Government of South Australia

Department of Planning,
Transport and Infrastructure


# TRAFFIC MODELLING GUIDELINES - **TRANSYT 15**

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Department for Planning Transport and Infrastructure
Traffic Modelling Guidelines – TRANSYT 15
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Disclaimer

The application of this manual does not guarantee that the resulting TRANSYT traffic analysis models will be 'fit-for-purpose'. This manual only provides a framework for model development, calibration and validation. Some models, particularly models to be used for financial analysis will require more stringent standards and it is the responsibility of the modeller to ensure that the models they develop are fit for their intended purpose.

This document should only be considered relevant in SA and for no other purpose than as a guide for modellers and managers undertaking work for DPTI.

DPTI and the authors of this manual accept no liability or responsibility for any errors or omissions or for any damage or loss arising from the application of the information provided.

The significant contribution to the development of these guidelines by Transport for New South Wales, Roads and Maritime Services and Transport for London in the development of their modelling guidelines is acknowledged.



The Guidelines are approved for use by DPTI staff and the departments' agents.

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Revisions

Revisions to the document will be made from time to time. Revisions will only be published on DPTI Home Page ( http://www.dpti.sa.gov.au/standards ).

It will be the responsibility of the users of this document to ensure that the most current version is followed.

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## Contents

# 1 INTRODUCTION

The Department of Planning, Transport and Infrastructure (DPTI) is the State Government agency responsible for managing the strategic road network within South Australia. As part of this responsibility, DPTI uses a range of analytical tools to assess road network performance and to plan future development of the network.

This document is designed to assist practitioners when building TRANSYT models of road networks suitable for submitting development or project scenarios to Department of Planning, Transport and Infrastructure, for assessment/approval by the Traffic Operations Group.

The DPTI Traffic Operations Group (Norwood Office) is responsible for managing DPTI traffic signal assets and the provision of any information required for the design of traffic signals, and further references in this document to DPTI imply the oversight of this group.

This manual covers the broad areas of building, calibrating, validating and documenting TRANSYT models and is to be used as the primary guide for the development of 'fit-for-purpose' TRANSYT models for use within DPTI.

TRANSYT is the DPTI preferred software to be used to justify traffic signal phasing, and phase sequences and is used to design co-ordination (linking) data.

Model developers and users need to have a high level of understanding of traffic operations, including SCATS® , and TRANSYT modelling in order to achieve accurate models that are 'fit-for-purpose' and to ensure that the behavioural parameters remain within acceptable bounds.

At the time of publishing this guide the latest version is TRANSYT 15.

A summary of Department of Planning, Transport and Infrastructure requirements in respect of a TRANSYT model is contained in the appendices;

- **A MODELLING PURPOSE STATEMENT AND MODELLING REQUIREMENTS**
- **B DATA COLLECTION,**
- **C TRANSYT 15 CONFIGURATION,**
- **D DPTI - MODEL CONVENTIONS AND LABELLING**

## 1.1 The Role of TRANSYT in Transport Modelling Analysis

TRANSYT[1] traffic analysis modelling is not suitable for all analytical tasks requiring some form of computer based modelling of traffic operations. For example, DTEI uses the CUBE network modelling software package for the macroscopic analysis of the complete strategic transport system, encompassing both road and public transport elements. This strategic model is referred to as the Metropolitan Adelaide Strategic Transport Evaluation Model (MASTEM). The agency also uses other software packages such as AIMSUN for Microscopic-simulation and mesoscopic-simulation, SIDRA INTERSECTION for analysing single intersections, and LINSIG both individual and simply linked intersections.

DPTI uses TRANSYT for producing a model output suitable for designing SCATS® co-ordination which includes the optimum cycle length, phase sequence and site offsets PP's or sub-system offsets LP's.

The advice that follows assumes that TRANSYT has already been selected as a required modelling software application to use for the project.

Whilst this section outlines the modelling requirements of DPTI in respect of TRANSYT modelling there will be cases where local conditions or project requirements dictate the use of methods which may be different to those outlined. For more detailed explanations of specific TRANSYT features it is advisable to consult the TRANSYT User Guide "Application Guide AG 70"[2], available from the "Help" menu function of TRANSYT.

WARNING: AG 70 IS WRITTEN IN UK TERMINOLOGY WHERE "STAGE" IS EQUAL TO "PHASE" AND "PHASE" IS EQUAL TO "SIGNAL GROUP" IN AUSTRALIAN TERMINOLOGY. The labelling of the actual TRANSYT models is however correctly represented using Australian Terminology providing the modelling preferences are correctly selected. (See **APPENDIX C - TRANSYT 15 CONFIGURATION)**

## 1.2 TRANSYT Background

TRANSYT produces optimised signal timings to progress platoons of traffic through a network.

It is possible to model priority (non signal controlled) intersections, including roundabouts within a TRANSYT model, but this is only appropriate where these intersections form part of a larger network comprised of signalised intersections.

[1] TRANSYT, is produced by the Transport Research Laboratory, UK
[2] TRANSYT 15 User Application Guide AG 70 (issue E) September 2014.

## 1.3 Model Description

TRANSYT contains two main components – a traffic model and a signal optimiser.

The traffic model predicts a Performance Index (PI) for a network based on a fixed signal timing plan and set of average traffic flows. The PI is a measure of the overall cost associated with congestion and is a weighted combination of total vehicle delays and stops experienced by traffic within the modelled network. The performance index is the main method of comparing alternative network configurations.

The signal optimisation component within TRANSYT modifies signal timings and assesses whether those adjustments have reduced the PI.

Optimisation is usually achieved using the Platoon Dispersion Model (PDM) which contains a simplified queuing model. Using this model TRANSYT cannot implicitly predict spatial phenomena such as cross intersection exit-blocking. However the use of the alternative Cell Transmission Model (CTM) or Congested Platoon Dispersion Model (CPDM) modelling techniques can be applied to overcome this limitation.

# 2 TRANSYT MODEL CHARACTERISTICS

The modeller will need to review the Project Specification to determine the model purpose. A clear purpose statement of the modelling requirement is required to be developed from the specification. The suggested requirements of the purpose statement are detailed in **APPENDIX A - MODEL PURPOSE STATEMENT AND MODELLING REQUIREMENTS.**

## 2.1 Network Familiarisation

Before commencing any modelling work or collection of site data, it is important for the modeller to familiarise themselves with the area to be modelled. This section details some initial steps that should be taken by the modeller to familiarise themselves with the area to be modelled.

The modeller will need to collect a range of data to enable the construction of the model and these are detailed in **APPENDIX B - DATA COLLECTION**

## 2.2 Modelling Extent

A project may have an influence beyond the boundaries of the area to be physically modified by the project. The Project Specification should be clear about which intersections are to be modelled however the model designer is thus responsible for determining the extent of the area of impact.

Failure to model the full extent of the project may result in modelling which is not fit for purpose. RETROSPECTIVE CHANGES TO THE SCOPE COULD CAUSE THE PREVIOUS MODELLING TO BE REJECTED.

TRANSYT will only be used to model signalised intersections which operate with a common cycle time or fractions of a common cycle time, i.e. double, triple or quadruple cycling. If there are groups of signal controlled intersections in the project with more than one common cycle length consider developing additional models.

## 2.3 Model Periods

The periods to be modelled should be described in the Project Specification. The standard Department of Planning, Transport and Infrastructure model period are outlined below and it is usual that they are included in any assessment:

- **AM peak**;
- **Business / Midday**; representing that middle period of the day where flows generally are as much as half of peak hour volumes.
- **PM peak**;

Some projects will include additional periods that might include:

- Saturday midday peak;

- Late night shopping periods [Thursday in the suburbs or Friday in the City] where heavily trafficked conditions might occur.
- Events at major venues.

The above list is not exhaustive. Additional time periods may be required depending on specific traffic patterns and flow profiles. The start time and duration of each time period will also vary depending on demand.

## 2.4 Features to consider for a TRANSYT base case model

### 2.4.1 Data collection and application

A variety of data needs to be collected to build a traffic model. These requirements are outlined in **APPENDIX B - DATA COLLECTION.**

### 2.4.2 SCATS® Summaries Data

"SCATS® summaries" provide current information on SCATS controller operations. (an example is provided in **APPENDIX F – DPTI SUPPORT SERVICES**) The data elements include, Site details, right turn movement operation, Phase green splits, Phase sequences, intergreen times, Phase skipping and double cycling, Cycle lengths, Walk time settings for pedestrians, SCATS Picture showing phases and detectors, MF values for each detector, Site Operation details and Phase settings including minimum green, Yellow and Red periods.

### 2.4.3 Non-Green (yellow/red) time

The time used by traffic during non-green periods can influence road capacity and adjustment for this phenomenon should therefore be a requirement during model calibration. Additional road capacity created by aggressive vehicle behaviour can be reflected in a traffic model but must be reported in the Traffic Signals Operation Performance Report for model auditing purposes. These periods must not be adjusted arbitrarily to achieve degrees of saturation less than 100%.

Non-green periods should be accounted for if vehicles are observed on-site to behave aggressively at the stopline, e.g. by crossing a stopline near the start of red. Site observations should record the total time (in seconds) utilised by traffic during non-green periods for each peak period.

### 2.4.4 Saturation Flow (Maximum Flow [MF])

Saturation flow is an expression of the maximum capacity of a link as predominantly determined by intersection characteristics (geometry, layout, turning radii, visibility etc).

It is important that measured saturation flows are used. **SCATS® MF values represent measured saturation flows and are included in the SCATS summaries and these must be used where provided.** Incorrect saturation flows represent a common source of modelling error.

The saturation flow input for a model should generally not be altered between models or modelled periods unless physical characteristics are modified, such as changes within a scenario model.

Where lanes are combined into single movement for modelling purposes then the MF for the individual lanes shall be summed.

Where fully saturated traffic appears to discharge at a rate less than the saturation flow (e.g. due to driver behaviour or exit-blocking), this should **NOT** be accounted for by changing the saturation flow in a model.

Situations may occur where satisfactory MF values are not available, for example due to lanes with shared movements. MF values should only be altered where a lane shares more than one turning movement. These should be assessed on a case by case basis, and identified along with an explanation of the method used to estimate saturation flows.

Manual methods to derive saturation flows are described in AUSTROADS GUIDE TO TRAFFIC MANAGEMENT PART 3 SECTION 6.4.2[3], and ARR 123 “Traffic Signals: Timings and Capacity Analysis”[4].

### 2.4.5 SCATS® Signal Timing data

Traffic modelling relies heavily on the accuracy of signal timings to correctly represent capacity at signalised intersections.

Much of this information will be made available from the Department of Planning, Transport and Infrastructure Traffic Operations Group, in the form of “SCATS Summaries”. The modeller is however responsible for ensuring that this information is configured appropriately in their model.

Signal timing data must be captured for the same time periods as other traffic data including traffic volumes and therefore will be required for each modelled period. If the “SCATS Summaries do not match all the model periods required in the Design specification additional data can be readily obtained on request.

For the Base case models where the use of the fixed time settings for pedestrian phases is not compatible with the vehicle phase splits provided in the SCATS summaries, i.e. because the actual green time allocated to the parallel vehicle movements is less than the pedestrian phase time settings, the fixed pedestrian times in the model will need to be reduced to reflect the average phase splits.

In the scenario models these reduced pedestrian times should also be used as the minimum phase settings, to reflect the actual pedestrian demand, unless the

[3] AUSTROADS – AGTM03-09 (2009) Guide to Traffic Management Part 3: Traffic Studies and Analysis. Association of Australian State Road and Transport Authorities, Sydney

[4] Akcelik, R. (1981) traffic signals: Capacity and Timing Analysis. Research Report ARR no 123 ARRB Transport Research Ltd, Vermont South, Australia (6TH reprint 1995)

modeller has reason to know that the pedestrian demands are expected to reduce.

### 2.4.6 SCATS® Linking and Offsets

For the base case model use the SCATS® linking input data to determine the linking offsets. This information is provided on request from DPTI. The existing linking data is readily available for each configured SCATS region and marriage chain. The modeller will need to specifically identify the adjacent Sites for which offset information is required where sites are not part of a common marriage chain.

### 2.4.7 In-Vehicle Transport Surveys

Vehicle surveys are needed to capture specific data for calibration and validation purposes, to aid in base case model development. This section details some of the information that may be required.

#### *2.4.7.1 Cruise Times*

Cruise times are assumed to be the same as the speed limit posted speed in the urban area. TRANSYT will calculate the cruise times (seconds) from the link distance. It is therefore essential that the link distance is measured accurately from the stop line to the downstream stop line.

Use Google Earth (or similar) to measure distance the between stop lines.

Where there is side friction, for example where there is persistent parking it may be necessary to measure the cruise times during in-vehicle surveys.

Note: Bluetooth records are not sufficiently accurate for stop line to stop line measurement of Cruise times.

#### *2.4.7.2 Journey Times*

Journey times should be collected under ‘normal’ network conditions free from incidents and events. Surveying should also take place on a neutral day, in order to capture typical traffic behaviour and levels of congestion. Journey times are used to compare before and after traffic conditions but can also be used as a guide to validate the base case model.

#### *2.4.7.3 Bluetooth*

Bluetooth data may be used for validating models by using route journey times and for overall project before and after assessments.

Note: Whilst the Adelaide metropolitan area has an extensive network of Bluetooth readers the distribution of these may not always facilitate evaluation of the model area.

### 2.4.8 Queue Lengths

Queue length data can be a useful check for model validation at locations where queues persist from one signal cycle to the next. Surveyed measurements are normally taken at a consistent point in the signal cycle (e.g. at the start of green), specified for each traffic lane and measured in metres.

The level of accuracy in queue measurement surveys can often be lower than for other surveys as the definition of a queue can be ambiguous as well as difficult to identify. Although the maximum length of queue has been found to be unreliable for validation purposes it remains important to identify on which approaches the queues are occurring for each model period.

It is important to understand that the maximum observed queues will not match the Mean Max Queue (MMQ) lengths predicted by TRANSYT as MMQ represents the average queue predicted over the model period.

### 2.4.9 Short lanes: Flared Approaches, and Funnels

In modelling short lanes in TRANSYT consideration needs to be given to the effects on adjacent lanes. In TRANSYT these short lanes are called “FLARED” lanes. It is the modeller’s responsibility to model these to reflect the expected traffic conditions. They are not modelled automatically as in some other modelling tools.

A “FUNNEL” is a term used in TRANSYT where lanes merge on the far (departure) side of the signal controlled intersection. This feature can simulate the same effect as a flare on the approach, i.e. a higher saturation flow at the start of the green period than at the close of the green period.

### 2.4.10 Degree of Saturation

Degree of Saturation (DoS) is a key parameter for validating traffic models.

DoS can never exceed 95% at existing intersections. The modeller needs to be aware from site observations which approaches are saturated to ensure that high DoS values are achieved in the base case model for calibration purposes. If the green splits, MF values (saturation flow) and traffic volumes are truly representative the DoS values will be accurate and should reflect modelled values near or above 95% for all saturated approaches except those where downstream queues reduce the effective green time.

For calibration of a normally saturated model it should only be necessary to indentify the oversaturated approaches which equate to degrees of saturation of near 95%.

### 2.4.11 Phase Skipping and Double Cycling etc

The modeller will need to consider if it is necessary to create models that reflect phase restrictions or additional phase demands and how this can be achieved in the model.

For base case models that reflect existing conditions the phase skipping and multiple cycling is described in the SCATS summaries, but even this information will need some interpretation to ensure the model adequately represents the phasing.

### 2.4.12 Pedestrian Facilities

The pedestrian phase time settings are included in the SCATS summaries, and these are required to be reflected in the model parameters.

It is may not however be necessary to model pedestrian signal groups (Objects) in TRANSYT for the assessment of conventional vehicle models. It may be sufficiently accurate to use the average vehicle phase times which reflect the average pedestrian demanded times.

Where the TRANSYT optimisation of projected models is likely to reduce the vehicle phase times, care must be taken to ensure that the phase minimum times are representative of pedestrian phase demands.

Some projects may however require the assessment of alternative pedestrian treatments in which case pedestrian demand measured during traffic surveys may be used in TRANSYT to model pedestrian delays, using pedestrian objects.

Modellers need to be aware of the effects of high volumes of pedestrians on turning traffic at intersections. It may be necessary for these circumstances to reduce the vehicle signal group green time to reflect the “wasted” green time at those locations.

### 2.4.13 Public Transport

If the model is to consider public transport priority options additional links will be required in the model/s, to model this correctly.

Where the performance of buses is to be assessed comparatively when they currently (normal for the base case) share the same lanes as the normal traffic flow, the bus flows can be identified on separate “minor “ links using the linkshare feature of TRANSYT.

The bus links for the proposed priority schemes will include bus stop delays and reduced cruise speeds of buses and be defined in separate links from the “normal” traffic links.

# 3 MODEL CONSTRUCTION

## 3.1 Building a TRANSYT model

Prior to building a model in TRANSYT information should already have been obtained, as identified in **APPENDIX B DATA COLLECTION**:

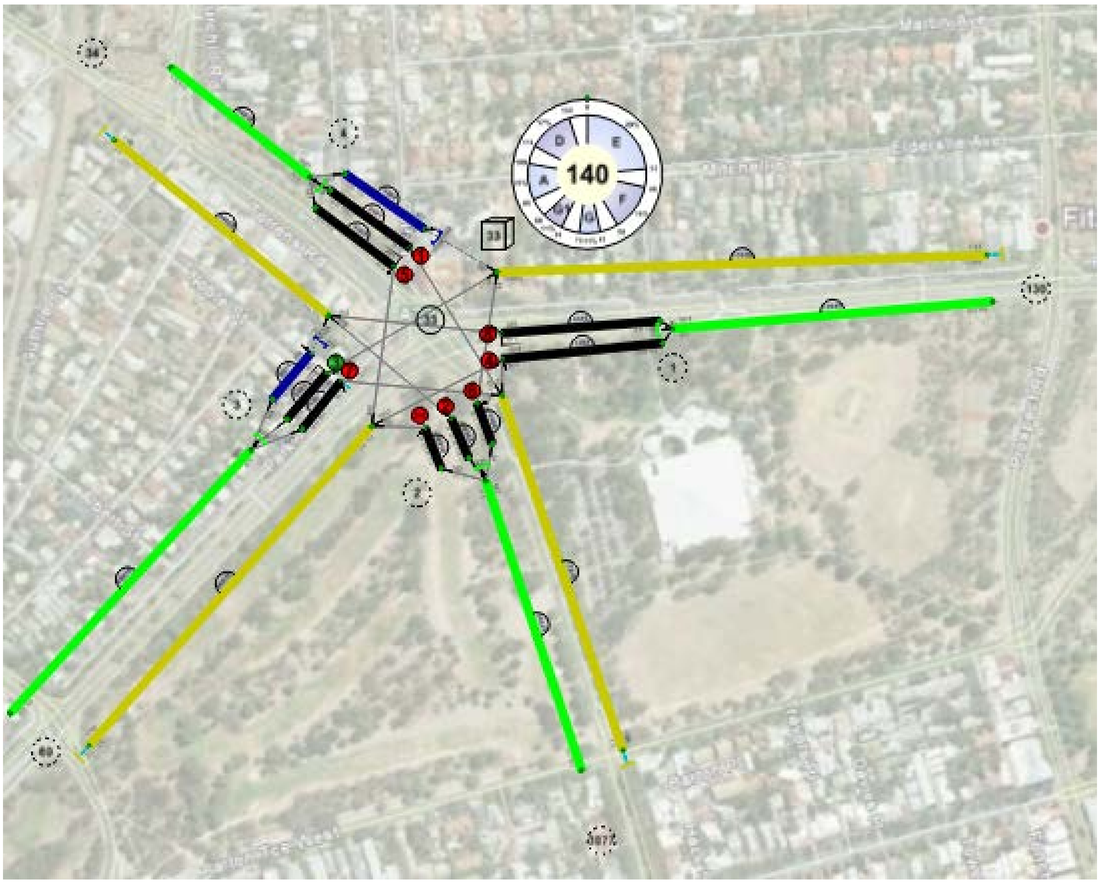
## 3.2 TRANSYT Network Structure

TRANSYT requires an abstract translation of the road network in order to represent the relationships observed on-street. It uses a series of Traffic Nodes, Controller Streams, and Links to model intersections and the interconnecting carriageway. The structure of a Traffic Node, Controller Stream and Links within TRANSYT determines its ability to accurately represent the traffic network.

A Traffic node represents an intersection and can be either signal-controlled or an unsignalised priority give-way.

A Controller Stream is used to control the traffic flows through the links.

DPTI only uses the TRANSYT "Link" representation of traffic approaches. Link models are more flexible in terms of managing traffic flows than the alternative option. Traffic flows should also be entered "DIRECTLY" rather than using an Origin / Destination (O/D) matrix input.



A “Link” represents a one-way traffic flow to or from a traffic node. Each link shall generally have a one to one relationship with a traffic movement e.g. left right or through. This will normally be adequate for modelling most situations however where the modeller expects differential queues to develop on adjacent lanes in the same movement additional links will be required to model this situation adequately. Additional links may also be required to model the behaviour of discrete vehicle types e.g. buses.

### 3.2.1 TRANSYT Labelling Convention

The node, controller stream and link numbering system used during model development should reflect set conventions to allow clear assessment of model output during audit and scenario optimisation. The DPTI conventions are described in **APPENDIX D DPTI - MODEL CONVENTIONS AND LABELLING**

### 3.2.2 Traffic nodes associated with Controller Streams

All signal controlled intersections will need a traffic node as well as an associated Controller Stream. The traffic nodes associated with Controller Streams shall be given the same numeric labels as the Controller Streams.

### 3.2.3 Controller Streams

Modellers should ensure that the controller stream signal timings are accurately represented in TRANSYT. For existing sites use the signal group and phase labels from the SCATS summaries

For new sites Information on the standard phasing to be used in the model and the labelling conventions to be used are contained in the Standard Drawing S-6841 “Traffic Signals Design Guide, Detectors, Signal Groups, Phasing and Pole numbering Standards”.

### 3.2.4 Non-Signalised Traffic Nodes

Priority give-way intersections in TRANSYT are modelled as ‘virtual’ signal-controlled intersections with stoplines at intersections. Give-way coefficients determine gap-seeking behaviour and depend on the following:

- Width of the give-way approach;
- Width of the main road;
- Visibility to the right;
- Visibility to the left; and
- Volume of the controlling flow(s).

Give-way coefficients, and how they differ according to the geometric characteristics of an intersection, are described in detail in the TRANSYT user guide “Application Guide 70” supplied with the application. These are entered in the link data for the give-way link concerned. DPTI uses the standard coefficients recommended in AG 70.

### 3.2.5 Signal-Controlled Links

Ensure that link signal timings are accurately represented in TRANSYT, particularly with respect to Signal Group gaining delays, and losing delays, and relative start and end displacements (affects the effective green periods).

Links associated with traffic signals will generally conform to the same labelling as separately controlled Signal Groups. Information on the standard signal group numbers to be used are contained in the Standard Drawing S-6841 "Traffic Signals Design Guide, Detectors, Signal Groups, Phasing and Pole numbering Standards".

### 3.2.6 Entry and Exit Links

Since entry and exit links do not have modelled upstream and downstream stoplines respectively, their link lengths and cruise times are arbitrary. It is however necessary for the link data to be consistent between base case models and scenario models.

### 3.2.7 Pedestrian Objects

Where the modeller uses Pedestrian Objects the crossing lengths can be entered from site-measured crossing distances. TRANSYT uses actual crossing times within the model using an average pedestrian walking speed of 1.2 m/s

# 4 MODELLING TECHNIQUES

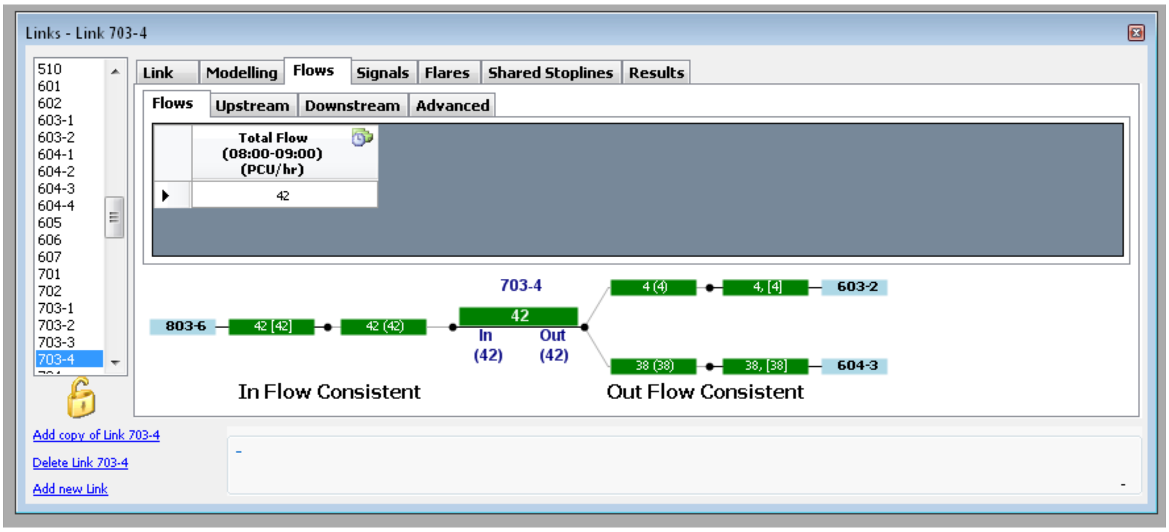
This section provides some basic guidance on appropriate techniques that can be applied with modelling judgement to better model particular conditions within a base case or scenario model.

## 4.1 Flow Balancing

Before turning counts are used in a model, a check must be made to ensure that traffic leaving one intersection arrives at neighbouring intersections and adjustments made accordingly.

There are a number of spreadsheet options available for smoothing traffic volumes or balancing them so the link outputs from one link equal the inputs at the downstream links. These methods should be considered before constructing the model. The spreadsheets can also be used to apply classification factors to convert vehicle numbers to PCU's.

TRANSYT 15 has a link consistency diagram which appears in the Link flows input tab window. This is useful to identify any input inconsistencies but it will not necessarily reconcile significant discrepancies.




Most base case TRANSYT models will be built using stopline flows from SCATS® Volume Store (VS) count surveys. The VS counts represent existing traffic volumes in "vehicle" units. It will be necessary to apply Passenger Car Units (PCU) factors to convert the counts to PCU values for entry to the TRANSYT model flows. Some midblock gains can easily be adjusted by adding uniform "midblock" entry flows. Midblock losses may simply be ignored if these are correct as the model will take account of this.

Any significant mismatches will however need to be accounted for and documented in the Traffic Signals Operational Performance Report.

#### 4.1.1 Passenger Car Units (PCU's)

Traffic is composed of various types of vehicles, the range and relative composition of which can vary from location to location. TRANSYT Traffic modelling software utilises a common unit, known as the Passenger Car Unit (PCU), to represent general traffic. Common vehicle types are assigned a conversion factor so that an equivalent PCU value can be generated from classified vehicle collected data.

Typical PCU[5] values to be used for different vehicle types are shown below:

| VEHICLE TYPE | PCU VALUE |
|---|---|
| **Pedal Cycle** | 0.2 |
| **Motor Cycle** | 0.4 |
| **Passenger Car** | 1.0 |
| **Light Goods Vehicle** | 1.0 |
| **Medium Goods Vehicle** | 2.0 |
| **Buses (11m )** | 2.0 |
| **Heavy Goods Vehicle, including Semi trailers** | 3.0 |
| **B-Doubles** | 4.0 |
| **Articulated Buses (17m)** | 3.2 |
| **Trams** | 3.5 |

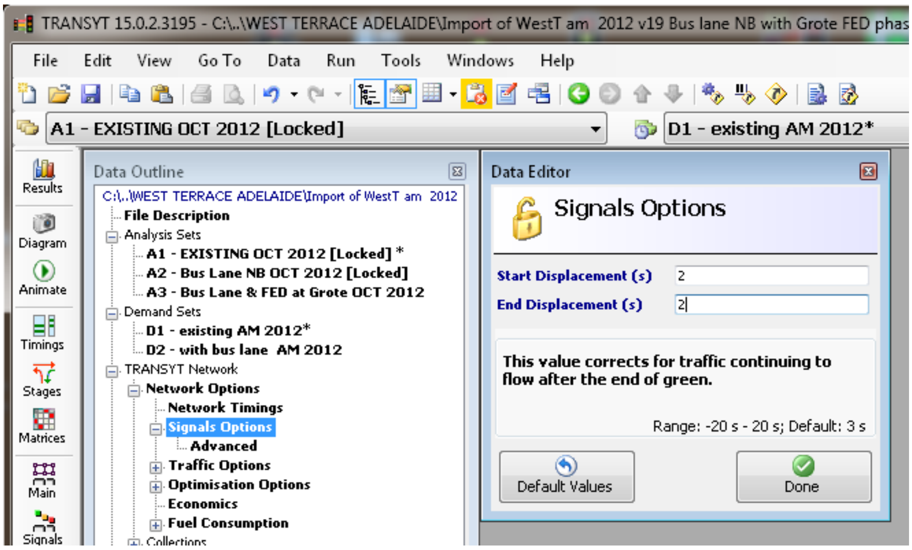
Table 1: Passenger Car Unit (PCU) values for various vehicle types.

[5] National Heavy Vehicle Register, National Transport Commission – Performance – Based Standards Scheme – Network Classification Guidelines July 2007.
https://www.nhvr.gov.au/files/resources/0018-pbsnetwrkclassglines.pdf

## 4.2 Adjustment of Signal Group "Gaining Delays" and "Losing Delays"

The times of the start and end of a signal group green period can be entered into TRANSYT.

There are configurable Relative Start and Relative End Displacements of Signal Groups which can be changed as global settings. These are dependent on normal driver stopping and starting responses.




Relative Start and Relative End Displacements of individual Signal Groups can also be made in the individual signal group settings. These are cumulative on the global settings so if the global setting is 2 and the individual setting is 1 the effective change is 3.

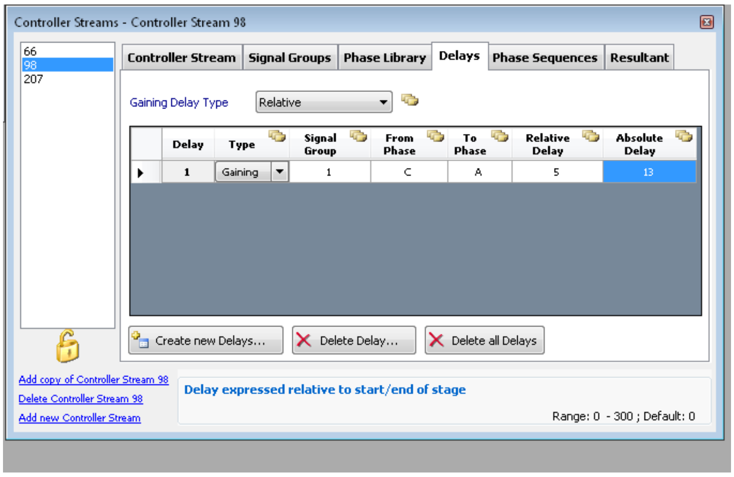
The individual signal group "gaining delays" and "losing delays" are also definable. These affect the actual green display period of the signal face.

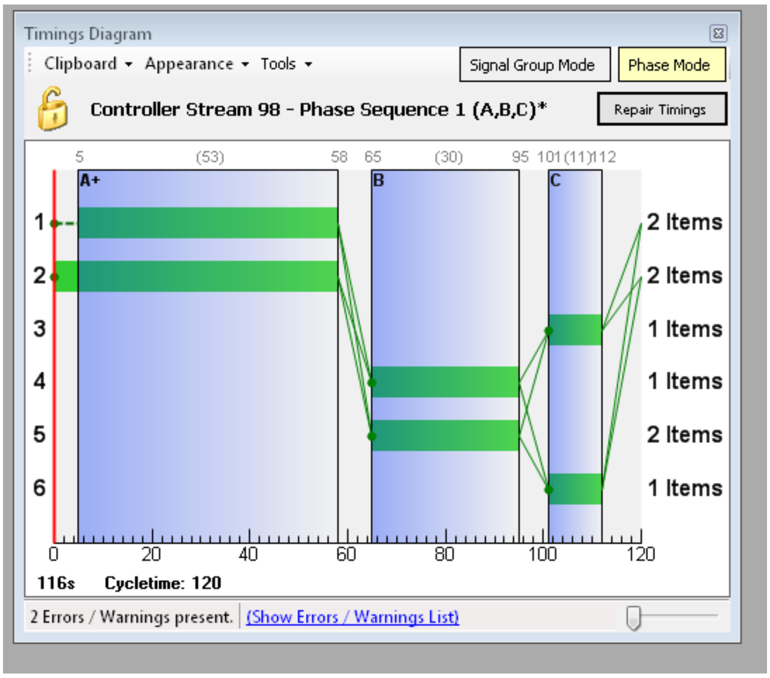
Signal Group "gaining delays" and "losing delays" control when a link commences and terminates green, relative to Phase change timings. These should be set according to link intergreen requirements and must also take account of any Signal Group delays that are present. Situations where it may be appropriate to modify "gaining delays" or "losing delays" include:

- Red arrow left turn pedestrian protection.
- High volume pedestrian interference with left turns.
- Red arrow drop-out for right turn filter movements.
- Accounting for exit-blocking.
- Modelling bus set-backs – 'B' lights.
- 'Bonus' storage effects (e.g. storage in front of a stopline for opposed right-turners which clear in the intergreen, and indicative arrows);
- Driver behaviour at particular intersections, resulting in usage of the starting yellow and red periods, beyond the dilema zone; and

This list is not exhaustive and other situations may be encountered where signal group "gaining delays" and "losing delays" adjustment is appropriate. It is up to the modeller to justify any decisions taken, and to fully report in the Traffic Signals Operation Performance Report on all adjustments. This is particularly important where multiple adjustments are made on the same link, as it can become impossible to audit signal timings if multiple modifications are not well documented.

The delays are configured via the **Controller Stream menu < Delays tab** and can be visualised in the timings diagram:



## 4.3 Stop and Delay Weightings

Stop and delay weightings are used to apply penalties to stops and delays on links by increasing their cost within the PI calculation used for optimisation.
For project evaluation use the default weighting settings set to zero, i.e. no weightings.

## 4.4 Queue Limits

Queue limit penalties can be imposed in order to discourage the formation of queues on links during the TRANSYT optimisation process, in a similar manner to stop and delay weightings. This penalty imposes an additional cost on network PI when the queue on a link extends past a user-defined or calculated value.

Queue limits and respective Penalties can be useful to prevent the formation of disruptive queues on circulating links within a gyratory, or on short internal links where queuing can cause wasted capacity within an intersection e.g. a staggered “Tee”.

Where it is necessary to provide queue penalties these costs should generally be a factor of 10 times the normal delay costs. See **APPENDIX C – TRANSYT 15 CONFIGURATION** for economic cost parameters.

QUEUE penalties should however be removed for making PI comparisons between alternative model scenarios. When Penalties have been removed it is necessary to re-run TRANSYT to produce the actual comparative PI. BEFORE THIS THE MODELLER SHOULD ENSURE THAT THE OPTIMISATION IS SET TO “NONE” TO ENSURE THAT THE PREVIOUSLY OPTIMISED TIMING SETTINGS ARE NOT ALTERED.

# 5 CALIBRATION AND VALIDATION

Traffic models are developed to understand how a transport network may react to scenario change. To do this a “base case” traffic model is created which represents the existing situation. This model provides the benchmark against which any scenario will be compared. By comparing results between the existing and scenario situation an informed decision can be taken on whether to proceed with the scenario based on the impact it will have on the existing network.

It is the responsibility of the model developer to generate a robust methodology that generates accurate, fit for purpose, modelling.

The exact nature of the required modelling elements will be defined by the scope in a documented “purpose statement”, and approved by Traffic Operations Group and/or the DPTI project manager.

## 5.1 Base case Model Calibration

Traffic models are as accurate as the calibration and validation processes undertaken during development. Modellers should consider the most appropriate techniques, as accurately calibrated and validated base case models form the basis for scenario options modelling.

Calibration describes the process of placing verifiable data into a traffic model to replicate observed street conditions. All input data for calibration should be auditable, such as signal timings and on-street measurements (e.g. lane distance, cruise times, saturation flows). Much of this data is supplied in the “SCATS Summaries” supplied by Traffic Operations Group. Calibration may require the adjustment of model parameters to recreate observed behaviour, for this reason the calibration process should be applied to each period being modelled.

A calibrated TRANSYT base case model is defined as being a model which has correct link structure and geometric input data, and representative signal timings for the modelled period. The calibration model should be accompanied with a technical report stating the purpose of the model, the modelled period, and study area. This report will form the calibration section of the Traffic Signals Operation Performance Report.

The purpose of the calibrated model is to allow the model developer, and any model auditor, to assess model structure and the correctness of initial input data. At this calibration stage it is possible to identify issues which may hinder future development of the model. For this reason the calibrated model should be accompanied with tabulated data that clearly emphasises model inputs and how they were derived from measured sources.

It is usual to prepare the calibrated model based on AM peak parameters.

## 5.2 Base Case Model Validation

Validation is the process of comparing model output against independently measured data that was not used during the calibration process. The purpose of validation is to verify that a model has been correctly calibrated and is therefore capable of producing valid predictions for project scenarios.

The overarching aim of validation is to produce a model that is fit for purpose. Common validation parameters such as degree of saturation and journey times, and queue length are used to show confidence that calibrated model results accurately reflect observed on-street behaviour.

Validation criteria are used to demonstrate that the modelled results fall within an acceptable tolerance of measured data. These criteria vary according to the modelling software used. If a model fails to validate it is often an indication that poor data collection practices were adopted or that further calibration is required.

### 5.2.1 Validated TRANSYT Base Case Model

Validated models are required for all model demand periods and would include any additional calibration of these alternatives where phasing or cycle lengths are different than the original (AM peak) calibrated model.

Base case TRANSYT models should not show results for DoS over 95%. TRANSYT uses stopline traffic counts rather than demand flow. All traffic should clear the stopline within the TRANSYT modelling period; therefore if a model has a DoS value over 95% then discrepancies may exist for one or more of the following parameters: saturation flow, link structure, green time and/or stopline flow.

### 5.2.2 Additional Validation Considerations

Queue lengths are not reliable as a validation measure but should be considered as a check i.e. queues should be predicted by the model where they can be observed but it is not necessary to quantify the length of the queue. TRANSYT will predict Mean Max Queue (MMQ) lengths on the links which represents the average queue over the model period so will provide a relative assessment of where queues occur.

Travel times produced by TRANSYT Models, represent averages for all vehicles using a defined route, and have been found not to match well the values observed from probe vehicles, and so will be ignored for the purpose of validation.

Journey times will however remain an essential element of a before and after study of the project.

# 6 SCENARIO MODEL DEVELOPMENT

The scope of a scenario can vary from a minor adjustment of timings at a single site to a complete redesign of intersections, layouts and methods of control across a wide area and include new intersections for a major project.

Scenario models are usually modified versions of validated and approved base case models. Any changes to the base case model should be limited to the minimum required to represent the scenario changes. When producing models of a scenario for a project it is essential that the model accurately reflects any changes which form part of the project, which should be discussed and agreed with the Project Manager and Traffic Operations Group and/or the DPTI client area.

Every scenario is unique and it is beyond the scope of this document to list all the parameters that may need adjustment. It is the responsibility of the modeller to determine the changes that are required and to justify any applied methodology.

When producing a scenario model it is important to consider the traffic management objectives of the project. Whilst overall network performance measures should be considered, these should not override Project specific considerations.

## 6.1 Developing Scenario Models

"Scenario" TRANSYT models should only be created from a validated base case model modified to construct the scenario.

Cruise times should not be changed to reflect a scenario that is expected to reduce queuing and delay as cruise times represent free-flow conditions. However, cruise times should be re-measured if scenarios are expected to involve changes that impact on cruise speed, such as a change in parked vehicles, introduction of speed reduction features or stopline-to-stopline distances being changed, or revised speed limits.

## 6.2 Changes to Intersection Design

Modifications to intersection design or method of control may typically require a recalculation of phase minimums and phase intergreens. For this purpose reference should be made to the DPTI Yellow Red Template (See **APPENDIX F - DPTI SUPPORT SERVICES**) which details phase minimum and intergreen timings including pedestrian phase times, i.e. walk and clearance, at signalised intersections. Calculation of phase intergreens for traffic must be undertaken in accordance with the DPTI Yellow Red Template.

For all new intersections use the DPTI Yellow Red Template and include the design output in the Traffic Signals Operations Performance Report.

Layout changes within a scenario design may affect saturation flows. Where existing saturation flows are affected by new issues such as pedestrian movements or parking regulatory changes, the impact of these should be accounted for in the saturation flow values used. To do this saturation flows may be estimated. The method of estimation should be documented in the Traffic Signals Operations Performance Report.

It is recommended that changes to geometric inputs are assessed by processing a version of the scenario model incorporating just these changes, before applying changes to signal timings or traffic flows. This will allow the modeller to gain a rudimentary estimate of the impact of physical design changes on the performance of the study area.

In the development of scenarios, the modeller must test alternative phasing arrangements and be confident that they are practicable.

A scenario model should supply intersection design information to a level of detail that allows the production of a Controller program. Care should be taken in interpreting TRANSYT output in order to reconcile Signal Group based model output with Controller programming and timing requirements.

Where critical offsets exist within a base case model, these need to be checked to ensure correct groupings are carried forward into any scenario options.

Consideration should always be given to pedestrian movements during intersection design. Designers should be mindful of optimising phasing design so pedestrians can move smoothly through the network.

## 6.3 Changes to Traffic Flow

Scenario modelling should represent the traffic flows or flow patterns in the Project Specification.

Where the model is for the assessment of development proposals, e.g. a new supermarket, the trip generation estimates and assumed trip distribution needs to be clearly described and shown in a map format, and included in the Traffic Signals Operations Performance Report. The source of the trip generation rates also needs to be included in the report.

Where flows are not significantly changed from the base case, short lanes or flare usage should not be expected to change from the values held within the calibrated and validated base case model. However where flows are predicted to change following implementation of a project scenario, the effective “QUICK” flare link saturation flows should be re-estimated.

### 6.4 Adjustments for Adaptive phase demands

The validated base case model on which the scenario model is based may have been calibrated with Adaptive phases appearing for only a proportion of the total cycles modelled.

If the cycle time is changed in the scenario model, then the number of demand dependent phase/signal group appearances, and consequently the proportion of green time may need to be adjusted to account for the change to the total number of cycles per hour that will be modelled. Similarly, if the cycle time does not change but demand (either pedestrian or vehicular) is expected to change then consideration should be given to whether the frequency and or duration of Adaptive phase appearances will need to be manually adjusted.

In order to generate optimum offsets for when Adaptive phases/signal groups appear it may be necessary to adjust minimum green times for these phases.

# 7 OPTIMISATION OF SIGNALS

## 7.1 General considerations

The initial stage of model optimisation provides an opportunity to assess the performance of the signals after major design decisions have been implemented.

The initial optimised signal settings are usually automatically generated through the TRANSYT optimisation algorithm to reduce delays and stops.

The final optimisation of traffic signals should only be considered after the physical review of the design of the project has been completed.

Major design decisions made during scenario development should be made without any weighting being applied for delays and Stops to the model links. In considering the optimisation of the signals consideration might be given to weighting the “Main” or “Arterial” roads in order to improve signal co-ordination.

## 7.2 Intersection Storage Effects

Storage in front of stoplines for right turn filter turners are frequently modelled as signal group gaining or losing delays, in order to account for vehicles clearing during the intergreen period. Where signal group gaining or losing delays have been modelled, they should not be removed from any optimisation steps unless physical layout or phase sequence changes within a scenario prevent the storage in front of the stopline from being used.

## 7.3 Utilisation of Network Capacity

A modeller may decide it is more efficient for a scenario to contain fixed signal offsets to prevent cyclical problems caused by short lanes i.e. flaring, on the approaches, and funnelling (downstream merging) or exit-blocking. Within certain network layouts the use of a fixed offset can encourage drivers to fully utilise available road space. Where the modeller has fixed the signal offset times in the scenario model, the justification for this needs to be included in the Traffic Signals Operation Performance Report.

## 7.4 Cycle Time Optimisation

The project specification will normally nominate a cycle time (e.g. 120 seconds) for testing the capacity of a network. Evaluation of the model will normally be based on this cycle length but the modeller can use the internal cycle time optimiser (CYOP) to evaluate alternative phase sequences, double, triple and quadruple cycling etc, and to recommend an optimised cycle length if there are significant benefits to be obtained.

## 7.5 Optimisation of Green Splits

TRANSYT requires a set of signal timings for every signal-controlled node prior to beginning optimisation, for a scenario model these initial timings should be derived from the validated base case model. A modeller can use “Auto Redistribute” to overwrite specified signal settings, which will allow TRANSYT to calculate initial signal timings based on equalised DoS on the critical conflicting links at each node.

As the initial start Phase may change during optimisation in TRANSYT, derived timings may not be exactly the same as those produced by a previous calculation. Modellers should also be aware that this effect can generate two repeated results when running back to back TRANSYT optimisations. In this situation “Auto Redistribute” should only be run during the initial optimisation to balance the network with subsequent iterations utilising already optimised timings for the next simulation run.

It is important at all stages of optimisation to assess model output to ensure scenario signal timings are fit for purpose relative to the scope of the project.

Modellers should note that it is not necessary to report modified green splits as these are not used as inputs to the SCATS adaptive system. It is however important that the green splits predicted are practical in terms of reflecting practical minimum green periods, including pedestrian clearance times.

# 8 MODEL REPORTS

The Traffic Signals Operation Performance Report should reflect the logical approach taken by a modeller to resolve the complex and iterative nature of traffic modelling. It should emphasise the sound engineering principles adopted during model development. Without accurate reporting the model development process is hindered by a lack of historical information. The following subsections outline an approach to model reporting which should allow a third party to accurately comprehend the decisions made during the development process from network familiarisation through to scenario evaluation.

A traffic model may be developed over a long period by a number of different modellers. While developing a model the modeller/s should retain detailed notes that include a record of all assumptions and modelling decisions. These notes should be kept for future reference, and can form the basis for subsequent reporting in the Traffic Signals Operation Performance Report.

It is the responsibility of the modeller and the project manager to ensure that all reporting is accurate, thorough and sufficient, and that submitted documents are fit for purpose to adequately support accompanying models. The TRANSYT *.t15 data files for each model period must accompany the Traffic Signals Operation Performance Reports submitted to the Department of Planning, Transport and Infrastructure

## 8.1 Calibration Report

The calibration section of the Traffic Signals Operation Performance Report should present all relevant survey data and include a history of model development.

Model auditing will rely on the Traffic Signals Operation Performance Report to explain how the model has been calibrated. For this reason the calibration section of the Traffic Signals Operation Performance Report should focus on presenting traffic model inputs and detailing how the model has been developed to ensure that it represents existing conditions. In particular, the following should be included:

- The stated purpose of the model;
- A list of all SCATS® site numbers in the model, with street addresses and where required a note detailing any operational relationships (e.g. marriage chains);
- Clear notes on any site observations and measurements, covering both the physical network and observed vehicle behaviour. Where behaviour is specific to a particular time of day, this should be noted along with how it has been accounted for in the model;
- Table of saturation flows for each link in the network, and indicating the MF values used and/or modified values, and if modified whether measured saturation flows were used,
- cruise times, and
- Effective bay lengths and flare lengths.

## 8.2 Validation Report

Validation Traffic Signals Operation Performance Reports should look in detail at comparisons between calibrated model results and existing conditions. The model developer should detail the validation process, from on-site surveys through to adjustments made within the model. Any decisions made by the model developer should be captured especially where model inputs have been adjusted in order to achieve validation.

Validated model results should be tabulated and compared with the surveyed on-street values for all modelled periods. If there are discrepancies between the model outputs and the on-street conditions then these should be identified, investigated and explained. Specific items that could be included in the validation section of the Traffic Signals Operation Performance Report are:

- Details of traffic flows used, where and when they were sourced from and how the model periods were chosen;
- Minimum Phase time adjustments made to reflect average phase utilisation e.g. where pedestrian phases are demand dependent.;
- Validation data, such as DoS and vehicle journey times;
- Relevant site observations not already included in the calibration Traffic Signals Operation Performance Report , such as:
- Give-way behaviour, exit-blocking, flare/non-green usage, parking/loading and bottleneck details; and
- Evidence of validation, comparing modelled results to on-street observations and measurements.

Any discrepancies between observed and model outputs should be analysed and discussed.

## 8.3 Scenario Models Report

The Traffic Signals Operation Performance Report accompanying any scenario model must give a full description of the scenario and any expected model impacts (e.g. any expected changes in demand i.e. the project specification requirement for projected flows). The modifications made to the validated base case model to develop the scenario model should all be based on these key details. All changes made in order to develop the scenario model should be documented by the modeller, along with the reasoning behind them. Specific items that should therefore be included in the scenario section of the Traffic Signals Operation Performance Report are:

- Project summary;
- Project objectives/problem identification;
- Scenario traffic management strategy;
- Evaluation of scenario results;
- Conclusions and recommendations;
- Design summary sheets;
- Model source data;
- Modelling assumptions;

- Electronic copies of model data file/s, (which include input and output data), must be supplied with the text report.

The Scenario report must also include:

- Details of the performance of each intersection using the specified design traffic flows including:
    - o Degree of saturation, LOS and predicted queue lengths for individual traffic movements;
- Intersection layout plans, traffic signal phasing, phase sequences and time settings.
- Offset parameters for linking to adjacent traffic signal sites;
- Discussion of alternative schemes considered and reasons for the recommendations;
- History of design changes with supporting reasons from 30% Nominal Design through to the Final Design;
- Discussion of any variations from the requirements of the original project specification.

Results of the scenario model should be compared to the validated base case model/s. This should be done for all modelled periods to demonstrate the impact of the scenarios on the network. The scenario section of the Traffic Signals Operation Performance Report should include a discussion of results. It is useful to include a section detailing the impact of any geometric changes as this enables Traffic Operations Group to make informed decisions about preferred design options. Version control should be applied to all model design documents to avoid ambiguity thus ensuring all parties are aware of the current design status for each scenario model.

All data presented with the validated and approved base case models should be presented in conjunction with the scenario section as DPTI will use the modelling output and analysis to make an assessment of the likely impacts of the project and in determining the traffic signals personality conditions to be programmed. Data provided with the base case and scenario model submissions will be considered when producing the personality, therefore it is in the modellers' interest to ensure scenario model reports are provided with adequate detail.

## 8.4 Recommended Scenario

It is essential that the modeller include in the scenario section of the Traffic Signals Operation Performance Report the recommended Scenario for the project.

The TRANSYT model Performance Index will normally be used to compare the base case with the project scenarios and to select the recommended scenario based on the lowest PI. The modeller may however base the selection using other criteria but these need to be included in the report.

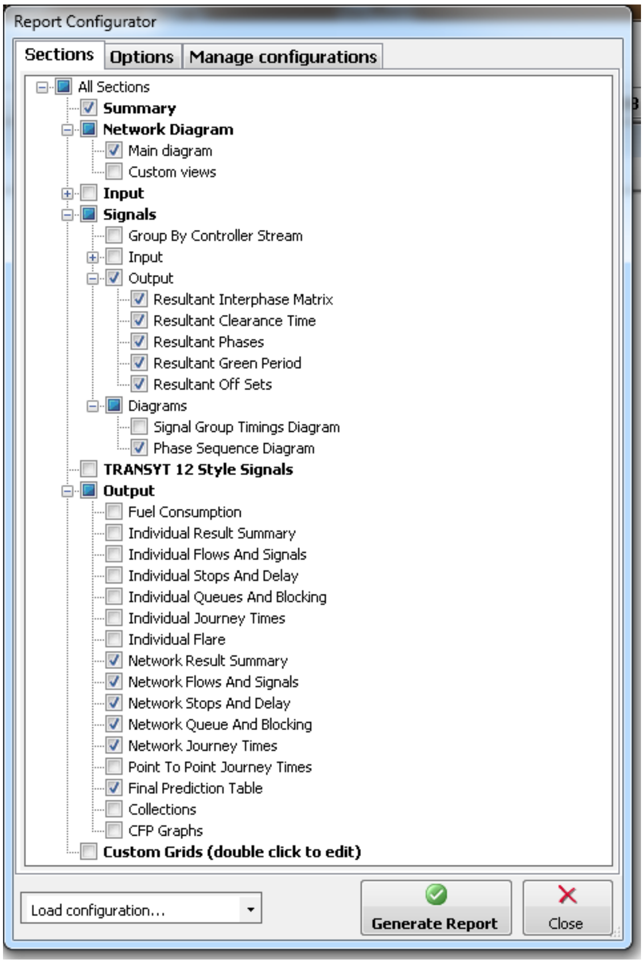
The modeller needs to be cautious that the preferred option does not include excessive queues [e.g. on side roads], not reflected in the comparative PI.

# 9 DOCUMENTATION REQUIREMENTS

TRANSYT can deliver a number of outputs that provide a modeller insight into model results. These allow analyses of optimised signal timings and their potential impact on-street such as required during scenario fine tuning.

The report options in TRANSYT can now be fully customised; however there are a series of preconfigured reports that for the most part provide the information required to assess the model performance:

DPTI specific requirements for the Traffic Signals Operational Performance Report are indicated by the ticks below in the Report Configurator:




Summary of requirements:

- NetCon Diagram - an image of the active NetCon Screen when the report was generated.
- Signals matrices (interphase)
- Signals diagrams (timing and phase diagrams).
- Signals Output resultant times, interphase matrix, Clearance times, etc.

- Signals Output resultant “Offsets” table to provide SCATS® offset values for linking purposes. (Offsets shows SCATS® daisy chain style offsets as positive and negative values)
- All Network outputs,
- Final prediction table, showing summary of all link results.
- CFP graphs, any CFP graphs for links selected for inclusion in the report.

TRANSYT is capable of providing reports for each timing segment and a summary of time segments. A summary of the demand “hour” is normally sufficient.

## 9.1 TRANSYT Report File

The report files should be examined to extract information relating to settings for link offsets, cycle times, traffic flows, saturation flow, mean cruise time, green start and end time.

The report provides numerical output which is of use to a modeller when assessing a scenario set of signal timings. It provides the intermediate and final settings produced during optimisation alongside link predictions for DoS, Mean Maximum Queue (MMQ) and Performance Index (PI), average excess queue and the separate components of delay. The report file also displays network data such as total distance travelled total monetary value for stops and delay, mean journey speed and total network PI. These data should not be used in isolation to assess the merit of scenario signal timings.

In the links summary table the TRANSYT report can be used to identify sources of poor optimisation or network performance. TRANSYT aids the interpretation of the TRANSYT report by flagging potentially problematic links using symbols. TRANSYT will produce a (✓) symbol in the “Adjusted Flow Warning” column to indicate that flow into that link has been reduced by more than ten percent..

It will also produce a (✓) symbol in the “DoS Threshold Exceeded” column when DoS is exceeded by 95%.

In the Link Results: Queues and Blocking can be found the predicted queue details. To estimate an average excess queue the MMQ of a link is checked against the queue limit/link capacity during each step of the cycle. If the limit is exceeded for a time step the excess queue is noted to generate an average excess queue value which accounts for the duration of time during which blocking back may have occurred. If Blocking is expected to occur this is shown with a (✓) symbol in the Estimated Blocking column.

The modeller must include in the Traffic Signals Operational Performance Report the “summary” report from TRANSYT which contains the Performance Index; for each demand period and each option including the base case.

For projects where traffic signals are co-ordinated the modeller must also include from the reporting outline the “Signals<Output<Resultant Off Sets” report (see below).

The "Offset Data" report is essential as it enables SCATS to be more easily configurable.

## Offset Data

### Controller Stream

| Controller Stream | Offset Positive (s) | Offset Negative (s) | Offset Relative To | Offset Valid |
|---|---|---|---|---|
| 0066 | 107 | -45 | 3045 | ✓ |
| 3042 | 147 | -5 | 3083 | ✓ |
| 3043 | 61 | -91 | 3084 | ✓ |
| 3044 | 0 | 0 | | |
| 3045 | 136 | -16 | 3094 | ✓ |
| 3083 | 144 | -8 | 3043 | ✓ |
| 3084 | 136 | -16 | 3044 | ✓ |
| 3094 | 24 | -128 | 3104 | ✓ |
| 3104 | 67 | -85 | 3044 | ✓ |

## 9.2 Graphical Output

TRANSYT produces a number of graphical outputs that are illustrative of the model scenario and may be used in the Traffic Signals Operational Performance Report to illustrate the performance visually. It is the modeller's choice which graphs might be included in the report. A description of those available is given below.

TRANSYT can produce histograms to illustrate **queuing** behaviour by plotting the number of PCUs in a queue against time in the cycle. The facility is useful as it can highlight queuing occurring during green periods, i.e. where flow along a link is greater than saturation flow.

**Cyclic flow profiles (CFP)** are histograms of traffic flow rate (PCU/hr) across a signal-controlled stopline throughout the length of a signal cycle. CFPs are useful for assessing offset progression between stoplines as the timing of platoon arrival and queue discharge can be compared between linked histograms.

The CFP also provides an indication of the Mean Modulus of Error (MME) for each link. MME is a measure of how bunched a travelling platoon is as it progresses along a link, and is an important parameter when deciding whether a particular link should be coordinated with an upstream link. A value for MME higher than 0.3 suggests stopline coordination may be effective whilst a value of zero indicates a uniform arrival pattern.

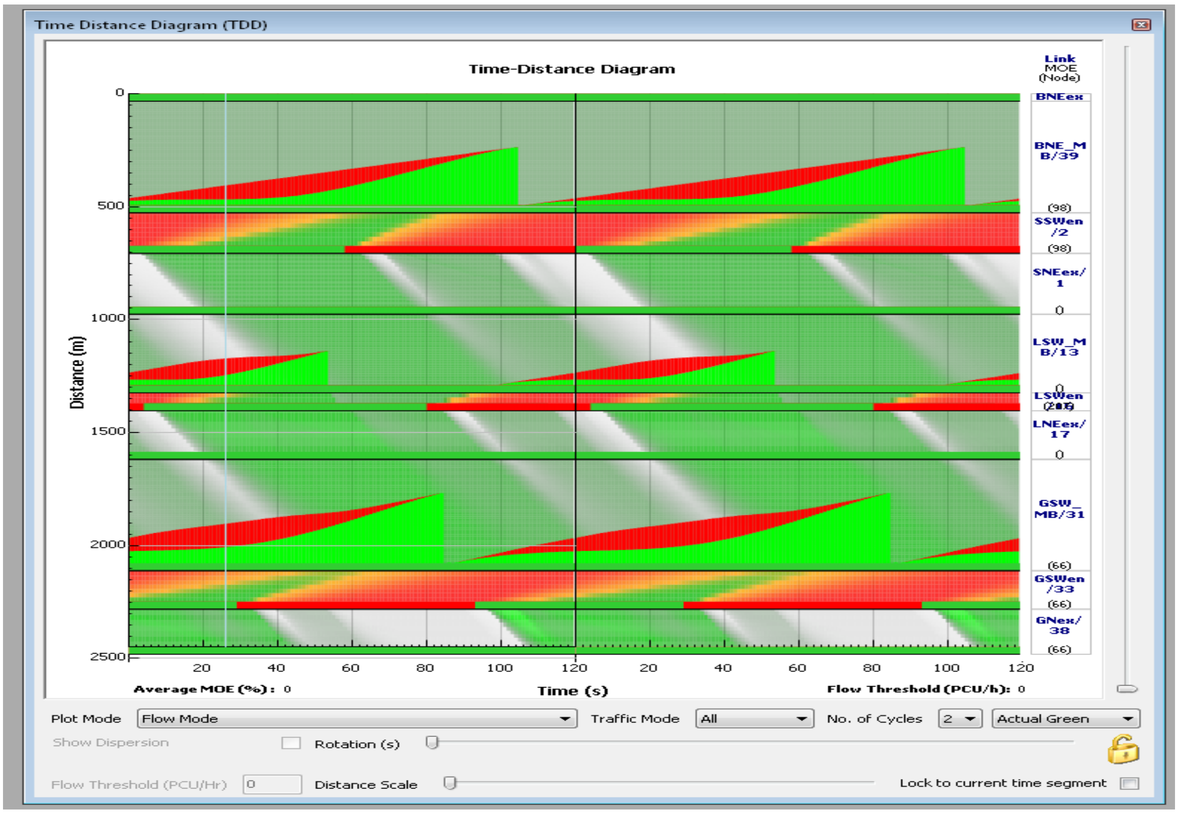
A **PI offset** graph can be used to indicate the likely change in link PI following a change in the offset between the displayed node and an upstream node. Generally the lower the PI the better the coordination between associated signalised stoplines.

The **Cycle Time Optimiser** (CYOP) produces an x-y graph of the Network cycle time versus the Performance index for a series of TRANSYT runs. This graph can be very useful in selecting a preferred cycle length.

Various **X-Y graphs** can be produced to compare data elements from different model runs.

A **time-distance diagram** allows the modeller to modify signal offsets to provide priority to a particular route by minimising stops and delay. The diagram illustrates the progression of a platoon along a complete route. This can be a useful feature when assessing the output of a scenario to check front and back end progression along a critical route. The user must first create a collection of links along a route to be able to generate the diagram. After creating the collection when it is selected and the time distance diagram can be generated. The time distance diagram will show grey areas representing the vehicle paths through the green time at adjacent controller streams.

The time distance diagram can also show a combination of flow and queue effects as shown below:



# 10 APPENDIX A - MODEL PURPOSE STATEMENT AND MODELLING REQUIREMENTS

Document clearly in a “purpose statement” the reason for and scope of the model e.g. to consider the impact of a major project or a new supermarket development on the arterial road or to review the traffic signal co-ordination on a route.

Where the model is being prepared for a discrete project the project specification should adequately describe the modelling requirements. The modeller may however need to prepare a modelling purpose statement to clarify modelling requirements.

In preparing the purpose statement the modeller should describe the objectives in a clear series of expected Outputs for example:

- Reduce delays, travel times and queues by improved signals co-ordination through SCATS®.
- Translate the Model recommendations into data input changes in SCATS®.
- Use the model to recommend any Phase sequence and or infrastructure changes that would improve transport/travel conditions.
- Input Objectives:
    - Collect input data; Use SCATS® summaries for all control data.
    - List the traffic demand periods to be modelled e.g. AM and PM peaks and representative Business hour. The models will represent hourly traffic volumes.
    - **Calibrate** **<u>One base case</u>** model based on AM peak traffic operations.
    - **Validate** **<u>Three base case</u>** models of existing traffic conditions for AM, PM and a representative Business hour. Hours usually selected from daily flow pattern 8-9am, 5-6pm and 1pm to 2pm. (note: peak hours should be selected to the nearest 15 minute period for the network being considered).
    - Optimise signal timings for **<u>Three scenario</u>** models for the same periods of the day as the base case models. New models are to reflect: Alternative phasing, recent traffic signal changes and geometric changes to the road.
- List all the sites to be included in the model and provide a mud map to illustrate the model scope showing symbolically the location of the intersections.
- List the model options to be created; which will always include a base case and at least one project case scenario. The project case scenarios will be compared with the base case. Use the base case to calibrate the existing situation.
- The Scenarios may include various changes to the Phase Sequence/s, Geometry, lane configuration and Cycle Lengths.
- The traffic modelling tool selected for this project is the latest version of TRANSYT. The version number should be provided in the modelling

scope statement so that the model might be considered for use in future work.

- The Base Case model will be a fair representation of the existing traffic conditions prevailing at the start of the project.
- The scenario options shall not be modelled until the base case model is calibrated and validated to the satisfaction of the project manager and DPTI.
- Calibration is intended to check all model input parameters are correct.
- Comparison of Degree of Saturation output with expected values shall be the main parameter used for validating the model.
- Travel times are not to be used for validation of the TRANSYT model options but might be used for evaluation of the post implementation benefits of the project.

# 11 APPENDIX B - DATA COLLECTION

Once familiar with the modelled network it is necessary to collect the relevant information required to generate an accurate base case traffic model. Without accurate data a model cannot be correctly developed, calibrated or validated. A common cause of inaccurate data is a lack of understanding and experience on behalf of a person collecting data. The modeller must possess a thorough understanding of modelling concepts as well as experience of developing traffic models.

Prior to building a model in TRANSYT the following information should be available:

- Site Layout Drawings,
- SCATS® SUMMARIES: these provide most of the Traffic Signal Controller and SCATS® site information necessary to create a model; these summaries include a SCATS® Picture Diagram.
- DPTI Traffic Signal Controller Specifications and Signal “Controller Operations Sheet” may be required if more detailed information is required than contained in the SCATS® summary,
- Measured values for link length, cruise time, and bay/flare usage.
- For the base case stopline traffic flows by lane using VS data from SCATS®. [VS data is readily available see below]. Turning movements should be derived by alternative means for shared lanes and undetected lanes;
- A picture should be obtained from Google Earth or similar source that can be used as a background for the models which includes most of the geographical area under consideration in the model.

Detailed drawings, maps and aerial photographs can be used to determine site layout. However, a site visit must be carried out to confirm the accuracy of any material used.

Site-specific parameters should also be collected for all periods of the day for which the models are being prepared as site conditions can vary temporally. Common examples of data that can be noted or measured during site visits are:

- Date, time of day and day of week;
- Intersection/network layout; lane / link lengths, lane widths and pedestrian crossing distances;
- Lane/road markings and usage;
- Cruise times;
- Saturation flows;
- Give-way behaviour;
- Vehicle and/or pedestrian spot counts;
- Right-turner effective bay length and blocking effects;
- Left-turner effective bay length and blocking effects;
- Short through lane (Flare) lengths and usage;
- Flaring and funnelling (diverging and merging lanes);
- Exit-blocking (measurement of wasted green time on approaches);

- Bus lanes, hours of operation, bus stop locations and bus stop dwell times [only required where buses are to be modelled on separate links];
- Car parks, street parking and interference during parking manoeuvres;
- Restrictions on the network (parking/stopping/loading, etc);
- Speed limits;
- Roadworks and other incidents, and their impact on throughput;
- Degree of saturation (it is important to know which approaches are oversaturated for each modelling period, this is used in validating the models);
- Journey times (for both private and public transport); and
- Queue lengths.

Whilst many of these parameters can be measured in quantifiable terms, it is also important to record general site observations that capture more subtle behaviour exhibited within the study area. It can be useful to note where traffic behaviour does not reflect street markings or the intended geometric design of a intersection, for example where ahead moving vehicles use a dedicated left-turn lane.

Many parameters are time dependent, and should therefore be recorded for each period being modelled, such as effective flare usage which can vary at a site according to differing traffic patterns.

## 11.1 Traffic Count Data

The project specification will detail the traffic flow requirements for model assessment. It is however essential, that existing traffic volumes are used to assess existing traffic networks, for validation purposes.

Traffic volumes representing existing flows will be supplied by DPTI for the purpose of calibrating and validating TRANSYT models. This is supplied the format shown in **APPENDIX F – DPTI SUPPORT SERVICES.**

These traffic volumes, to be used for all existing traffic signal sites as the basis for calibrating an existing traffic signal network, comprise SCATS® VS data. The selection of suitable days to abstract the data is the responsibility of the modeller. The VS data is a measure of vehicle detector inputs, and should therefore be converted to passenger car units (PCU's) for input to the TRANSYT model.

Where no VS data is available for lanes or movements additional manual counts may be required.

The time and duration of the peak demand periods to be modelled may be determined from the VS count data. This should represent an hourly period during which the largest total amount of traffic was observed. A modelled peak period is typically one hour, however longer peaks can be used in the Demand set, if appropriate, but the TRANSYT analysis is based on a single hour. VS count data is normally supplied in "column" output in either hourly or 15 minute increments by site and detector.

Classified counts are available for most of the Adelaide metropolitan road network from the “integrated transport intelligence and Mapping System” (ITIMS) Traffic Information Map website maintained by the Road Asset Management Section (RAMS).

Classification counts will be used to factor vehicle counts to produce passenger car units PCU’s (through car units [TCU’s]). PCU’s are the values used as the demand input flow values used in TRANSYT.

Do not use the iTIMS intersection count turning volumes for creating base case models. These intersection counts may provide some additional support information however given the temporal distribution of these counts they are not suitable for use as model flows. The VS data can be supplied for a common demand period for all intersections in the project.

Manual counts may be required for significant non-signalised intersections and for non detected movements at signal controlled intersections.

Note it is the modeller’s responsibility to ensure that the Traffic counts and green splits supplied are for the same periods at all modelled intersections, i.e. that they are compatible for validation of the models.

## 11.2 Typical Traffic Conditions

Where data needs to be collected from site, either during general site visits or traffic surveys, the modeller must ensure that network conditions and traffic signals are operating typically and there are no other unusual activities or travel patterns. This includes, but is not limited to:

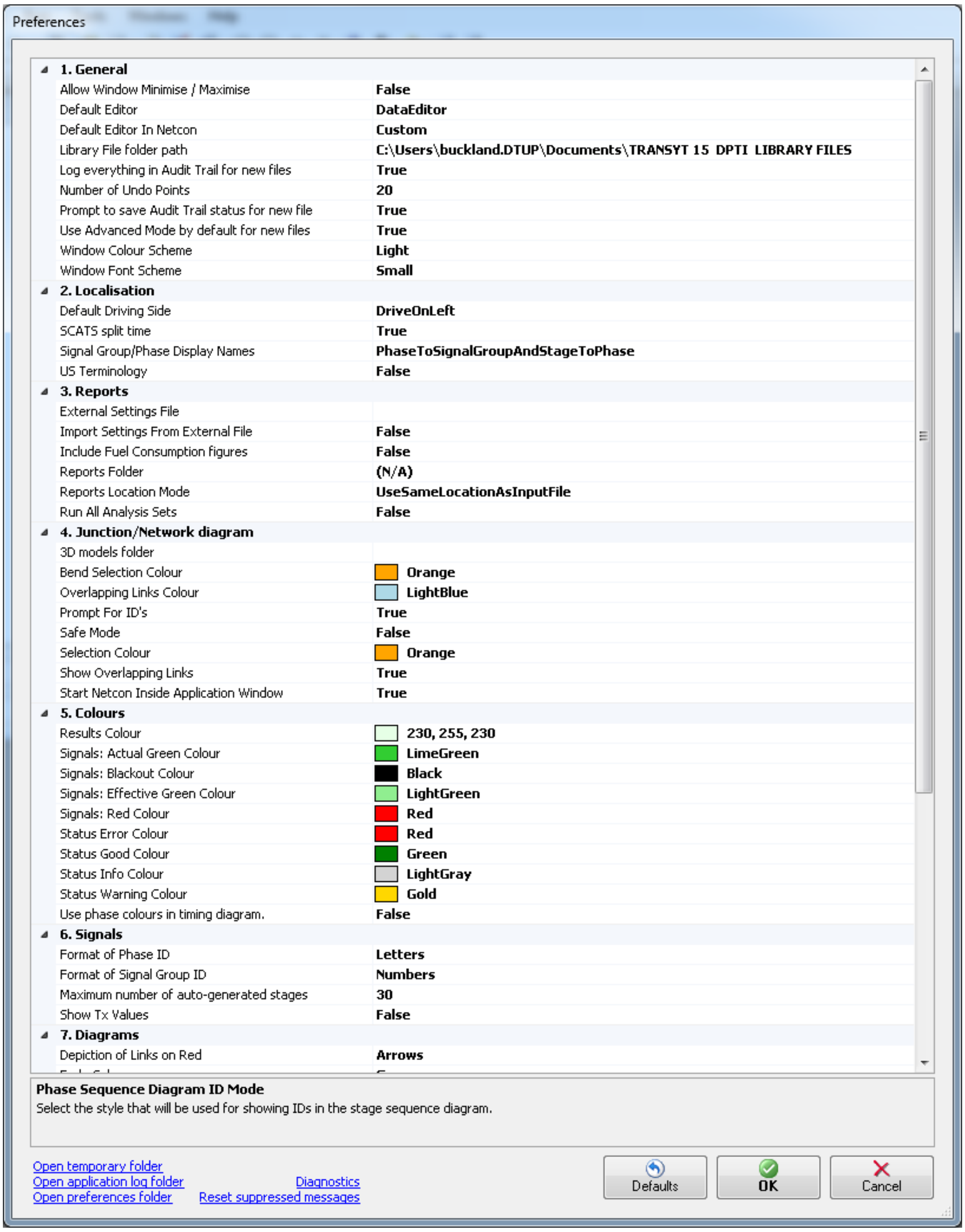
- Day of week behaviour (e.g. avoiding Monday mornings and Friday evenings);
- School holidays;
- Roadworks;
- Temporary road closures;
- Events;
- Festivals;
- Traffic incidents;
- Temporary loss of SCATS® Masterlink control (e.g. local control); and
- Temporary use of atypical (e.g. SCATS® fallback) timing plans and strategies.

# 12 APPENDIX C - TRANSYT 15 CONFIGURATION

TRANSYT program settings need to be specified and/or checked before commencing model development.

## 12.1 Initial parameter set -up

A new project may be initiated by starting from scratch or by using a TRANSYT template or library file. After opening the application by either means and before starting a model check that the preferences are set correctly from the Menu File < Preferences:



Preferences

| | |
|---|---|
| **1. General** | |
| Allow Window Minimise / Maximise | False |
| Default Editor | DataEditor |
| Default Editor In Netcon | Custom |
| Library File folder path | C:\Users\buckland.DTUP\Documents\TRANSYT 15 DPTI LIBRARY FILES |
| Log everything in Audit Trail for new files | True |
| Number of Undo Points | 20 |
| Prompt to save Audit Trail status for new file | True |
| Use Advanced Mode by default for new files | True |
| Window Colour Scheme | Light |
| Window Font Scheme | Small |
| **2. Localisation** | |
| Default Driving Side | DriveOnLeft |
| SCATS split time | True |
| Signal Group/Phase Display Names | PhaseToSignalGroupAndStageToPhase |
| US Terminology | False |
| **3. Reports** | |
| External Settings File | |
| Import Settings From External File | False |
| Include Fuel Consumption figures | False |
| Reports Folder | (N/A) |
| Reports Location Mode | UseSameLocationAsInputFile |
| Run All Analysis Sets | False |
| **4. Junction/Network diagram** | |
| 3D models folder | |
| Bend Selection Colour | Orange |
| Overlapping Links Colour | LightBlue |
| Prompt For ID's | True |
| Safe Mode | False |
| Selection Colour | Orange |
| Show Overlapping Links | True |
| Start Netcon Inside Application Window | True |
| **5. Colours** | |
| Results Colour | 230, 255, 230 |
| Signals: Actual Green Colour | LimeGreen |
| Signals: Blackout Colour | Black |
| Signals: Effective Green Colour | LightGreen |
| Signals: Red Colour | Red |
| Status Error Colour | Red |
| Status Good Colour | Green |
| Status Info Colour | LightGray |
| Status Warning Colour | Gold |
| Use phase colours in timing diagram. | False |
| **6. Signals** | |
| Format of Phase ID | Letters |
| Format of Signal Group ID | Numbers |
| Maximum number of auto-generated stages | 30 |
| Show Tx Values | False |
| **7. Diagrams** | |
| Depiction of Links on Red | Arrows |

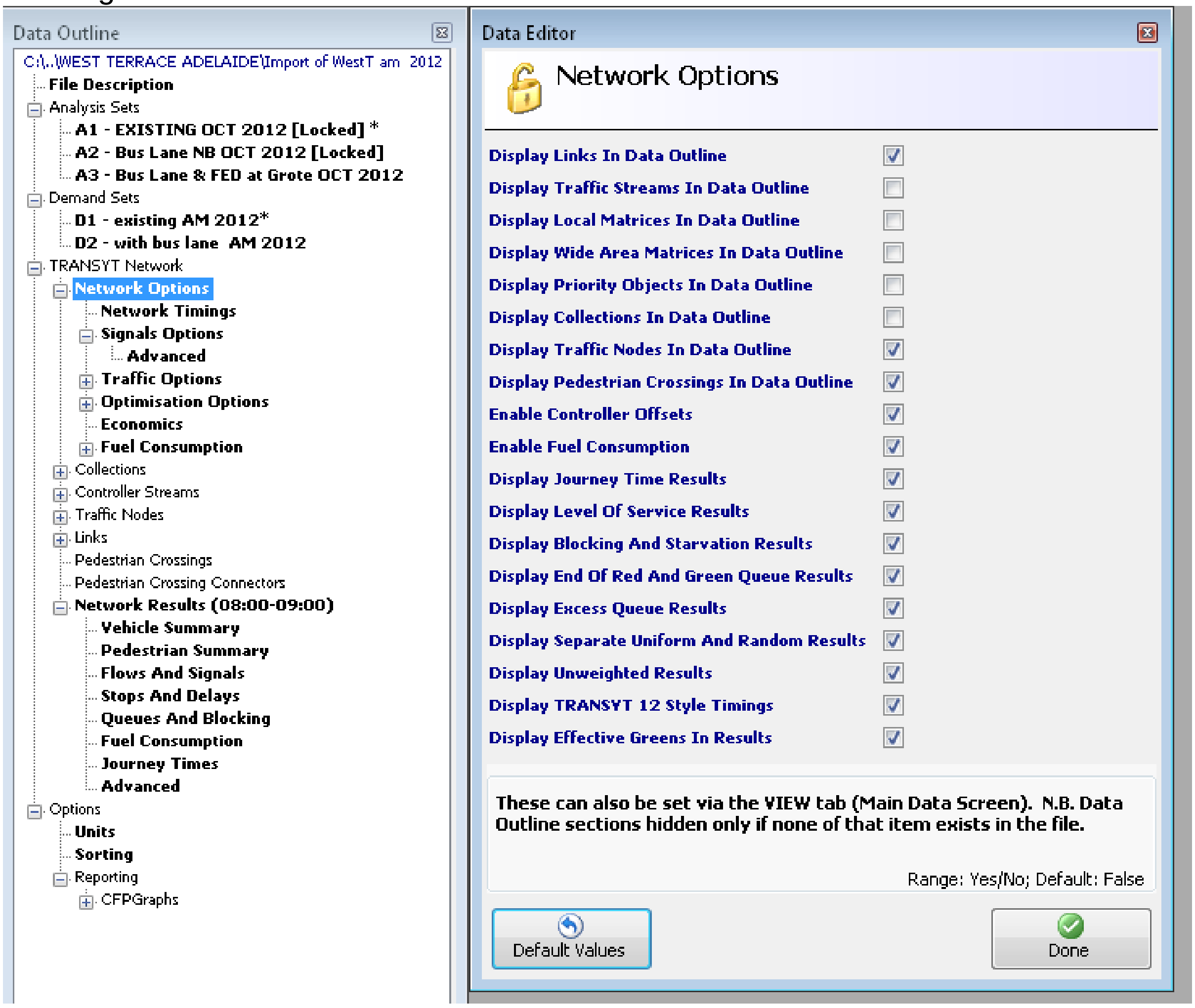
**Phase Sequence Diagram ID Mode**
Select the style that will be used for showing IDs in the stage sequence diagram.

Open temporary folder
Open application log folder
Open preferences folder
Diagnostics
Reset suppressed messages
Defaults
OK
Cancel

The main requirements are to:

- Locate the "Library File folder path" to point to the Library files;
- Set the log audit trail to "true".
- Set the Phase\Stage to "PhaseToSignalGroupAndStageToPhase"
- Set SCATS® split time to "true"
- Set Advanced Mode to "true"
- Set the Phase ID to "Letters"" and the Signal Group ID to "numbers" this will match DPTI personality practice.

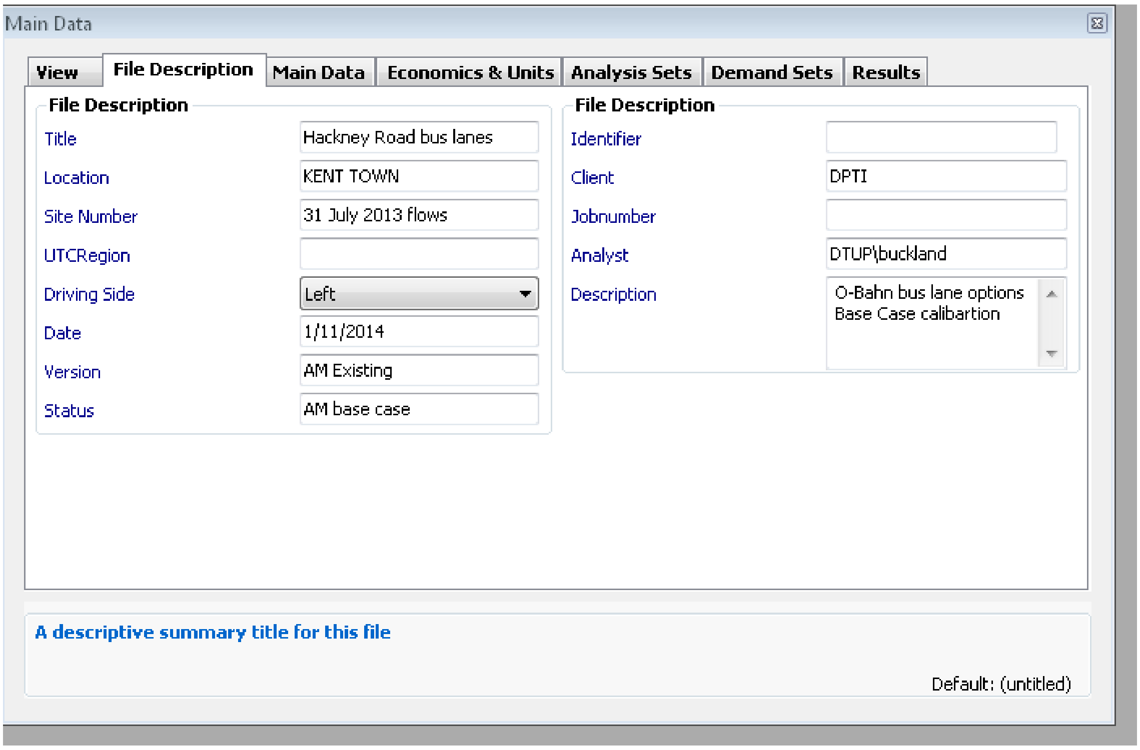
From the Data Outline open Network Options and tick all of the items shown in the diagram below:




The options will be displayed initially only as a label in the Data Outline but when real data is entered a "+" box will appear. After all the data is entered, for simplicity any unused options can be deselected.

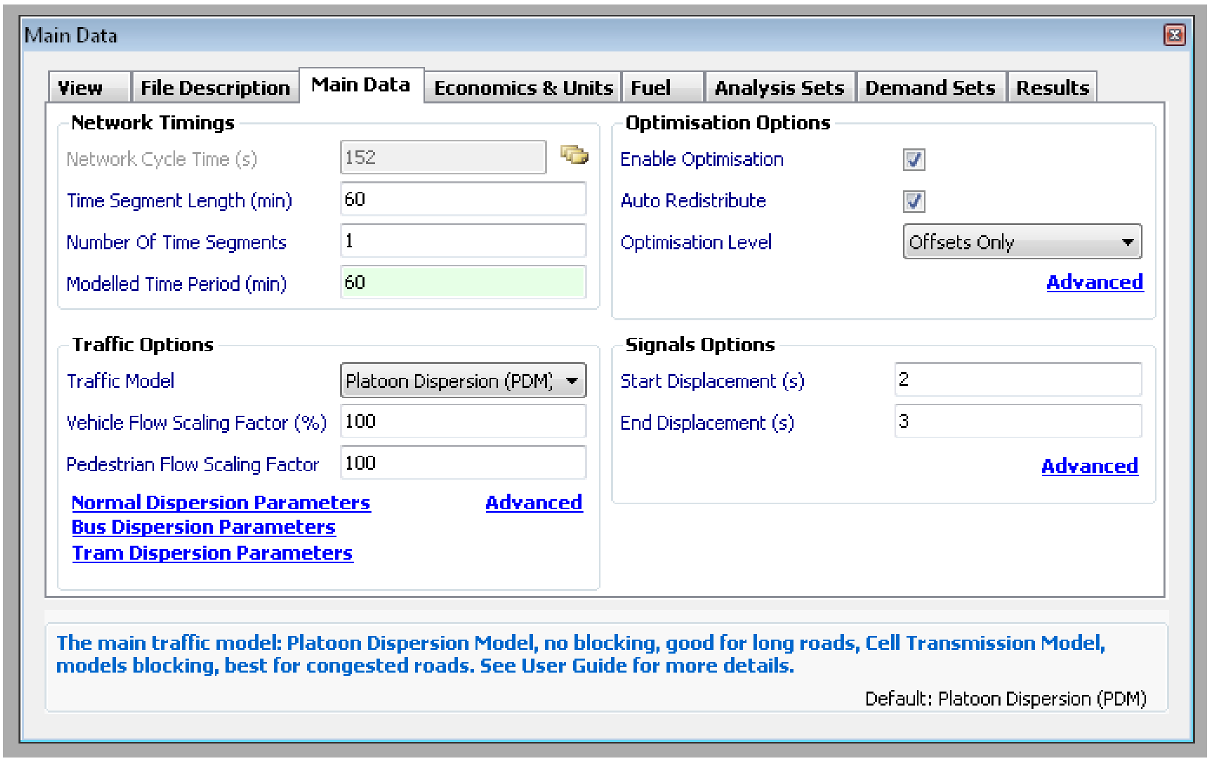
If TRANSYT is being used to assess “level of service”, there is an option to use the USA Highway Capacity Manual (2000) method[6]. To use this the “Display Level of Service Results” option in the Network Options data editor has to be enabled.. the Data editor is available from the Data Outline.< TRANSYT Network < ”Network Options”

In the Main Data<File Description Tab; complete sufficient details to ensure that the model is sufficiently described so as to be unique. The “UTCRegion” shall normally be completed with the most representative SCATS region.




6 TRB (2000). Highway Capacity Manual, Transport Research Board, National Research Council Washington D.C., U.S.A. [“HCM 2000”]

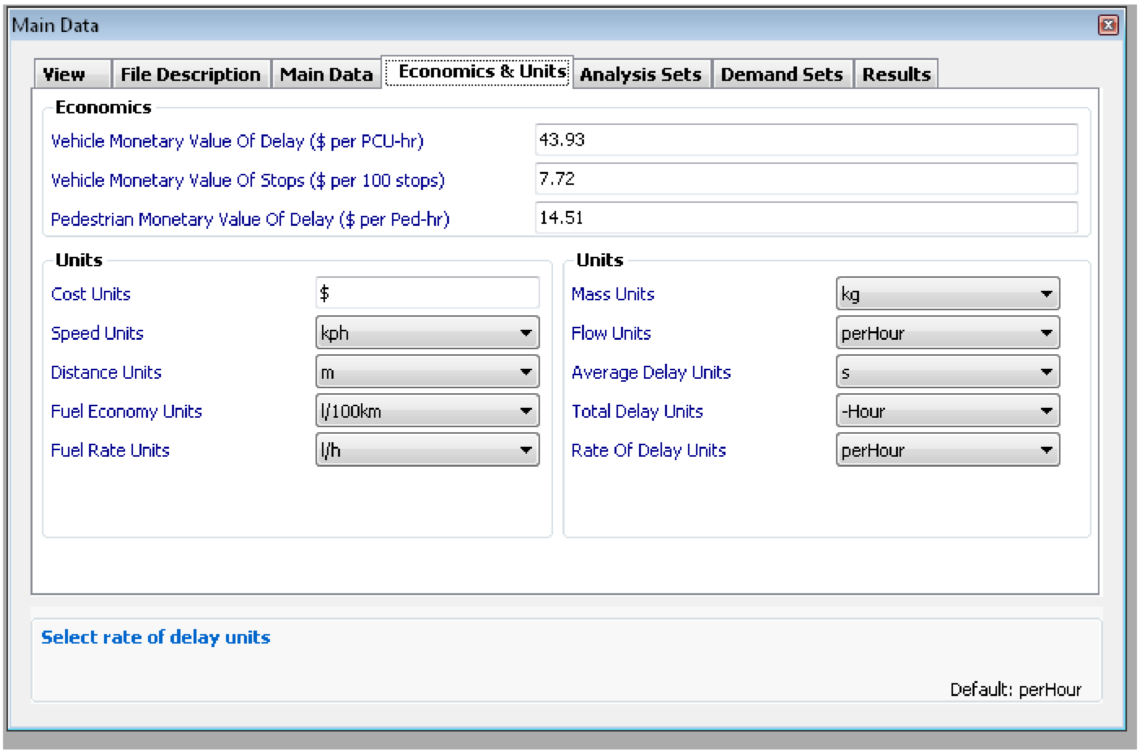
In the Main Data < Main Data tab use the default values except that for evaluation of the base case the Optimisation Options “Enable Optimisation” and “Auto Redistribute” should be unticked, and the network cycle time should be entered with the value provided in the SCATS summaries. For the base case cycle length where the cycle times are not common for all the model sites, the advice of DPTI should be sought.




To reflect Peak period economic factors In the Main Data < Economics and Units Tab, change to the following in the “Economics and Units” tab:

- Vehicle Monetary Value of Delay $ per PCU hour = $43.93
- Vehicle Monetary values of Stops $ per 100 stops = $7.72
- Pedestrian Monetary Values of Delay $ per Ped Hr) = $14.51
- Cost Units to “$” symbol.
- Speed units to “kph”
- Distance to “m”
- Fuel economy to litres / 100km “l/100km”
- Fuel Rate units to “l/h”
- Mass Units “kg”
- Flow Units “perhour”
- Average delay units “s”
- Total Delay units “-Hour”
- Rate of Delay units “perhour”

Where TRANSYT is being used to evaluate the economic benefits of a project the economic values for the “Business” period may need to be changed.



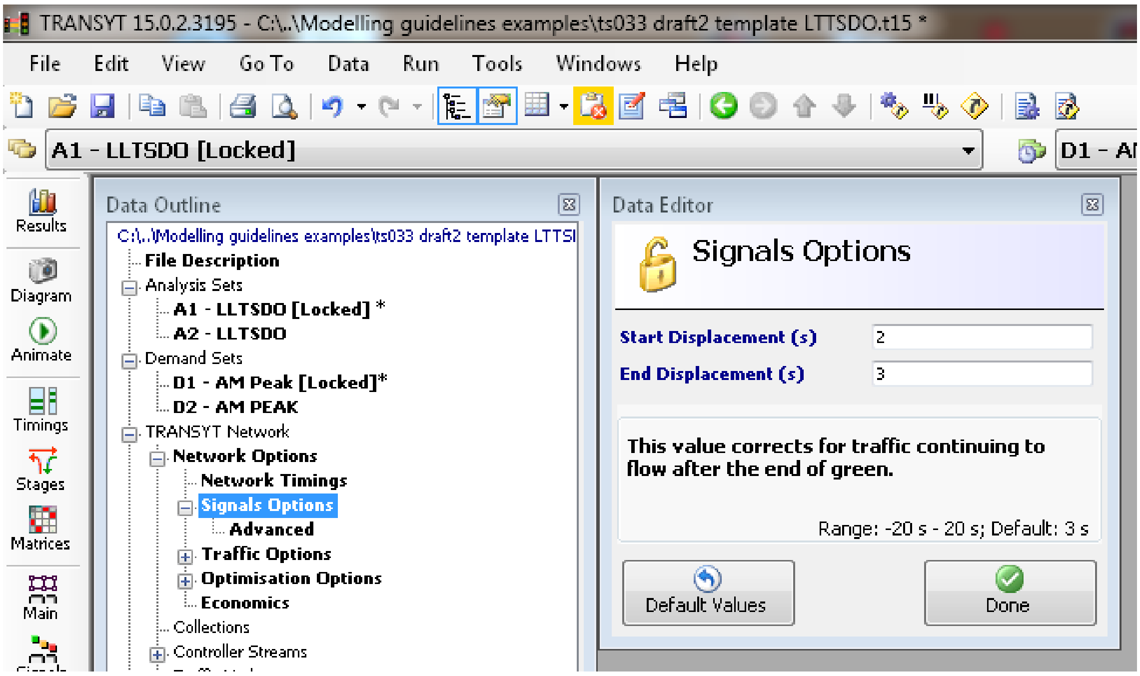

Transport for New South Wales published the costs in "Principles and Guidelines for Economic Appraisal of Transport investment and initiatives" in a Manual in March 3013. The costs of delay and stops in A$ is published annually by Transport for New South Wales as an update of Appendix 4 of the manual. The values should be updated for new projects but not changed for the duration of an ongoing project assessment.

The values to be used above are derived from the November 2013 edition as follows:

- Vehicle Monetary Value of Delay ($ per PCU-hour), is taken from:
  - Tables 8 *"Average hourly value for travel time per vehicle - urban", "Average hourly value Light vehicle (car and LCV) ($/veh-hr)"* is equal to $25.87 per PCU hour, plus
  - Table 11 *"Urban vehicle operating: resource cost (cents/km)" for a "Private car (used)" at 60km/h (30.1c/km)"* is equal to $18.06 per PCU hour
  - This makes a total of $43.93
- Vehicle Monetary values of Stops ($ per 100 stops), is taken from
  - Table 15 *"Vehicle operating cost per stop" "VOC/stop (including fuel) for a car*" is equal to $7.72
- Pedestrian Monetary Values of Delay $ per Person-hour), is taken from:
  - Table 1 "Value of travel time, Urban and Rural Roads" being equivalent to a "Urban Car-Private value per (single) Occupant" equal to $14.51 per person hour

This Transport for New South Wales information is normally updated and distributed by Peter Tisato, Manager Sustainable Transport Planning, Telephone 8204 8210, PO Box 1533 GPO Adelaide SA5001

The default relative End Displacement in TRANSYT may be changed from the 3 seconds default value to reflects significant use of the yellow red period. This value can be changed by selecting from the Data Outline < TRANSYT Network < Signals Options:



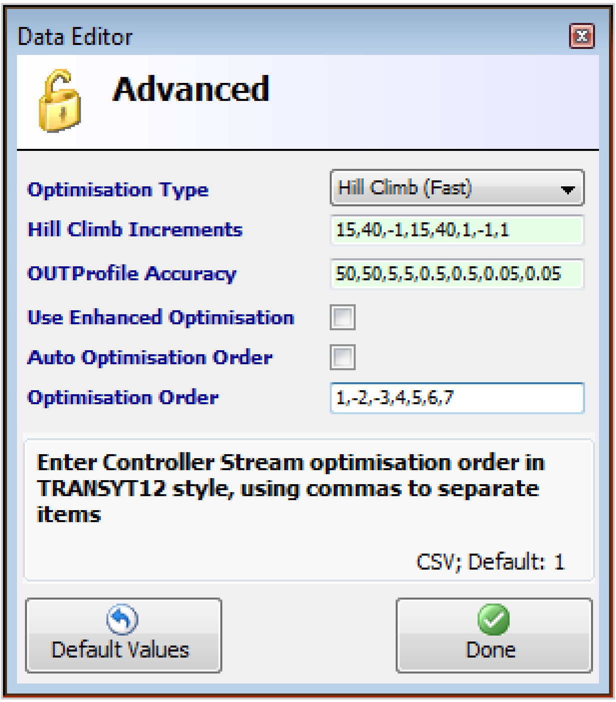

The modeller must understand that changing the displacement values in this window will affect every link in the model. The value used must therefore reflect the average measured use of the yellow/red period following the green signal. Where there is excessive use of the yellow/red period by drivers at discrete movements, the effective green time will need to be adjusted by changing the signal group effective green at the discrete signal group data input or by using the signal group gaining or losing delays.

Two further inputs in the Main Data instruct TRANSYT how Controller Streams should be optimised:

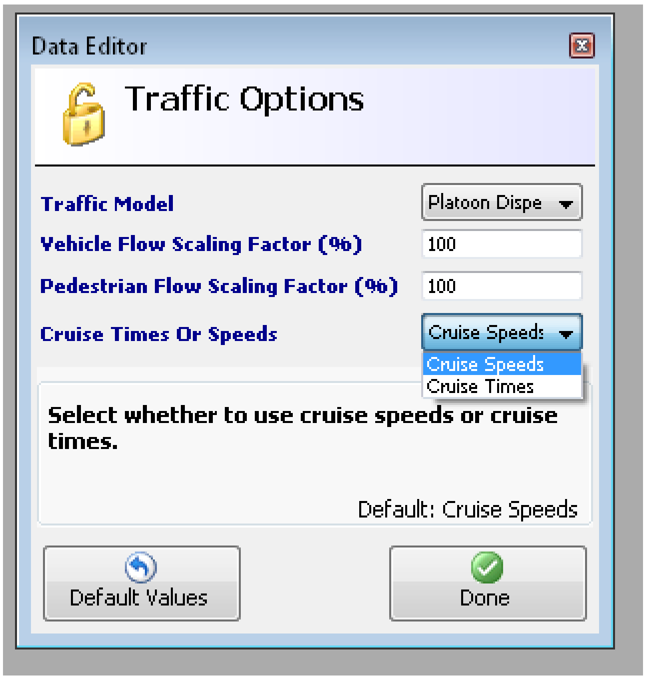
- Controller Stream Grouping – this facility allows fixed offsets between nodes to be maintained (e.g. for critical offsets within a SCATS® MASTERLINK or FLEXILINK grouping). Offsets for the node group are optimised as a single entity rather than as individual nodes. [Nodes with a minus sign before them are grouped to the adjacent previous node in the list.]
- A further feature listing Controller Streams restricts the green time splits from being changed during optimisation.

The Controller Stream grouping and fixed green splits options are accessed from the **Main Data < Main data tab < Optimisation Options < Advanced hyperlink** , and can be used to manage the base case and scenario modelling by listing the “Optimisation Order”:  If an intersection is not included in the list its settings will be unchanged providing the “auto Optimisation Order is unticked.

Controller Streams are generally identified by positive numbers. However, in the Controller Stream (Optimisation) List the number may be prefixed by a negative sign. In this case the controller stream will be grouped with the next positive controller stream in the controller stream list and the controller stream s in the group will be optimised together. For example in controller stream list below of (1,-2, -3, 4, 5, 6, 7) will result in controller streams 2, 3 and 4 being grouped and optimised together.



In the **DATA OUTLINE SELECT < TRANSYT Network < Traffic Options** select the default Traffic Model to be Platoon Dispersal and the "Cruise Times or Speeds" to be "Cruise Speeds". DPTI uses the posted speed limits with the speed option (km/h) to calculate travel times for cruise link times (not the "Cruise Times" option).




Save the file after configuring the above.

## 12.2 Project file names

Project version control must be applied to each model and all changes fully documented.

The following is a guide to the practice used for traffic signal co-ordination projects by DPTI.

Immediately after opening a project in TRANSYT it should be "saved" with an appropriate file name.

DPTI file naming convention uses the following Project Name_Project year_Model period_ Model Option_Version number, (e.g "City bus lane_2013_AM_Base_V3"). (Note the number of characters in a file name is limited by Windows.)

Where:

- Project name includes a geographical description. For a co-ordination project usually the title will comprise the traffic signal site numbers at each end for a corridor model,
- Project year will normally be the current year (assumes that the model will be used for later assessments),
- Model period will include “AM”, “Bus” ( for midday business period), “PM” and “Th” or “Fr” for late night shopping,
- Model options will include “Base” for the base case and S1, S2.. etc for new scenarios. The Base case network and scenario options need to be documented in the Traffic Signals Operation Performance Report .
- Version number V1, V2 etc needs to be added to the file for minor changes to the model as it is developed. The modeller will need to identify model elements that may need to be reviewed as the model develops. These will be “lost” unless the modeller has manually saved versions of the files.

The file naming convention is used during whole of the model development.

## 12.3 Scaling and Background

Insert the “map” file from Google Earth or similar application into the NetCon Window to provide a background and scale this to the links in the network. The modeller will need to have first scaled the links to match TRANSYT representation by using the “link length display” function available from the toolbar in NetCon.

The background can be used to correctly orient the model and can be useful for displaying animations and portray a more graphic image of the model. It can easily be toggled off and on when the detailed components of the model are being viewed.

Stretching the links to match the correct scaling also aids in the graphical queue displays available in TRANSYT. Graphical representation of the queues on each link will then be in proportion to one another.

## 12.4 DPTI Standards and TRANSYT Library files.

Existing intersections will use the nomenclature of the existing sites supplied in the SCATS summaries.

New model intersections shall be labelled with the phase and signal group arrangement shown in the Standard Drawing S-6841 “Traffic Signals Design Guide, Detectors, Signal Groups, Phasing and Pole numbering Standards”.

DPTI is developing TRANSYT 15 library files reflecting SA practice. Contractors interested in using these should contact Traffic Operations Group directly. The library files where available only represent standard intersection configurations and therefore need to be customised to reflect the discrete site/s being modelled.

# 13 APPENDIX D – DPTI - MODEL CONVENTIONS AND LABELLING

## 13.1 DPTI TRANSYT Model Preferences

Use the basic PDM optimisation Model option to generate the base case report and Performance Index. (Note: Remember for the base case to un-tick the “Enable optimisation” and “Auto Redistribution” in the Main Data window/Main Data tab or the model will loose the input values for all the phases and offsets when TRANSYT runs to produce a performance index.)

Project case scenario models shall use the PDM model option with the “extended Offsets and Green splits” optimisation and with “auto redistribute” ticked on for the first run only. To save processing time this “auto redistribute” can be ticked off after the initial running of the scenario in TRANSYT.

Only consider using the Cell Transmission Model (CTM) or “Congested” Platoon Dispersal Model (CPDM) model alternatives for discrete links if the upstream queuing affects on a link adversely affects an upstream intersection.

The TRANSYT model task list shall be reviewed and all warnings eliminated before finalising each model.

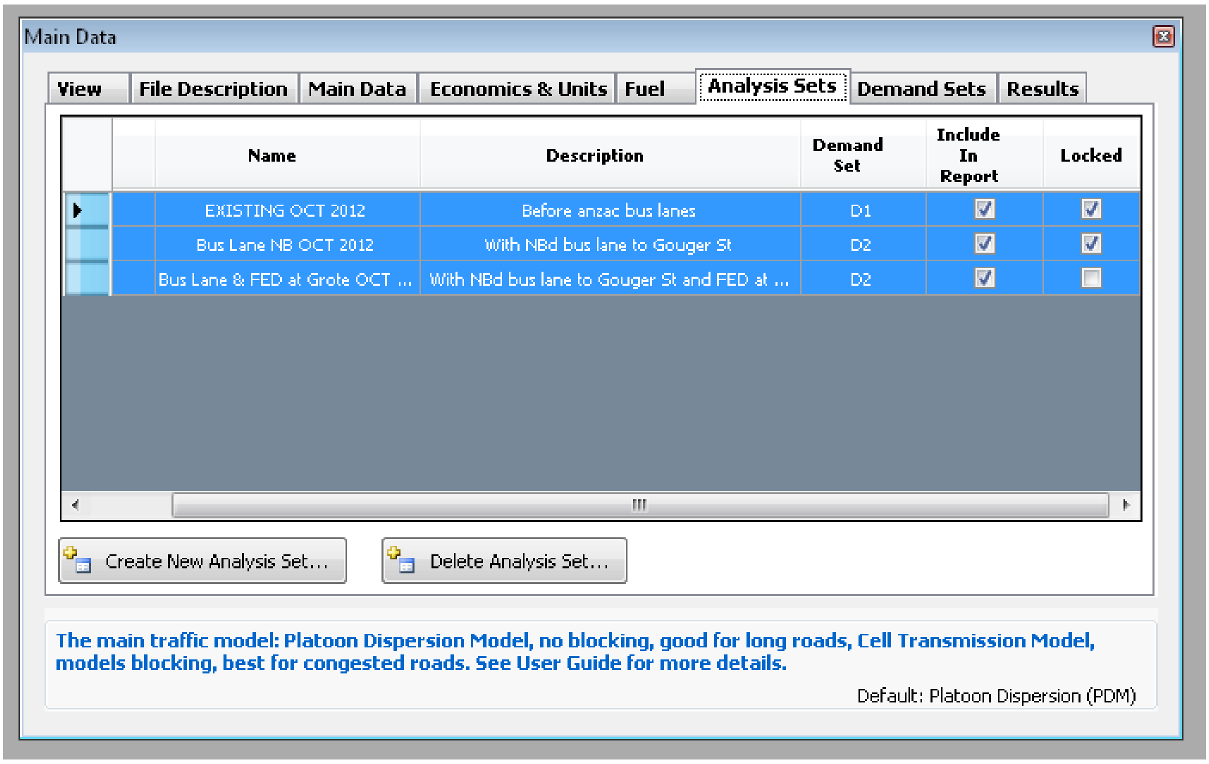
## 13.2 File, Analysis Sets and Demand Sets

The “file Description” fields in TRANSYT will be completed comprehensively and include the SCATS region name in the UTCRegion field. Department of Planning, Transport and Infrastructure conventionally uses only one file for each time period. If separate files are created one of the “file description” fields should include the time period e.g. PM peak.

Each Analysis Set shall have the name and description fields completed with suitable descriptions of the Scenario.

The Demand Sets name and description field will be completed to provide a unique description of the demand.

When any Analysis Set or Demand Set is completed i.e. finally calibrated and validated, or in the case of a Scenario when the final changes have been incorporated in the model the “Set” should be “locked” so no changes are inadvertently made to the particular “Set” configuration.




When TRANSYT files are supplied to (DPTI) all the Analysis and Demand Sets shall be “locked”. The native files will be used to confirm the details reported in the TSOPR.

### 13.3 Traffic and Controller Input Data

Traffic Nodes, and the level of input detail required to describe their behaviour, can be classed according to whether or not they are signal-controlled. Signal controlled Links are controlled by a Controller Stream. Priority controlled traffic nodes e.g. Give Way intersections and roundabouts have control information provided in the traffic node data.

#### 13.3.1 Traffic Node Numbering

Traffic nodes control the flows of traffic and they may also represent Non-signalised methods of control, i.e. priority and roundabout control. Controller Streams represent the control methods at signal controlled nodes. The traffic node numbering therefore does not need to match the controller stream numbering; however it is DPTI practice to use the same number for the associated traffic node as the controller stream number. Traffic nodes controlling Bottlenecks and priority intersections may be numbered in any logical sequence.

#### 13.3.2 Controller Stream Numbering

Controller Streams are entered separately from traffic nodes in TRANSYT 15.

For each Controller Stream in the network, the following data needs to be entered:

- ID shall be the SCATS® TS number, entered as a 4 digit number e.g. 0066 for TS066, 3001 for TS3001.
- DPTI will nominate TS numbers for intersections proposed in a new scenario.
- Name – for a corridor model the controller stream will normally be named after the Side Road or local Road.
- Description - enter the SCATS® Sub System number as a three digit number represented by zzz i.e. SS zzz.
- Enter the signal groups and label them numerically to represent the actual signal groups.
- Phases - enter the Phases Actually running in the controller and match the labelling
- Enter all the phase sequences the controller will use for each period and select sequence 1 for calibration of the AM model.
- Where the Controller double cycles select this option in the Controller Stream phase sequence tab.
- Signals Manipulation select PhaseBased.
- Offset Relative To - Enter the SCATS® master intersection (TS number) the modeller wishes to link to.

Then for each defined Phase at every node, the following input parameters are specified:

- %age Green time for the Phase (derived from the average signal timings);
- Interphase between previous and current Phases; and
- Minimum Phase green time.

All controller streams will be displayed in the Network Diagram with timing wheels for the report pictures.

### 13.3.3 Phase and Signal Group Numbering

Phase and signal group labelling in TRANSYT models shall match the existing Controller configuration. Where phases are configured in the controller but are not used in the current SCATS® sequences the phase letters shall match the same labels as the current SCATS® sequence. Where phase or signal groups are normally not used in a particular period of the day e.g. because the phase is removed from the sequence or because of low demand, an example is a G2 in a Diamond, then this may be left out of the sequence for that period of the day.

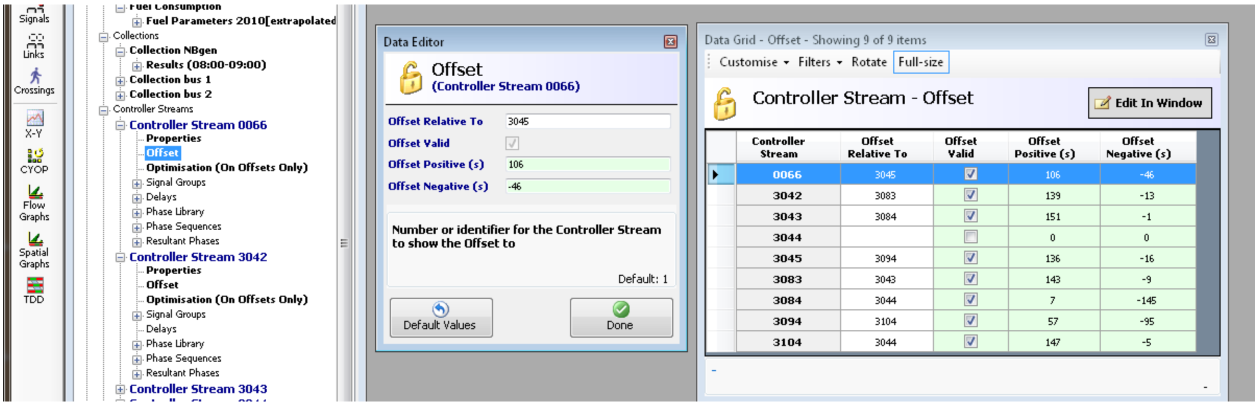
New model intersections shall be labelled with the phase and signal group arrangement shown in the Standard Drawing S-6841 “Traffic Signals Design Guide, Detectors, Signal Groups, Phasing and Pole numbering Standards”.
It may be necessary to use non-standard phase labelling to match circumstances, e.g. repeat phases may need to be labelled D1 or D2, D3, D4 etc. TRANSYT will accept full alphanumeric labels.

## 13.3.4 Phase Sequences

Enter the appropriate phase sequences for each analysis set. The phase sequence in the base case shall include only the SCATS phasing actually used.

When configuring phase sequences in TRANSYT it is necessary to begin with the SCATS® offset or link "reference" phase (i.e. if the SCATS link specification ends with "B" and the next phase in the sequence is "D", D is the reference phase and should be the first phase listed in TRANSYT). Note: the reference phase is not necessarily the SCATS stretch phase unless this is the co-ordinated reference phase.

In the data outline select from a controller stream the "offset" and in the Data Editor complete the field "offset relative to". (Tip: if the modeller clicks on the Data Grid it is possible to complete the whole of the SCATS® daisy chain in one window.)




## 13.3.5 Minimum Green and Intergreen Values

Vehicular Signal group minimum green times should normally be taken from the controller yellow + red time settings. Where the modeller chooses not to use separate pedestrian signal groups the minimum Vehicular Signal Group Green times may need to include the walk and clearance period for conventional walk with traffic pedestrian phases. Pedestrian phases are demand dependant, unless the phase is auto-introduced as in the City Centre. In order to accommodate this pattern of demand, in the base case these times may need to be modified (reduced) to permit average phase green splits to be used. If this is the case the modified minimum green time should be maintained in any scenario options.

Interphase times in TRANSYT will be devised using the "intergreen matrix." After entering the intergreen times for the signal groups always check that the Interphase times reflect the Controller yellow + red phase time settings.

Use the signal intergreen matrix for inputting intergreen values then check they match SCATS® values using the Interphase tab.

It is necessary to determine if pedestrian phases are to be modelled. Where pedestrian phase times determine the minimum cycle time and pedestrian phases are not modelled, it is necessary to ensure that the minimum green times reflect the duration of the pedestrian phases. Otherwise use the vehicle minimum green times.

### 13.3.6 Traffic Link Numbering

The traffic link label should be constructed in the form xxyy from the last two digits of the controller stream number (e.g. xx=66) followed by a two digit number representing the signal group number controlling the movement (e.g. yy=01 [to form 6601]. Additional links may be required to cater for differential queues in adjacent lanes on the same approach, or for links representing different vehicle types e.g buses. Where these are required they may be numbered in any sequence from the last Signal Group number.

### 13.3.7 Exit Link Numbering

Exit links from the network should be labelled with the node number suffixed by two digits, usually representing the through entry link with an “E” suffix.

### 13.3.8 Priority Intersection Link Numbering

Give-way links use the same methodology as signalised links, with labelling commencing with the associated node number and then a unique two digit number in any logical sequence.

### 13.3.9 Pedestrian Objects

Pedestrian Objects will require local matrixes to be constructed to input pedestrian volumes. Pedestrian volumes should be manually entered into the matrix.

### 13.3.10 Pedestrian Object Numbering

Pedestrian Objects links should be labelled in a similar manner to signalised traffic links, using the respective pedestrian signal group numbers i.e. P1,P2 etc,

## 13.4 LINK TRAFFIC FLOW INPUT DATA

Traffic flows shall be input to TRANSYT links by the “direct” method, rather than using matrix entry format.

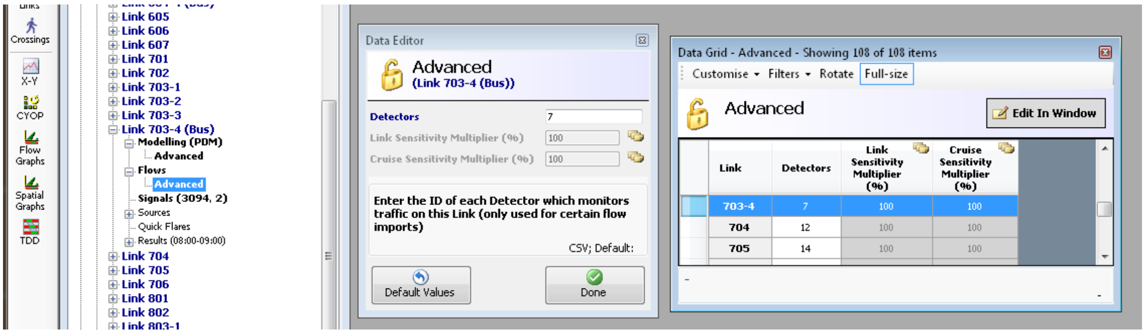
Links are to be defined on a one-for-one basis with traffic signal groups which control discrete movements. Additional links may be required on signal approaches where there is differential queuing on adjacent lanes of the same movement.

Traffic flows can be entered either manually or using the SCATS data import feature.

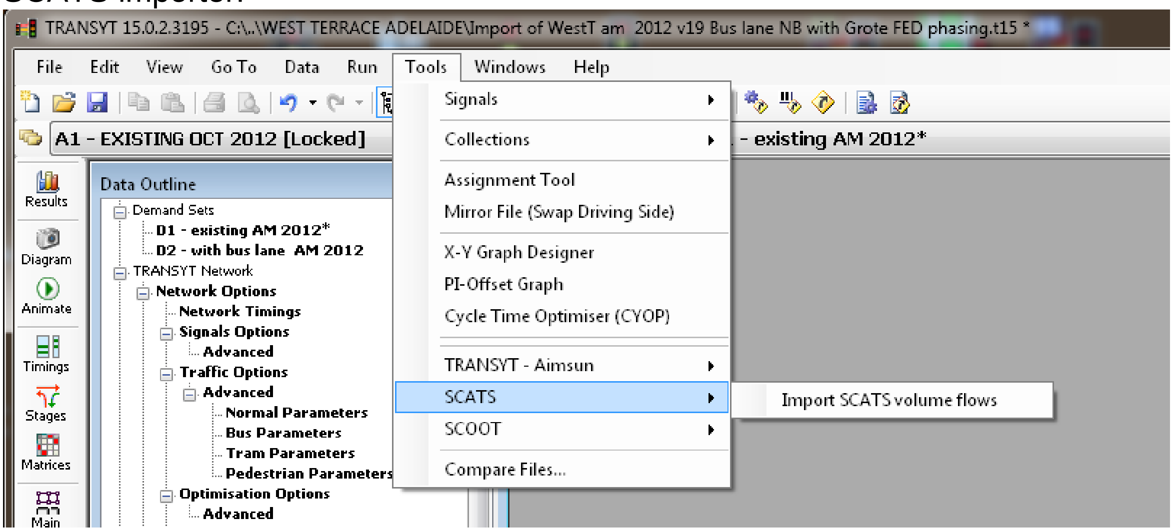
If the modeller chooses to use the SCATS importer the traffic volumes must be arranged to uses the same file format as Traffic reporter single site “column” output **APPENDIX F – DPTI SUPPORT SERVICES**). This is the same output that is normally supplied by DPTI to consultants and contractors. For another example see the TRANSYT user guide AG 70, Section 34, Appendix F – Importing SCATS data, page 541. If the modeller is importing traffic volumes using traffic reporter *.txt files and some of the TS sites are across regional boundaries the modeller will need to change the “Region” names of the data files so they all match, ensuring that only the site numbers are unique and match the model labels.

The SCATS® detector numbers shall be entered in the link specification. This is done from the Data Outline Link<Flows<Advanced by calling the Data Editor or from the Links window flows tab/Advanced tab. Multiple Detectors, for an approach with more than one lane, are entered by separating the detector numbers by a comma.

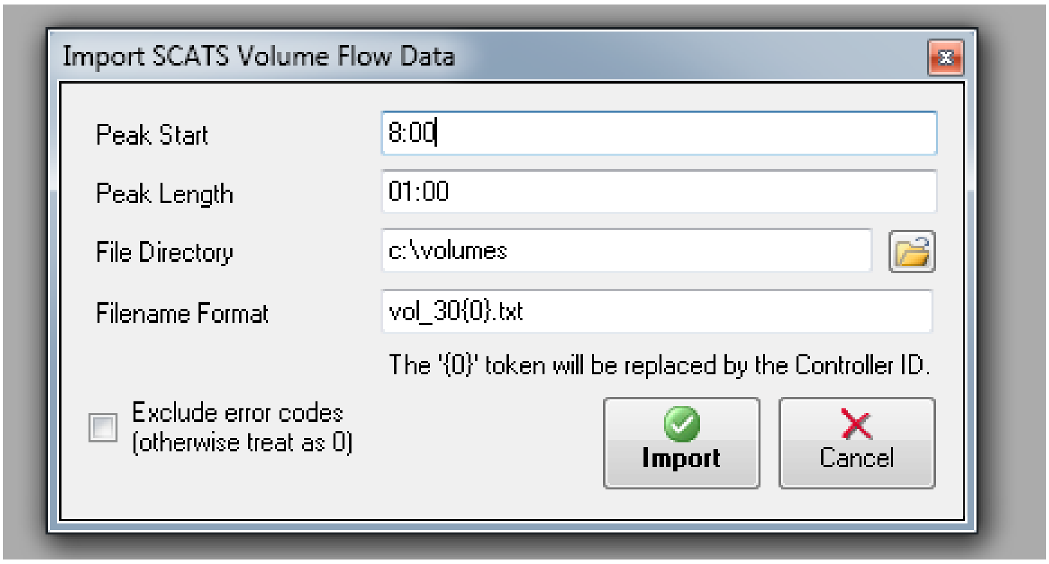
Selecting a Data grid while the Data Editor is displayed will make detector number entry a simple process:




SCATS importer:




Import SCATS Volume Flow Data form:


Import SCATS Volume Flow Data
Peak Start
8:00
Peak Length
01:00
File Directory
c:\volumes
Filename Format
vol_30{0}.txt
The '{0}' token will be replaced by the Controller ID.
Exclude error codes
(otherwise treat as 0)
Import
Cancel

# 14 APPENDIX E - REFERENCES

References appearing as footnotes in the document:

Akcelik, R. (1981) traffic signals: Capacity and Timing Analysis. Research Report ARR no 123 ARRB Transport Research Ltd, Vermont South, Australia (6^TH reprint 1995)

AUSTROADS – AGTM02-08 (2008) Guide to Traffic Management Part 2: Traffic Theory. Association of Australian State Road and Transport Authorities, Sydney

AUSTROADS – AGTM03-09 (2009) Guide to Traffic Management Part 3: Traffic Studies and Analysis. Association of Australian State Road and Transport Authorities, Sydney

AUSTROADS – AGTM10-09 (2009) Guide to Traffic Management Part 9: Traffic Operations Association of Australian State Road and Transport Authorities, Sydney

National Heavy Vehicle Register, National Transport Commission – Performance – Based Standards Scheme – Network Classification Guidelines July 2007.
https://www.nhvr.gov.au/files/resources/0018-pbsnetwrkclassglines.pdf

*National Transport Commission* - Heavy vehicle charges Report to the Standing Council of Transport and Infrastructure February 2012
http://www.ntc.gov.au/Media/Reports/(25A93AE3-86FB-FCE2-9D20-648467189BE3).pdf

TRB (2000), - Highway Capacity Manual, Transport Research Board, National Research Council Washington D.C., U.S.A. ["HCM 2000"]

TRB (2010a), - Highway Capacity Manual, Transport Research Board National Research Council Washington D.C., U.S.A. ["HCM 2010"]

TRL, TRANSYT 15 User Application guide AG 70 (issue E) September 2014.
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# 15 APPENDIX F – DPTI SUPPORT SERVICES

## 15.1 SCATS SUMMARIES

The following is an example containing the normally provided information:

**TS 100 – Cross Rd / Marion Rd**

**SITE DETAILS:**

- Double Diamond Overlap ( no trailing turns )
- Running phase sequence at all time A, D, E, G

-

**RIGHT TURN MOVEMENT OPERATION:**

- Right turns filter at all times.

**PHASE PERCENTAGE DURING PEAK PERIODS:**

- A phase (Marion Rd) is the stretch phase
- Phase time during 6May-8May, 2014:

| Period | Time | Ave CL | A | D | D1 | E | G | G2 |
|---|---|---|---|---|---|---|---|---|
| AM | 0800 - 0900 | 120s | 56s | 25s | - | 24s | - | 15s |
| BUS | 1400 - 1500 | 120s | 58s | 22s | - | 24s | 6s | 10s |
| PM | 1630 – 1730 | 120s | 56s | 18s | 4s | 24s | - | 18s |

**LINKING:**

- TS100 is linked to TS099 (Anzac Hwy / Marion Rd)
- TS346 (Cross Rd / Arthur St / Maynard Rd) is linked to TS100
- TS289 (Marion Rd, Tram line, Glengyle Tce) is linked (handshaking) with TS 100.

**INTERGREEN TIME:**

- Phase A, D, E, G have 6 seconds of intergreen time (yellow = 4.0s, red = 2.0s).
- There is no early cut-off green time for TS100

**Minimum Green Time**

| A | D | E | G |
|---|---|---|---|
| 10s | 7s | 7s | 7s |

**QUEUE & TRAM LOGIC**

- Queue detectors on north for northbound traffic (dets 14 & 15) will stop Marion Rd south through (dets 5, 6 or SG2) and Cross Rd east right turn (det 13 or SG8) movements from calling or extending a phase. (at the start of A phase SG2/SG8 will be held red, and D1 phase (Cross Rd west) only will run)
- D (Cross Rd right turn), E (Cross Rd), G (Marion Rd right turn) are skipped after boom gate rising at TS289 (Marion Rd, Tram line, Glengyle Tce) for 50 seconds during 7am-9am & 3pm-6pm and 30 seconds during other times

**CYCLE TIME:**

- Maximum cycle time for TS100 is 120 seconds

-

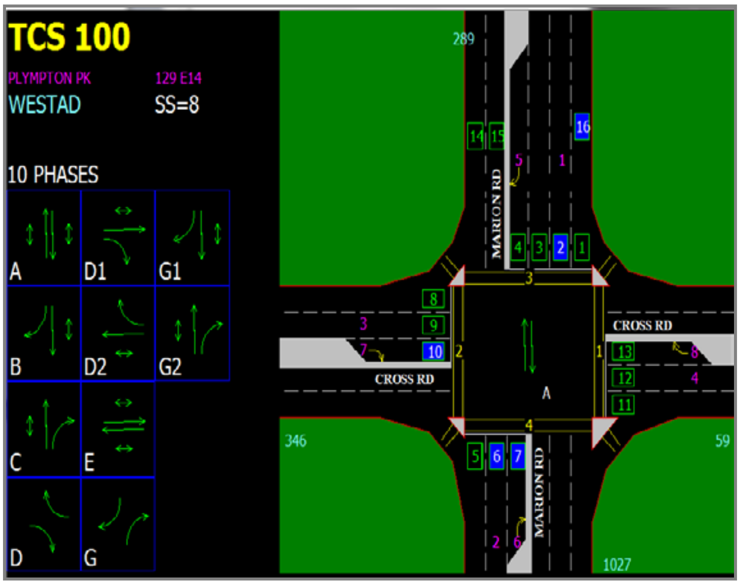
## WALKING TIME:

| Pedestrian | Parallel Vehicle Phase | Time Required |
|---|---|---|
| P1 | A,G1 | 21s |
| P2 | A, G2 | 22s |
| P3 | E,D1 | 22s |
| P4 | E,D2 | 22s |

## PED COUNT: 21 October -23 October, 2014

| Ped phase | AM | BUS | PM |
|---|---|---|---|
| | 0800-0900 | 1400-1500 | 1630-1730 |
| P1 | 7 | 3 | 3 |
| P2 | 2 | 4 | 4 |
| P3 | 2 | 2 | 2 |
| P4 | 2 | 3 | 3 |

## SITE GRAPHICS




## TABLE: SCATS Maximum Flow recorded 6 May-8 May, 2014.

| Detector No | Maximum Flow |
|---|---|
| 1 | 1773 |
| 2 | 1641 |
| 3 | 1905 |
| 4 | 1469 |
| 5 | 1693 |
| 6 | 1898 |
| 7 | 1989 |
| 8 | 1773 |
| 9 | 1818 |
| 10 | 1898 |
| 11 | 1794 |
| 12 | 1942 |
| 13 | 1908 |

Note: SCATS Maximum Flow is just an indication of the lane Saturation Flow which may vary during time of day and not necessarily same as traditional Saturation Flow (as per definition) used in Modelling Packages

## SCATS NOTES RELATING TO TS100:

** IF Queue dets or Tram logic is NOT OPERATING PROPERLY and CAUSING PROBLEMS******
*** APPLY XSF5 to ignore queue dets 14 & 15. ****
*** APPLY XSF8 to ignore Tram force logic. ***

SITE OPERATION:
DDO (No trailing turns). A is normally stretch. A,D,E,G voting with ISS.
Basic flexilink fallback data included.
A Phase is allowed to GAP out at the start of the Tram X-ing Closure (MSS bit 8 at TS289) if it has already been running for more than 30 seconds & Z2 (not Boom Gate Rising) is set at TS289

RIGHT TURNS:
SG's 5,6,7,8 filter via XSF9,10,11,12 set in VP's.
Default after hours filters for SG5,6,7,8. To cancel apply XSF6.
SG 5/6 Green time is limited to TSM13/14 seconds in G phase.
SG 7/8 Green time is limited to TSM15/16 seconds in D phase.
Dets 4,7,10 or 13 can be set with XSF13,14,15 or 16 if dets are faulty.
XSF7 = TRUE allows F1 demands, XSF7 = FALSE allows F demands.

PHASE SKIPPING:
An 'FS' is placed on D,E,G after boom gate rising at TS289 (test for MSS bit 2 at TS100) for
* 50 seconds between 07:00 to 09:00 & 1500 to 1800 Mon - Fri
* 30 seconds at all other times
SP1 is also loaded via VR & actionlist 154 to boost D & E % after tram closure & skipping

HANDSHAKING WITH TS289:
TS289 will test for the following MSS bit to allow SG1 @ TS289 to go green early with queue dets 5 to 7
* MSS 9 = To E (XSF4 = TRUE will only set in the RED period)
* MSS 10 = SG1 is GREEN & Dets 1, 2, 3 presence time has NOT expired

TRAM LEVEL CROSSING INTERVENTION:
Boom Barrier Rising from TS289 det 20 sets MSS bit 2 for TSM23 (50) secs
(for VR testing to ignores Cross Rd after tram)
City Bound advance tram warning det 18 (normally open) or Z2 set MSS bit 6.
Glenelg Bound advance tram warning det 19 (normally open) set MSS bit 7.
If Either advance det is sets will
- inhibit P2,P3 & P4 from calling or running for TSM21(60) seconds
- with only queue det 9 or 10 at TS289 (via det 16) will ISOLATE & FORCE to A phase
- with queue det 8 (via det 17) & 9 or 10 (via det 16) at TS289 will ISOLATE & FORCE to B phs
- XSF3 = TRUE will activate the force logic without tram advance dets (queue dets 9 or 10 at TS289)
- MSS bit 8 will be set whilst the tram force logic is running. If advance det is locked on for more than TSM19 (90) secs, MSS bit 3 & alarms message will be set

QUEUE DETS:
To stop queue forming back from tram line;
DETS 14-15 presence time expired will close SG2 or 8 and set MSS bit 4.
If a queue det is locked on for more than TSM19 (200) secs MSS bit 5 & alarms message will be set
If SG8 was red due to a queue and then SG2 gets a green then SG8 will not be allowed to be skipped again until it has gone green.

PEDESTRIANS:
P1/P2 can late intro in A until XSF1
P3/P4 can late intro in E until XSF2
P2,P3 & P4 are suppressed with advance tram (see below).

FREIGHT:
Heavy Vehicle Extension logic for Marion Rd through dets (use TSRS11=11 secs).

CYCLISTS:
Cyclist C1 extends MIN GRN of D2, E or F1 phase for Special_Timer_12 = 14 seconds
Cyclist C2 extends MIN GRN of D1, E or F phases for Special_Timer_12 = 14 seconds

TURN RIGHT WITH CARE:
South Approach TRWC is driven by WAIT8 output and has a feedback contact to DET24
T.R.W.C Sign fault monitoring feedback is via detector 24 causes MSS bit 15 to be set to advise the TMC.
(after a delay of TSM18 (200) secs for maintenance purpose before alarm occurs)

MSS OUTPUTS:
2 Boom Gate Rising (used to skipped Cross Rd after tram)
3 Advance train detector 18 or 19 locked off
4 Queue detector 14 or 15 set
5 Queue detector 14 or 15 locked on

6 City Bound Advance Tram Detected
7 Glenelg Bound Advance Tram Detected
8 Tram force Operating.
9 To ABG1 phase (handshaking with TS289)
10 SG1 green and dets 1, 2 or 3 presence time NOT expired (handshaking with TS289)
16 Isolated MSS (with tram force)

HISTORICAL:
2013-03-27 New program (Ensure SG8 not skipped multiple times)
2011-07-05 New program (Add Scats handshaking MSS bit to allow TS289 to go green early with queues)
2010-05-05 Advance tram override time reduced to 50 secs due to issue with tram inputs at TS289..TD
2010-04-27 Disabled ALL peds late intro due to conflicts with RT filtering ..TD
2009-12-18 PAPL removed site changed to IP over VPN (TSM9,10 set to 200 secs)
2009-07-15 Program update (tram force logic altered & tram advance inputs relay from TS289)
2008-09-03 load SP1 to assist Cross Rd after tram & phase skipping ..TD
2008-05-15 D,E phase skipping after tram added ...TD
2008-05-15 Queue dets 14-15 DAC=1 (7) to prevents lack of use alarms holds SG1,8 RED ...TD
2008-05-06 LQ=700(800) to helps reducing cycle rotation ..TD
2007-01-17 VR36 alarm generation added when MSS 5 present ... RMB
2006-11-21 New program to fix program fault
2006-08-23 G phase skipping & before/after tram intervention added ...TD
2006-06-14 New program (new tram logic).2006-06-14 New program (new tram logic).

## SCATS ACTION LIST RELATING TO SITE TS100

2: ; 07:00 MON-FRI
I=100!TSRPT4=30!TSRPT10=30!TSRPT13=30! ;Increase RT presence time 10/2/05 RLW
I=100!TSRS23=50! ;increased D,E,G skipping time after tram for peak traffic

4: ; 09:00 MON-FRI
I=100!TSRPT4/TSRPT10/TSRPT13/ ; Increase RT presence time in AM 10-2-05 RLW
I=100!TSRS23=30! ;reduced D,E,G skipping time after tram for offpeak traffic

6: ; 16:00 MON-FRI
I=100!TSRPT4=30!TSRPT10=30!TSRPT13=30! ;Increase RT presence time 10/2/05 RLW
I=100!VAR1.4=0!VAR2=1059!SS=8!KCL=160,1,3,4!PM8=2! ;G removed from ISS & fixed at 15%

8: ; 18:00 MON-FRI
I=100!TSRPT4/TSRPT10/TSRPT13/ ;Increase RT presence time in PM 10/2/05 RLW
I=100!VAR1.4=7!VAR2=59!SS=8!KCL=0! ;G phase back in ISS
I=100!TSRS23=30! ;reduced D,E,G skipping time after tram for offpeak traffic

17: ; 15:00 MON-FRI
I=100!TSRS23=50! ;increased D,E,G skipping time after tram for peak traffic

154: ;TS100 after train & phase skipping load plan 1 to assist cross Rd (<D>=20% E=20%)
I=100!PM8=1!PL/

5002: ; MCRC Toy Run START 8/12/02
I=100!CL=120^!PL=0#!E=0PDNGG!G=10A!A=25D!D=10E!

5003: ; MCRC Toy Run FINISH 8/12/02
I=100!CL/PL=0/

## 15.2 VOLUME STORE (VS) OUTPUT

The volume store output is usually formatted as shown below in 24 detector column format. An example for TS064 (the file name can be saved with any chosen format) is shown below:

vol_3064.txt - Notepad

File Edit Format View Help

Site: 64 Wednesday, 26 March 2014 Traffic Flow filename:WESTAD_20140326.vs

Wednesday, 26 March 2014
approach - detector(s)...

| Approach 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 00:15 | 28 | 24 | 2 | 6 | 19 | 27 | 0 | 4 | 3 | 1 | 2 | 7 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 130 |
| 00:30 | 24 | 18 | 4 | 3 | 10 | 18 | 0 | 3 | 1 | 2 | 3 | 6 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 97 |
| 00:45 | 20 | 18 | 4 | 1 | 14 | 12 | 2 | 3 | 2 | 3 | 4 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 88 |
| 01:00 | 14 | 11 | 4 | 3 | 12 | 11 | 2 | 2 | 1 | 1 | 4 | 7 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 76 |
| 01:15 | 12 | 8 | 3 | 1 | 6 | 10 | 0 | 5 | 0 | 1 | 3 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 57 |
| 01:30 | 13 | 10 | 2 | 1 | 12 | 12 | 3 | 1 | 1 | 1 | 1 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 62 |
| 01:45 | 11 | 15 | 2 | 1 | 7 | 6 | 2 | 3 | 1 | 1 | 1 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 56 |
| 02:00 | 8 | 12 | 3 | 2 | 9 | 11 | 4 | 0 | 5 | 0 | 1 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 60 |
| 02:15 | 10 | 8 | 2 | 0 | 8 | 10 | 2 | 0 | 4 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 47 |
| 02:30 | 9 | 3 | 3 | 0 | 12 | 7 | 0 | 4 | 3 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 44 |
| 02:45 | 17 | 8 | 3 | 1 | 13 | 6 | 0 | 1 | 1 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 53 |
| 03:00 | 10 | 5 | 0 | 2 | 11 | 16 | 1 | 2 | 2 | 0 | 4 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 55 |
| 03:15 | 18 | 3 | 1 | 1 | 12 | 10 | 1 | 4 | 4 | 0 | 2 | 6 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 69 |
| 03:30 | 9 | 3 | 4 | 1 | 14 | 13 | 5 | 6 | 5 | 0 | 1 | 2 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 69 |
| 03:45 | 7 | 8 | 2 | 1 | 20 | 12 | 3 | 1 | 2 | 0 | 4 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 65 |
| 04:00 | 13 | 4 | 1 | 2 | 14 | 16 | 8 | 0 | 1 | 0 | 1 | 4 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 71 |
| 04:15 | 6 | 7 | 1 | 2 | 19 | 23 | 2 | 4 | 3 | 4 | 4 | 4 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 84 |
| 04:30 | 11 | 4 | 7 | 1 | 30 | 23 | 2 | 4 | 1 | 1 | 7 | 6 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 99 |
| 04:45 | 14 | 13 | 9 | 3 | 34 | 36 | 7 | 10 | 1 | 2 | 6 | 9 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 155 |
| 05:00 | 17 | 9 | 9 | 9 | 34 | 53 | 5 | 8 | 6 | 2 | 17 | 20 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 198 |
| 05:15 | 27 | 13 | 7 | 5 | 57 | 61 | 2 | 7 | 7 | 5 | 18 | 29 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 248 |
| 05:30 | 38 | 24 | 14 | 11 | 71 | 98 | 5 | 21 | 11 | 4 | 19 | 21 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 348 |
| 05:45 | 44 | 36 | 11 | 7 | 103 | 147 | 17 | 21 | 16 | 2 | 19 | 22 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 455 |
| 06:00 | 50 | 40 | 21 | 17 | 112 | 156 | 24 | 17 | 19 | 7 | 13 | 15 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 511 |
| 06:15 | 64 | 61 | 13 | 8 | 151 | 187 | 13 | 16 | 19 | 7 | 21 | 21 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 595 |
| 06:30 | 86 | 90 | 13 | 10 | 216 | 267 | 25 | 31 | 27 | 9 | 19 | 25 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 834 |
| 06:45 | 112 | 121 | 26 | 16 | 224 | 226 | 27 | 34 | 36 | 16 | 30 | 36 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 924 |
| 07:00 | 108 | 113 | 28 | 15 | 219 | 248 | 29 | 38 | 40 | 12 | 41 | 49 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 966 |
| 07:15 | 118 | 123 | 28 | 12 | 211 | 232 | 30 | 47 | 51 | 14 | 35 | 44 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 974 |
| 07:30 | 127 | 130 | 26 | 15 | 227 | 263 | 24 | 61 | 58 | 17 | 51 | 56 | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1091 |
| 07:45 | 160 | 166 | 29 | 20 | 207 | 242 | 28 | 66 | 70 | 19 | 41 | 48 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1118 |
| 08:00 | 160 | 166 | 15 | 14 | 237 | 267 | 31 | 71 | 72 | 24 | 38 | 59 | 38 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1192 |
| 08:15 | 127 | 151 | 16 | 17 | 222 | 244 | 25 | 69 | 77 | 19 | 60 | 62 | 35 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1124 |
| 08:30 | 158 | 168 | 22 | 14 | 180 | 227 | 30 | 73 | 78 | 25 | 64 | 63 | 39 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1141 |
| 08:45 | 161 | 147 | 19 | 18 | 192 | 230 | 26 | 64 | 69 | 22 | 63 | 62 | 46 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1119 |
| 09:00 | 151 | 145 | 43 | 23 | 177 | 196 | 17 | 64 | 69 | 33 | 70 | 69 | 51 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1108 |
| 09:15 | 132 | 142 | 34 | 22 | 135 | 172 | 29 | 55 | 59 | 32 | 53 | 60 | 38 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 963 |
| 09:30 | 137 | 162 | 28 | 24 | 148 | 162 | 22 | 82 | 85 | 27 | 48 | 58 | 35 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1018 |
| 09:45 | 149 | 146 | 33 | 23 | 134 | 160 | 25 | 60 | 73 | 22 | 52 | 53 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 980 |
| 10:00 | 133 | 128 | 21 | 25 | 149 | 169 | 31 | 69 | 68 | 21 | 61 | 64 | 37 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 976 |
| 10:15 | 146 | 133 | 37 | 20 | 127 | 147 | 23 | 53 | 52 | 23 | 47 | 40 | 35 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 883 |
| 10:30 | 133 | 141 | 41 | 18 | 135 | 154 | 22 | 54 | 62 | 29 | 63 | 75 | 48 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 975 |
| 10:45 | 131 | 136 | 38 | 34 | 137 | 180 | 18 | 52 | 59 | 18 | 62 | 70 | 44 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 979 |
| 11:00 | 130 | 108 | 36 | 26 | 120 | 157 | 27 | 75 | 78 | 25 | 62 | 64 | 45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 953 |

vol_3064.txt - Notepad

File Edit Format View Help

Site: 64 Wednesday, 26 March 2014 Traffic Flow filename:WESTAD_20140326.vs

Wednesday, 26 March 2014
approach - detector(s)...

| Approach 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 00:15 | 28 | 24 | 2 | 6 | 19 | 27 | 0 | 4 | 3 | 1 | 2 | 7 | 7 | 0 | 0 |
| 00:30 | 24 | 18 | 4 | 3 | 10 | 18 | 0 | 3 | 1 | 2 | 3 | 6 | 5 | 0 | 0 |
| 00:45 | 20 | 18 | 4 | 1 | 14 | 12 | 2 | 3 | 2 | 3 | 4 | 3 | 2 | 0 | 0 |
| 01:00 | 14 | 11 | 4 | 3 | 12 | 11 | 2 | 2 | 1 | 1 | 4 | 7 | 4 | 0 | 0 |
| 01:15 | 12 | 8 | 3 | 1 | 6 | 10 | 0 | 5 | 0 | 1 | 3 | 5 | 3 | 0 | 0 |
| 01:30 | 13 | 10 | 2 | 1 | 12 | 12 | 3 | 1 | 1 | 1 | 1 | 3 | 2 | 0 | 0 |
| 01:45 | 11 | 15 | 2 | 1 | 7 | 6 | 2 | 3 | 1 | 1 | 1 | 2 | 4 | 0 | 0 |
| 02:00 | 8 | 12 | 3 | 2 | 9 | 11 | 4 | 0 | 5 | 0 | 1 | 3 | 2 | 0 | 0 |
| 02:15 | 10 | 8 | 2 | 0 | 8 | 10 | 2 | 0 | 4 | 0 | 1 | 1 | 1 | 0 | 0 |
| 02:30 | 9 | 3 | 3 | 0 | 12 | 7 | 0 | 4 | 3 | 1 | 1 | 1 | 0 | 0 | 0 |
| 02:45 | 17 | 8 | 3 | 1 | 13 | 6 | 0 | 1 | 1 | 0 | 2 | 0 | 1 | 0 | 0 |
| 03:00 | 10 | 5 | 0 | 2 | 11 | 16 | 1 | 2 | 2 | 0 | 4 | 1 | 1 | 0 | 0 |
| 03:15 | 18 | 3 | 1 | 1 | 12 | 10 | 1 | 4 | 4 | 0 | 2 | 6 | 7 | 0 | 0 |
| 03:30 | 9 | 3 | 4 | 1 | 14 | 13 | 5 | 6 | 5 | 0 | 1 | 2 | 6 | 0 | 0 |
| 03:45 | 7 | 8 | 2 | 1 | 20 | 12 | 3 | 1 | 2 | 0 | 4 | 4 | 1 | 0 | 0 |
| 04:00 | 13 | 4 | 1 | 2 | 14 | 16 | 8 | 0 | 1 | 0 | 1 | 4 | 7 | 0 | 0 |
| 04:15 | 6 | 7 | 1 | 2 | 19 | 23 | 2 | 4 | 3 | 4 | 4 | 4 | 5 | 0 | 0 |
| 04:30 | 11 | 4 | 7 | 1 | 30 | 23 | 2 | 4 | 1 | 1 | 7 | 6 | 2 | 0 | 0 |
| 04:45 | 14 | 13 | 9 | 3 | 34 | 36 | 7 | 10 | 1 | 2 | 6 | 9 | 11 | 0 | 0 |
| 05:00 | 17 | 9 | 9 | 9 | 34 | 53 | 5 | 8 | 6 | 2 | 17 | 20 | 9 | 0 | 0 |
| 05:15 | 27 | 13 | 7 | 5 | 57 | 61 | 2 | 7 | 7 | 5 | 18 | 29 | 10 | 0 | 0 |
| 05:30 | 38 | 24 | 14 | 11 | 71 | 98 | 5 | 21 | 11 | 4 | 19 | 21 | 11 | 0 | 0 |
| 05:45 | 44 | 36 | 11 | 7 | 103 | 147 | 17 | 21 | 16 | 2 | 19 | 22 | 10 | 0 | 0 |

## 15.3 YELLOW RED TEMPLATE SPREADSHEET

This template is used to calculate clearance times for new or modified intersections.

DRT 707 July 96

**CONTROLLER TIMESETING CALCULATION SHEET** Init: ________ Date: ____________

Site: ____________________________________________ TS: ___

| Approach Phase | Design Speed (km/h) | Amb (sec) | WIDTH (Mtrs) | Min Grn (sec) | ECO (sec) | Red (sec) | Intergreen (sec) | Transport Class | Minimum Required Green + Intergree |
|---|---|---|---|---|---|---|---|---|---|
| A | | | | | | | AT = | | |
| B | | | | | | | BT = | | |
| C | | | | | | | CT = | | |
| D | | | | | | | DT = | | |
| E | | | | | | | ET = | | |
| F | | | | | | | FT = | | |
| G | | | | | | | GT = | | |
| SM1 | | | | | | | = | | |
| SM2 | | | | | | | = | | |
| SM3 | | | | | | | = | | |
| SM4 | | | | | | | = | | |
| SM5 | | | | | | | = | | |
| SM6 | | | | | | | = | | |
| SM7 | | | | | | | = | | |
| SM8 | | | | | | | = | | |

| PED | M/WAVE | WALK | | PED PHASES | CL1 | CL2 * | MIN CL1 (if used) | MAX CL1 |
|---|---|---|---|---|---|---|---|---|
| P1 | Yes No | | M/1.2 m/s | | | | | |
| P2 | Yes No | | M/1.2 m/s | | | | | |
| P3 | Yes No | | M/1.2 m/s | | | | | |
| P4 | Yes No | | M/1.2 m/s | | | | | |
| P5 | Yes No | | M/1.2 m/s | | | | | |
| P6 | Yes No | | M/1.2 m/s | | | | | |
| P7 | Yes No | | M/1.2 m/s | | | | | |
| C1 | Yes No | | M/5.5 m/s * | | | | | |

*Note: Clearance 2 times are calculated as the lowest intergreen for phases in which the ped runs - 2 seconds
Cyclist speed of 5.5 m/s based on Austroads Part 14 (15th percentile <20kph)

**SLOT DATA** (including AT,BT, .....GT from above)

Ped, Termination Parameters
Wnt = new CL1 + new intergreen

Ped. Late Introduction (VPn=19)
VPn + 2=d1 + walk + new CL1 + new CL2 + CD

| | CL1 | CL2 | | W | SM | CL1 | CL2 + 2 | COMS | TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| W1T | + | = | PED 1 | | | | | = | |
| W2T | + | = | PED 2 | | | | | = | |
| W3T | + | = | PED 3 | | | | | = | |
| W4T | + | = | PED 4 | | | | | = | |
| W5T | + | = | PED 5 | | | | | = | |
| W6T | + | = | PED 6 | | | | | = | |
| W7T | + | = | PED 7 | | | | | = | |
| W8T | + | = | PED 8 | | | | | = | |

Checked by: ____________________ Sent for installation:

**NOTE: PLEASE FILE THIS COMPLETED FORM IN YELLOW/RED FOLDERS**
C0347

SELECT PC CALCULATION SHEET

CALCULATE EARLY CUT OFF VALUE

SAVE FILE

PRINT SHEET

Enter Values for Speed, Width and Transport Class
1 = Semis - Buses
2 = B Doubles
3 = A Doubles
4 = A Triples
For Each Phase:
Once all fields have been entered,
click this button to calculate required min greens