estimate of delay. These values of delay then relate to a certain Level of Service. Illustrating the LOS is useful for comparative purposes between options and perhaps between S-Paramics and SIDRA.

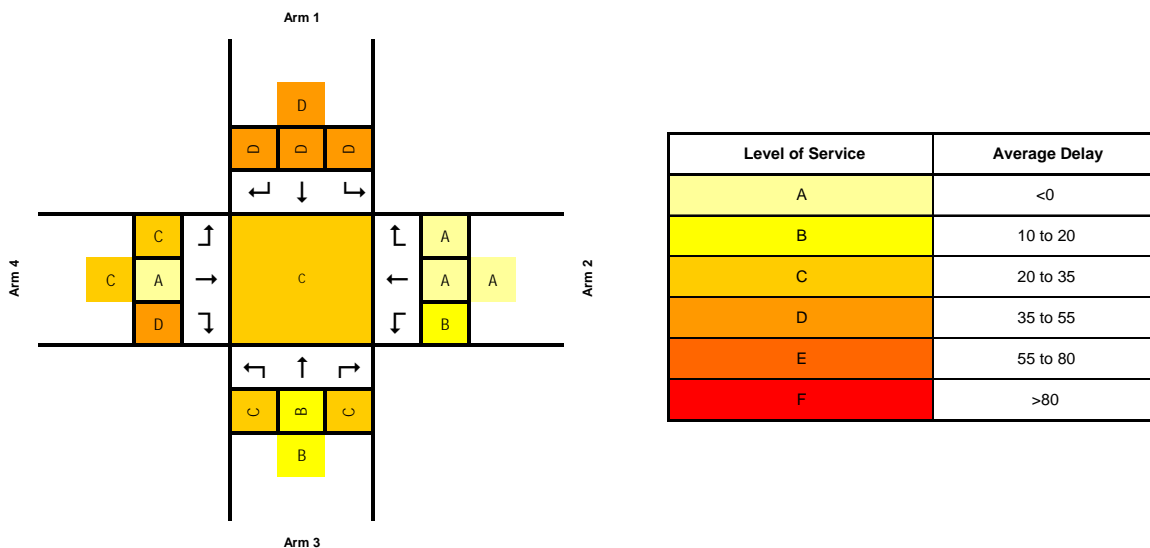


Figure 33: Level of Service Diagram Example

## Pollution

(Data acquired from the *link-pollution.csv* file).

An effective statistic for comparative studies that is, between options. With S-Paramics modelling individual vehicles traversing the network comprehensive information can be gathered about each vehicle including fuel consumption and emissions. However, this element of the model requires the user to input various additional information relating to vehicle type, engine size, age of the vehicle etc which in some circumstances may not be possible to ascertain. The pollution data may be copied from the installation directory, it is worth noting this is based on British vehicles which are in general smaller in size to those found in New Zealand. Alternative pollution files can be created if required, but the modeller is responsible for their validity. An example of the output is presented below.

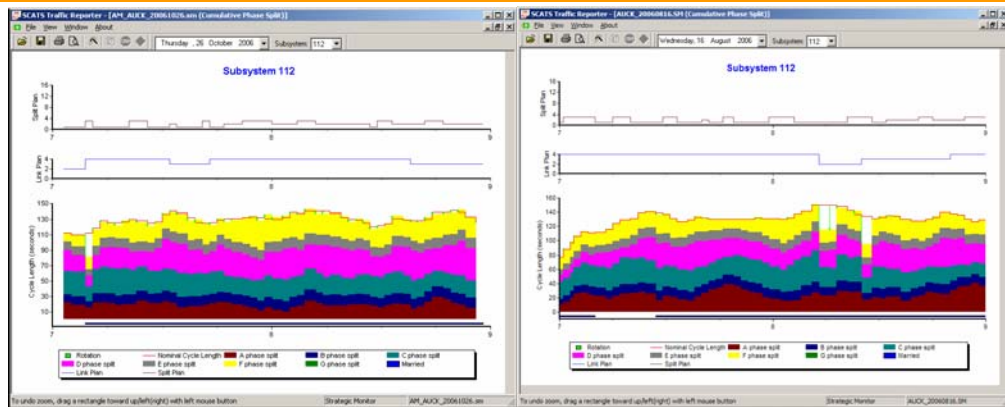
Period	Carbon Monoxide (kg)	Carbon Dioxide (kg)	Total Hydrocarbons (kg)	Oxides of Nitrogen (kg)	Fuel Consumption (liters)	Particulate Matter (g)
AM	2,553	22,335	390	253	11,539	346
IP	2,451	21,517	372	246	11,104	354
PM	3,303	28,335	509	315	14,721	293

Table 13: Pollution Data Output Example

## Signal Timing Comparison

(Data acquired from the *signals.csv* / or *signaltimes.csv* file for fixed time models or *xx.sm* files for b+FUSE models.)

This is seen as a **mandatory check when running with b+FUSE**. SCATS and in turn b+FUSE is highly dependant on traffic volumes. Minor errors in calibration, in particular routing, will have consequences on signal timings produced by SCATS. With feedback enabled this could transpire into large errors. This check is seen to serve as an additional validation tool. If b+FUSE is not adopted then comparison of base model signal timings with SCATS IDM data is a mandatory requirement within the Calibration Report.



Statistics for Subsystem 112 on Thursday 26 October 2006				Statistics for Subsystem 112 on Wednesday 16 August 2006						
Cycle Time			Average Splits							
	Actual	Nominal	Required	A	B	C	D	E	F	
Maximum	143	141	143	sec	18	13	27	32	13	26
Minimum	81	110	93	%	14.4	10	20.9	24.5	10	20.1
Average	131	132	131							
Number of cycles: 53										
Link Plans				System Plans						
	1	2	3	4	1	2	3			
	2	15	36	16 23 14						
Period: 07:00 - 09:00				Period: 07:00 - 09:00						
OK				OK						

Observed

Modelled

Figure 34: Traffic Signal Timings Comparison of Observed and Modelled Data

## 6.4 Reporting Requirement Specification Summary Table

### Reporting Requirements

For the purpose of producing a Calibration or Option Report for a micro-simulation model, CCC will provide the client with Reporting Specification Summary Tables. These tables will confirm the mandatory measures and acceptability criteria that need to be shown in the Calibration or Options report. Blank templates are attached in Appendix C, to which CCC may require alternative criteria or additional measures may be added for specific projects. Example tables, for both the calibration and option reporting requirements, are shown on the subsequent pages in Table 14 and Table 15.

### Calibrated Model Performance Reporting

Based on the reporting requirements requested in the brief, the Consultant shall produce as a summary table confirming the models performance and what criteria have been achieved. An example Model Performance Summary is shown in Table 16.

Reporting Requirements (Project Brief)					
Ref	Criteria and Measures	Calibration Acceptance Targets		Requirement For This Project? PEM/CCC/Not Mandatory (x)	Example Table/Figure in This Guide
		PEM Criteria	CCC Criteria		
		<b>1.1</b>	<b><i>Land Transport New Zealand, PEM Criteria</i></b>		
	<i>Hourly Link Flows, Modelled versus Observed</i>				
	Individual Link Volumes	± 20%	95% within 20% (>50vph)	CCC	Table 5
	Screenline Volumes	± 10%	± 10%	PEM	Table 5
	R <sup>2</sup> value for modelled versus observed flows for all individual links	>0.85	>0.90	CCC	Table 5
	R <sup>2</sup> value for modelled versus observed flows for all screenlines	>0.85	>0.90	CCC	Table 5
	GEH statistic < 5.0 for individual link flows	>60% of cases	>60% of cases	PEM	Table 5
	GEH statistic < 10.0 for individual link flows	>95% of cases	>95% of cases	PEM	Table 5
	GEH statistic < 12.0 for individual link flows	100% of cases	100% of cases	PEM	Table 5
	GEH statistic < 4.0 for screenline flows	Most cases	Most cases	PEM	Table 5
	Percentage Root-Mean-Square Error (RMSE) for entire network	<30%	<30%	PEM	Table 5

Reporting Requirements (Project Brief)					
	<i>Vehicle Kilometres Travelled (VKT)</i>				
	If actual data available, measurements of modelled VKT should be within 5% of observed VKT			x	Table 5
	<i>Intersection Flows and Delays</i>				
	Modelled turning flows	Within 30% of observed	90% within 30% (>50 vph)	CCC	Table 5
	Overall network statistics	COV < 5%	COV < 5%	PEM	Table 5
<b>1.2</b>	<b>Link Flows, CCC Criteria</b>				
	Link Volume Summary Table	95% within 20% (>50vph)		CCC	Table 8
	Link Volume Plot	$R^2 \geq 0.90$		CCC	Figure 27
	Link Accuracy Criteria	75% within $2x\sqrt{\text{Observed}}$		x	Table 11
	Link Acceptability Criteria	95% within $5x\sqrt{\text{Observed}}$		x	Table 11
	Individual Link Volume Table			x	Table 9
	Link Volume Bandwidth Diagram			x	Figure 28
<b>1.3</b>	<b>Turn Counts, CCC Criteria</b>				
	Turn Count Summary Table	90% within 30% (>50 vph)		CCC	Table 7
	Turn Count Plot	$R^2 \geq 0.90$		CCC	Figure 26
	Turn Count Accuracy Criteria	75% within $3x\sqrt{\text{Observed}}$		x	Table 11
	Turn Count Acceptability Criteria	95% within $8x\sqrt{\text{Observed}}$		x	Table 11
<b>1.4</b>	<b>Queues, CCC Criteria</b>				
	Queue Length Comparisons	Similar profile and range		CCC	Figure 30, Figure 31

<b>Reporting Requirements (Project Brief)</b>				
<b>1.5</b>	<b>Journey Time, CCC Criteria</b>			
	Journey Time Table	Within 1 Std Dev	x	Table 12
	Journey Time Graph	Similar profile and range	x	Figure 32
<b>1.6</b>	<b>Matrix Estimation, CCC Criteria</b>			
	Matrix Estimation Trip End Comparisons	Similar distribution	CCC	Figure 21
	Matrix Estimation Trip Length Distribution	Similar profile	CCC	Figure 22
<b>1.7</b>	<b>Traffic Signals, CCC Criteria</b>			
	IDM Comparisons	Similar profile	CCC	Figure 24, Figure 28

Table 14: Calibration Reporting Specifications - Example



Optional Statistical Comparisons			
Ref	Criteria and Measures	Mandatory For This Project? ✓=Yes, x=No	Example Table/Figure in This Guide
2.1	Queue Length Comparisons	✓	Figure 31
2.2	Journey Time Graph	x	Figure 32
2.3	LOS Diagram (delay)	✓	Figure 33
2.4	Pollution	x	Table 13
2.4	IDM Comparisons	✓	Figure 34

Table 15: Option Reporting Specifications - Example

Calibrated Model Performance Summary					
Ref	Criteria and Measures	Calibration Acceptance Targets	Model Performance	Achieved Criteria?	Reference to Consultant Calibration Report
<b>1.1</b>	<b>Land Transport New Zealand, PEM Criteria</b>				
	<i>Hourly Link Flows, Modelled versus Observed</i>				
	Individual Link Volumes	95% within 20% (>50vph)	93% within 20% (>50vph)	<b>x</b>	Section x, Table x
	Screenline Volumes	± 10%	± 12%	<b>x</b>	Section x, Table x
	R <sup>2</sup> value for modelled versus observed flows for all individual links	>0.90	0.95	✓	Section x, Figure x
	R <sup>2</sup> value for modelled versus observed flows for all screenlines	>0.90	0.92	✓	Section x, Figure x
	GEH statistic < 5.0 for individual link flows	>60% of cases	75% of cases	✓	Section x, Table x
	GEH statistic < 10.0 for individual link flows	>95% of cases	90% of cases	<b>x</b>	Section x, Table x
	GEH statistic < 12.0 for individual link flows	100% of cases	100% of cases	✓	Section x, Table x
	GEH statistic < 4.0 for screenline flows	Most cases	92% of cases	✓	Section x, Table x
	Percentage Root-Mean-Square Error (RMSE) for entire network	<30%	10%	✓	Section x, Table x




Calibrated Model Performance Summary					
	<i>Intersection Flows and Delays</i>				
	Modelled turning flows	90% within 30% (>50 vph)	90% within 30% (>50 vph)	✓	Section x, Table x
	Overall network statistics	COV < 5%	1.5%	✓	Section x, Table x
<b>1.2</b>	<b>Link Flows</b>				
	Link Volume Summary Table	95% within 20% (>50vph)	77%	✘	Section x, Table x
	Link Volume Plot	R2>=0.90	0.95	✓	Section x, Table x
<b>1.3</b>	<b>Turn Counts</b>				
	Turn Count Summary Table	90% within 30% (>50 vph)	78%	✘	Section x, Table x
	Turn Count Plot	R2>=0.90	0.96	✓	Section x, Figure x
<b>1.4</b>	<b>Queues</b>				
	Queue Length Comparisons	Similar profile and range	Similar profile and range	✓	Section x, Figure x
<b>1.5</b>	<b>Journey Time</b>				
<b>1.6</b>	<b>Matrix Estimation</b>				
	Matrix Estimation Trip End Comparisons	Similar distribution	Similar distribution	✓	Section x, Figure x
	Matrix Estimation Trip Length Distribution	Similar profile	Similar profile	✓	Section x, Figure x
<b>1.7</b>	<b>Traffic Signals</b>				
	IDM Comparisons	Similar profile	Similar profile	✓	Section x, Figure x

Table 16: Calibrated Model Performance Summary

## 7 Peer Review Process

### 7.1 Peer Review Process

The Peer Review process is often an iterative procedure and can be defined by the following three stage process. Note, unless agreed otherwise, it is important that all submissions, responses and communication between the modeller and the auditor be conducted through the Client.

-  Stage A: This is the initial review stage, which includes the modeller supplying the model and associated documentation for review and the Peer Reviewer issuing a response based on the outcome of the audit. The consultant modeller should review the peer review comments, make adjustments to the model as necessary and reply to any audit recommendations not included in the revised model.
-  Stage B: This reiterative stage may not be required or may be a comprehensive process. Based on the modellers reply to the auditors recommendations the Client may choose to repeat the peer review process.
-  Stage C: The peer review process is considered complete once all the documentation involved in the review process has been collated into a 'Master Document' and a summary page is signed off by all parties including the Consultant modeller, Client and Peer Reviewer, in agreement that the model is appropriately calibrated.

This three stage process is further summarised in the following flow diagram.

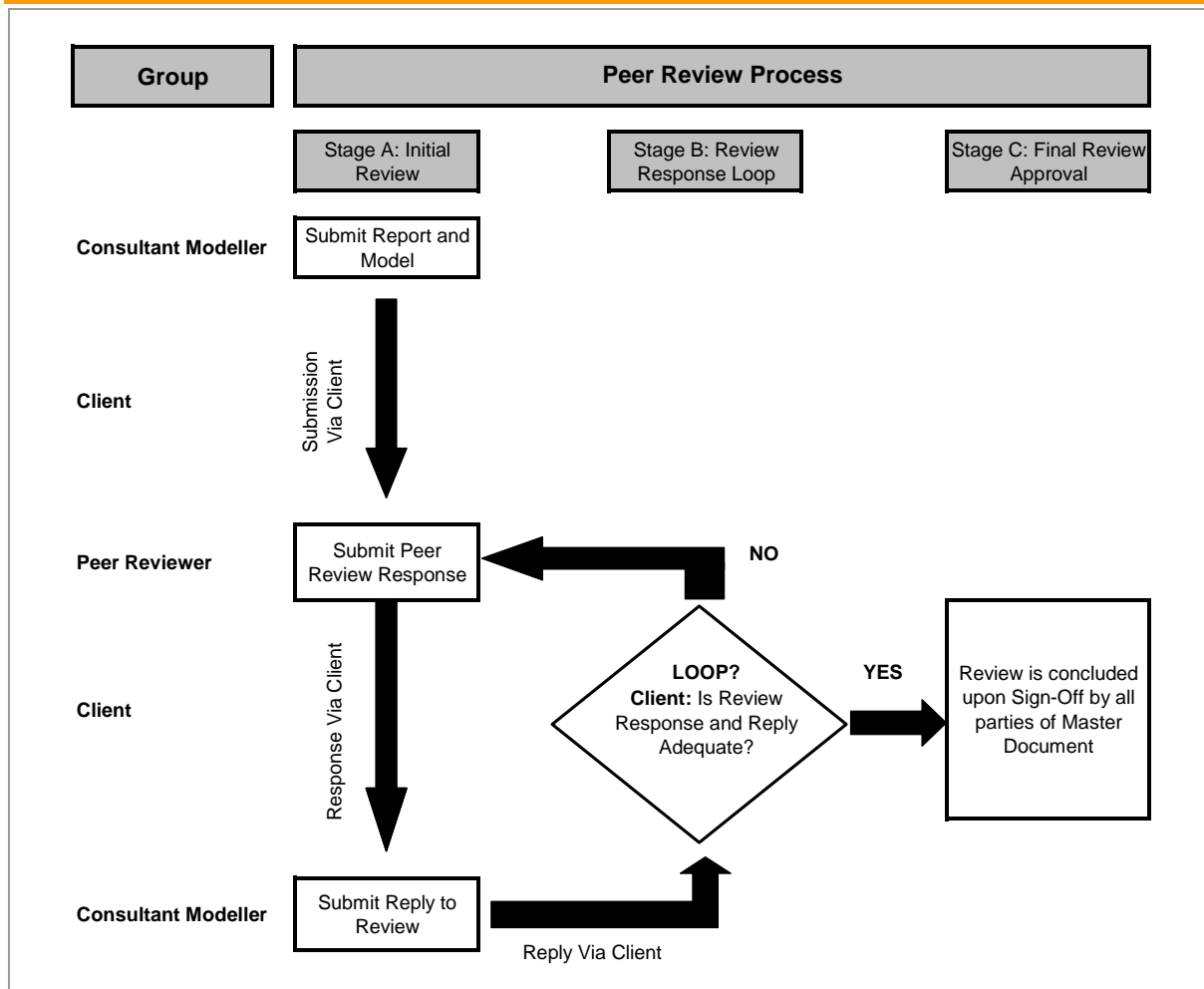


Figure 35: Peer Review Flow Chart Procedure

## 8 Acknowledgments

### 8.1 Additional Media

This guideline acknowledges the work and effort that has been given to the additional Guidelines, organisations such as SIAS, Austroads, FHWA and Transport for London.

### 8.2 baseplus

Christchurch City Council would like to thank baseplus for their input and advice in devising these guidelines and providing the web space to host the standard downloads file.

## APPENDIX A : Model Development Notes

**APPENDIX B : Model Check Files**

Standard Model Files:

Behaviour <b>Use the Standard CCC model file.</b>	
Buses <b>Bus routes and schedules: Use the name of the route followed by an 'i' for inbound and 'o' for outbound which are relative to the central major hub. For the orbitor and metrostar use 'c' for clockwise and 'a' for anti-clockwise</b> <b>Bus stops: Use on the ground bus stop numbers</b>	
Categories <b>Use the Standard CCC model file.</b>	
Configuration <b>Use default release style of precise</b> <b>Suggested Use of standard Queue Definition</b> <b>Use Mean Target Headway of 0.8</b> <b>Use Mean Reaction Time of 1.0</b> <b>Use Network minimum Gap of 0.8 in 2005.1 or earlier, and 1.6 in 2006.1 or later.</b> <b>Enable New Zealand Left Turn</b> <b>Use standard Signal Settings</b>	
Controllers <b>Set port to 2100</b>	
Detectors <b>Following location, shape and naming conventions.</b>	
Periods <b>Use the Standard CCC model file.</b>	
Options <b>Use different background colour for each period</b>	
Vehicles <b>Use the Standard CCC model file.</b>	
Version <b>Is the latest version used [2006.1]</b>	
VShape <b>Use the Standard CCC model file.</b>	

General Modelling Guidelines

Use the Standard Model <b>Use the Standard CCC Model as a base from which to built your model.</b>	
Bounding Box <b>Orientate Model North for translation in X and Y if required.</b>	
Model Development Notes <b>Use baseplus model development notes.</b>	
Annotations File <b>Enter an appropriate model description.</b>	
Bus Stop Dwell Times <b>Additional consideration given if focus of the model on bus.</b>	
Links <b>Ensure consistency between periods and use GA look next where appropriate.</b>	
Priorities <b>Ensure consistency between periods and add to seconds to observed "all red" time if using version 2005.1.</b>	
Profiles <b>Smooth Profiles.</b>	
Zone Inclusion <b>Only include zones that are significant trip generators.</b>	

General Network Construction Guidelines

Zone Connections <b>Adhere to guidelines.</b>	
Right Turning Bays <b>Adhere to guidelines.</b>	
Using Restrictions <b>Use sparingly.</b>	
Cordoning a Large Model. <b>Refer to guidelines for assistance.</b>	
Calibration Report Requirements <b>Adhere to guidelines.</b>	



**APPENDIX C : Reporting Specification Tables**

Reporting Requirements (Project Brief)					
Ref	Criteria and Measures	Calibration Acceptance Targets		Requirement For This Project? PEM/CCC/Not Mandatory (x)	Example Table/Figure in This Guide
		PEM Criteria	CCC Criteria		
<b>1.1</b>	<b>Land Transport New Zealand, PEM Criteria</b>				
	<i>Hourly Link Flows, Modelled versus Observed</i>				
	Individual Link Volumes	± 20%	95% within 20% (>50vph)		Table 5
	Screenline Volumes	± 10%	± 10%		Table 5
	R <sup>2</sup> value for modelled versus observed flows for all individual links	>0.85	>0.90		Table 5
	R <sup>2</sup> value for modelled versus observed flows for all screenlines	>0.85	>0.90		Table 5
	GEH statistic < 5.0 for individual link flows	>60% of cases	>60% of cases		Table 5
	GEH statistic < 10.0 for individual link flows	>95% of cases	>95% of cases		Table 5
	GEH statistic < 12.0 for individual link flows	100% of cases	100% of cases		Table 5
	GEH statistic < 4.0 for screenline flows	Most cases	Most cases		Table 5
	Percentage Root-Mean-Square Error (RMSE) for entire network	<30%	<30%		Table 5

<b>Reporting Requirements (Project Brief)</b>					
	<i>Vehicle Kilometres Travelled (VKT)</i>				
	If actual data available, measurements of modelled VKT should be within 5% of observed VKT				Table 5
	<i>Intersection Flows and Delays</i>				
	Modelled turning flows	Within 30% of observed	90% within 30% (>50 vph)		Table 5
	Overall network statistics	COV < 5%	COV < 5%		Table 5
<b>1.2</b>	<b>Link Flows, CCC Criteria</b>				
	Link Volume Summary Table	95% within 20% (>50vph)			Table 8
	Link Volume Plot	R <sup>2</sup> ≥ 0.90			Figure 27
	Link Accuracy Criteria	75% within 2x√Observed			Table 11
	Link Acceptability Criteria	95% within 5x√Observed			Table 11
	Individual Link Volume Table				Table 9
	Link Volume Bandwidth Diagram				Figure 28
<b>1.3</b>	<b>Turn Counts, CCC Criteria</b>				
	Turn Count Summary Table	90% within 30% (>50 vph)			Table 7
	Turn Count Plot	R <sup>2</sup> ≥ 0.90			Figure 26
	Turn Count Accuracy Criteria	75% within 3x√Observed			Table 11
	Turn Count Acceptability Criteria	95% within 8x√Observed			Table 11
<b>1.4</b>	<b>Queues, CCC Criteria</b>				
	Queue Length Comparisons	Similar profile and range			Figure 30, Figure 31

<b>Reporting Requirements (Project Brief)</b>				
<b>1.5</b>	<b>Journey Time, CCC Criteria</b>			
	Journey Time Table	Within 1 Std Dev		Table 12
	Journey Time Graph	Similar profile and range		Figure 32
<b>1.6</b>	<b>Matrix Estimation, CCC Criteria</b>			
	Matrix Estimation Trip End Comparisons	Similar distribution		Figure 21
	Matrix Estimation Trip Length Distribution	Similar profile		Figure 22
<b>1.7</b>	<b>Traffic Signals, CCC Criteria</b>			
	IDM Comparisons	Similar profile		Figure 24, Figure 28

Table C1: Calibration Reporting Specifications

<b>Optional Statistical Comparisons</b>			
<b>Ref</b>	<b>Criteria and Measures</b>	<b>Mandatory For This Project?</b> ✓=Yes	<b>Example Table/Figure in This Guide</b>
2.1	Queue Length Comparisons		Figure 31
2.2	Journey Time Graph		Figure 32
2.3	LOS Diagram (delay)		Figure 33
2.4	Pollution		Table 13
2.4	IDM Comparisons		Figure 34

Table C2: Option Reporting Specifications