Siemens Mobility, Traffic Solutions

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SYSTEM/PROJECT/PRODUCT: Siemens Mobility, Traffic Solutions UTC System

SCOOT USER GUIDE

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1. INTRODUCTION

1.1 Purpose

This document describes the reasons for using SCOOT and how to get the best out of the facilities offered by it. The emphasis has been very much placed on practical problems that the engineer is likely to encounter whilst setting up a SCOOT system. In certain areas the information supplied is similar to that given in the SCOOT Traffic Handbook, which should also be read before setting up a SCOOT system. This document is intended as a supplement to the Traffic Handbook, not as a replacement.

1.2 Scope

This is a technical document that should be read by everyone who is involved in the design or implementation of a SCOOT system. It covers the values used for database preparation and how to carry out validation, fine tuning and customising. Implementers should also have a good knowledge of traffic signal control. The facilities mentioned relate to the STC UTC system and may not necessarily be found in the systems of other manufacturers.

1.3 Related documents

1.3.1 Traffic Handbook for SCOOT MC3 (found on the STC Documentation CD)

1.3.2 666/HB/16940/000 Operator Handbook for an STC UTC System

1.4 Definitions

This section provides a definition of the common SCOOT terms. It should be read in conjunction with Figure 1 (database hierarchy) and Figure 2 (typical node/link configurations).

1.4.1 Area

The whole SCOOT network on a UTC system. The Area is composed of a collection of Regions.

1.4.2 Region

A group of Nodes that are operated under SCOOT control at the same common cycle time. Normally these will be nodes between which co-ordination is desirable. Some of the nodes may be double cycling at half of the region cycle time.

1.4.3 Node

A junction or pelican under control in the SCOOT network. Pedestrian controllers of all types can be controlled by SCOOT but the user needs to determine whether they are configured as junctions or pelicans.

Junctions/Pelicans that are close together may be operated as one node, normally referred to as a multi-node. Controllers within the multi-node usually have a fixed offset between them and consequently have no internal SCOOT detectors. These offsets can be varied by the introduction of different SCOOT translation plans.

1.4.4 Link

A traffic movement into a stop-line in most cases or away from a stop-line in some instances. A Link may run through a number of stages. In the SCOOT database users can configure 6 different types of link:

(1) Entry - an entry link is an input of traffic from outside the network.

(2) Normal - a normal link is a movement of traffic that is fed from another node.

(3) Filter - a filter link is normally used for right turn overlaps, where it is impossible to site the detector in an upstream position. The loop is positioned in an historic downstream position beyond the stop-line. This loop could also be a detector for another downstream link into the next junction.

(4) Exit - an exit link is used on the exit from the network where exit blocking is likely to occur.

(5) Stop-line Entry - in version 4.2 loops upstream of but close to the stop-line can be used under some circumstances. This type caters for traffic from outside the network.

(6) Stop-line Normal - similar to stop-line entry but taking traffic fed from another node.

1.4.5 Detector

A loop or other detector that is detecting the vehicle flow for a particular link. A link may collect data from a number of detectors. A detector normally covers 1 or 2 lanes, hence a three-lane approach would have 2 detectors. A SCOOT detector is advised to be 2 metres in the direction of flow (although see the description of “use of existing detection” later in this guide). This is considered the optimum length for detecting the onset of queues.

1.4.6 Stage

A SCOOT stage on a node represents a UTC stage or group of UTC stages. It is important to differentiate them from UTC stages although in a one to one relationship they will normally have a close association, e.g. SCOOT 1 = UTC A,   SCOOT 2 = UTC B etc.

1.4.7 Flow Profile

A representation of demand (flow) for each link built up over several minutes by the SCOOT model. SCOOT has two profiles:

(1) Short – Raw data representing the actual values over the previous few minutes

(2) Long – A smoothed average of values over a longer period

SCOOT will choose to use the appropriate profile depending on a number of factors.

1.4.8 Interval

The time base that SCOOT uses for a number of actions including modelling and optimisation. An interval is 4 seconds.

1.4.9 LPU

Link Profile Units are a hybrid of flow and occupancy and is the basic unit of demand within SCOOT. The first action of SCOOT on receipt of new detector data is to convert the bit patterns into LPUs.

1.4.10 Upstream node

The node that feeds traffic onto a normal link.

1.4.11 Downstream node

The node that controls traffic for a link. Link SCNs are based on the downstream node SCN.

1.4.12 Time now

Each node has its own timer which runs cyclically from time 0 to the node cycle time -1. This is used to manipulate offsets within a region. "Time now" is the value of this timer.

1.4.13 Critical Node

This is the “busiest” node that is dictating the region cycle time. This could be one of a number of nodes within a region. If the degree of saturation of the critical node goes above 90% (ISAT - see section 8.120) SCOOT will increase the cycle time if permitted.

1.5 Issue state and amendment

Issue C	For first review
Issue 1	First issue
Issue 2	Second issue
Issue 3-6	Not issued
Issue 7	Minor Corrections. Document and Software issues align
Issue 8	Updated for plan preparation changes
Issue 9	Not issued
Issue 10	Revised and updated to reflect V10 software
Issue 11-13	Not issued
Issue 14	Updated to reflect V14 software including SCOOT V3.1
Issue 15	Minor Amendments
Issue 16	Not issued
Issue 17	Updated to reflect V17 software
Issue 18	Not issued
Issue 19	Updated to reflect V19 software including SCOOT V4.2
Issue 20	Not issued
Issue 21	Updated to reflect V21 software

Issue 22	Not issued
Issue 23	Updated to reflect V23 software including SCOOT V4.5
Issue 24-27	Not Issued
Issue 28	Updated to reflect V28 software including SCOOT MC3
Issue 29	Not issued
Issue 30	Updated to reflect SCCOT MC3 SP1 (version 5.1)
Issue 32	Updated to reflect SCOOT MMX (version 6) and change for Mantis 12287 (sect 3.6.3 Variable Intergreeens). Changes for MMX SP1 (version 6.1).
Issue 33	Not issued
Issue 34	Updated to reflect software up to V34.3
Issue 35	Updated to reflect version 35 software
Issue 35A	Correct minor error for PUBR

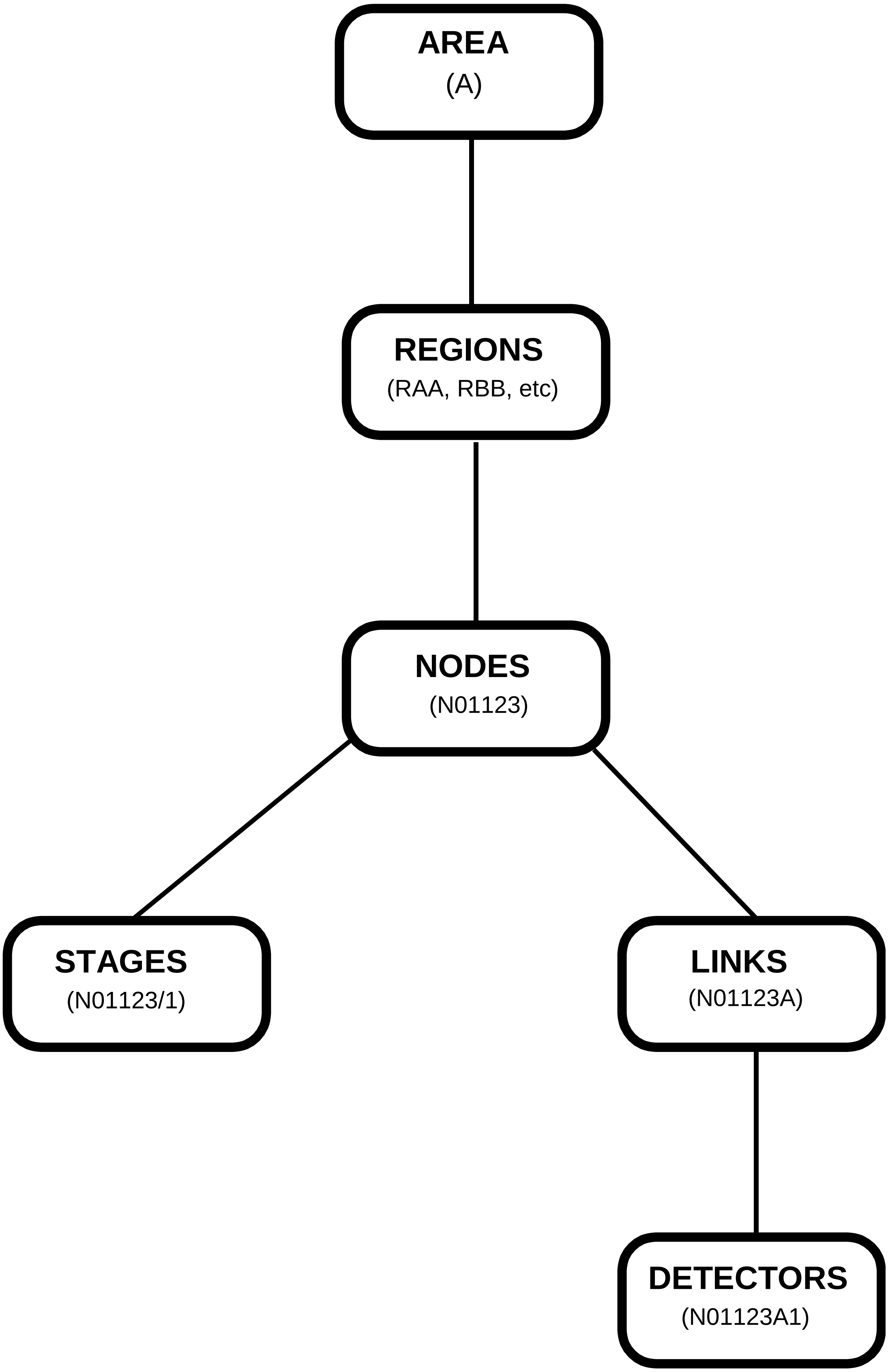


Figure 1 - SCOOT Equipment Hierarchy

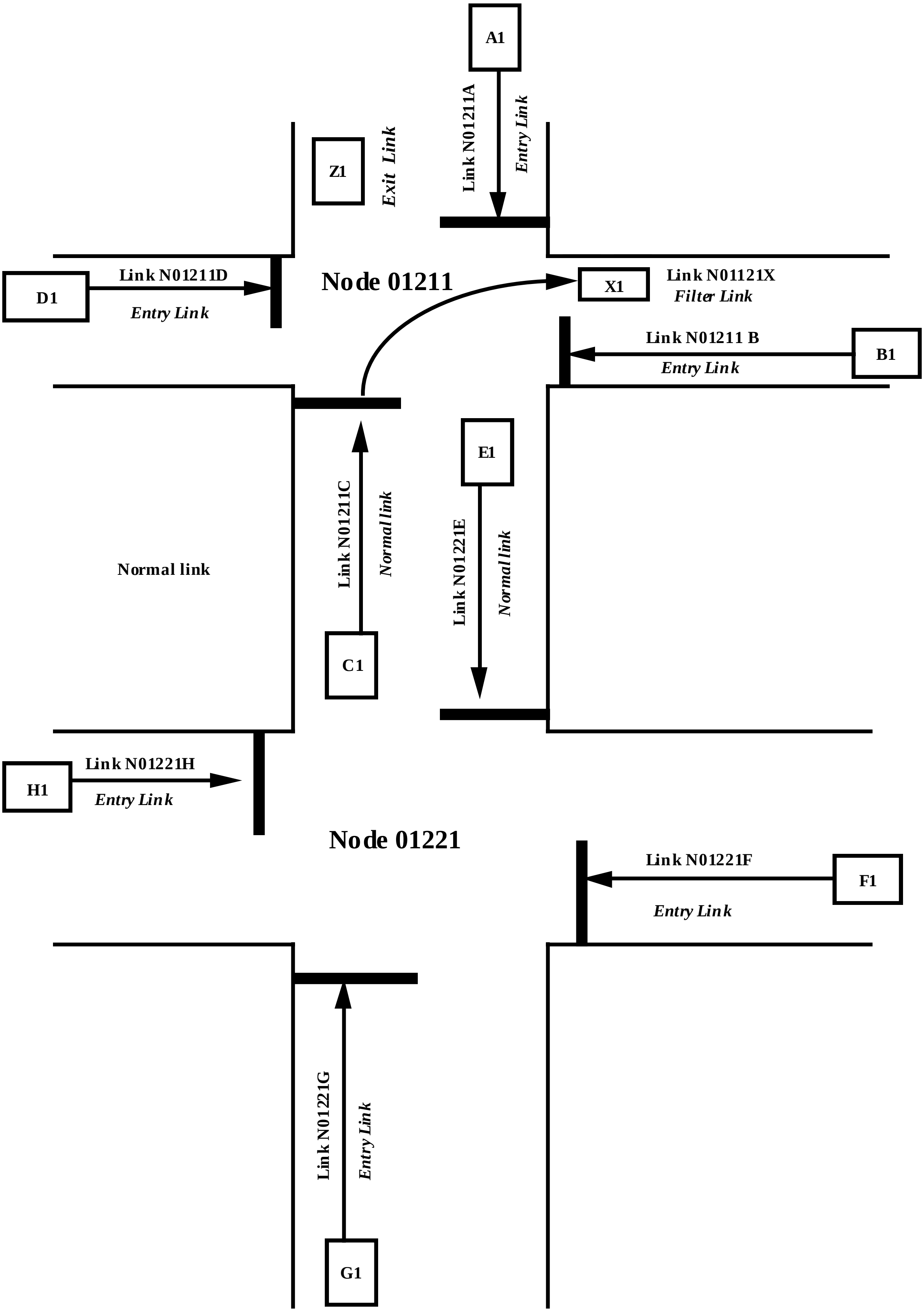


Figure 2 - Loop and Link Designations

2. OVERVIEW OF SCOOT

2.1 Introduction

The road system in a town forms a network of junctions. It has been found over many years that the best way to control traffic in such networks is by a co-ordinated system of traffic lights. Early co-ordinated systems worked with fixed time plans. Signal timings were calculated from observed traffic flows for the morning peak, off-peak and evening peak periods. The most successful method of calculating fixed time plans is the TRANSYT program from TRL. This is internationally accepted as the best method of calculating fixed time settings.

In the 1970s, TRL and British industry developed SCOOT, a dynamic on-line method of signal control, based on the principles of TRANSYT. SCOOT measures the traffic demand on all roads in real time and optimises the signal timings for that measured traffic. This is clearly better than using timings calculated by TRANSYT, which rely on historical flows. The flow and processing of data within a UTC system with SCOOT is shown in Figure 3.

SCOOT has been shown to work well in varying types of road networks such as gyratory and one-way systems, as well as being able to handle different driver behaviour in cities across the world such as Beijing, China and Santiago, Chile. SCOOT has been extensively tested in large surveys. The reports on these show that SCOOT control typically saves about 15 per cent delay compared with timings calculated by TRANSYT using up-to-date traffic flows. No other traffic control system has been shown to improve upon TRANSYT timings by such a large margin. In addition, to maintain good control and co-ordination, research has shown that TRANSYT timings need to be updated as traffic flows change. SCOOT, because it continuously measures the traffic flow, automatically keeps its timings up-to-date. Therefore, SCOOT would show even greater benefits over out-of-date TRANSYT timings.

As SCOOT has a model of the traffic behaviour on each link it is possible to obtain useful traffic statistics which otherwise would need a survey. The SCOOT model enables the traffic engineer to try different strategies and tactics and to study the results. Changes can be made to the model for specific local conditions. This has been done successfully by Siemens working with TRL, for example a collaborative project in Beijing which produced a new detector arrangement and new SCOOT processing and validation techniques to meet the requirement of high bicycle flows.

In short, there are three main reasons why SCOOT is a good system for controlling traffic in towns:

(a) SCOOT uses an on-line model of traffic behaviour, from data continuously obtained from on-street detection, to predict stops and delays within the network.

(b) SCOOT is the traffic responsive system that has been shown to give the greatest benefits compared with any similar adaptive systems.

(c) SCOOT is successfully operating in a large number of very different cities throughout the world.

2.2 Prediction

The basic philosophy of SCOOT is to obtain the optimum traffic signal settings. Any changes required to achieve this must be implemented with minimum disturbance to traffic movement. The prediction of traffic delays and stops for the particular pattern of traffic flows that exist in a network requires a traffic model and various optimisation routines.

SCOOT has at its heart a traffic model that produces a prediction for a short time in the future to give an estimate of traffic demand for the next cycle of the traffic lights and further ahead for cycle time changes. The optimisation routines then use this model to predict the effect of small changes to the current settings of the signals. By considering separately the Split, Offset and Cycle time of the signals the best timings are chosen for use on the street. As the resulting changes are regular but small, the disturbance to traffic is minimised.

2.3 Traffic Model

The SCOOT traffic model is based on data collected four times a second from presence detectors on every link in the network for which optimum timings need to be calculated.

Figure 4 shows the processing of detector data collected in 1/4-second intervals into the SCOOT model. This data is processed and used to establish the Flow Profiles, one for each link. The traffic predicted to be crossing the downstream stop-line in each interval is stored in these profiles. Figure 5 shows three very different profiles. Profile A can be seen to show a platoon of traffic in the early part of the cycle with a tail (which might be turning traffic) of much smaller volume in the second half. Profile B is of the same volume but no platoon is obvious. Profile C is where the upstream node is double cycling. These platoon shapes are discussed further below.

The model also includes all the traffic control stop-lines. Every stop-line is controlled by SCOOT nodes and stages. These represent the signal controllers and their UTC stages. The use of Red-Green information at the stop-lines and traffic volume in the Profiles allows prediction of the queues that will form for a given green time. The model then contains a representation of traffic demand (Flow Profiles), stages, stops and delays. The VEGA diagram in Figure 6 shows the arrivals and the queue build up and discharge at the stop-line.

Congestion is directly measured from the detector. If the detector is placed beyond the normal end of queue in the street it is rarely covered by stationary traffic, except of course when congestion occurs. If any detector shows standing traffic for the whole of an interval this is recorded. The number of intervals of congestion in any cycle is also recorded.

The percentage congestion is calculated from:

$$\frac{\text{No of congested intervals x 4 x 100}}{\text{cycle time in seconds}}$$

This percentage of congestion is available to view and more importantly for the optimisers to take into account.

2.4 Optimisers

The purpose of the optimisers is to predict the on-street effect of different signal timings and to select the most appropriate set, always retaining the principle of small, regular changes. See Figure 7.

2.4.1 Split Optimiser (Stage duration)

The split optimiser runs for a node at an optimum point before each stage change. Figure 8 shows the effect of an advance decision and Figure 9 that of a retard decision. It considers the effect of advancing, retarding or holding the stage change and the effect this has on the degrees of saturation of the links. The degree of saturation is defined as 'The ratio of the average flow to the maximum flow that can pass a stop-line'. In SCOOT terms this becomes 'The ratio of the demand flow to the maximum possible discharge flow', i.e. it is the ratio of the demand to the discharge rate (Saturation Occupancy) multiplied by the duration of the effective green time. The Split optimiser will try to minimise the maximum degree of saturation on links approaching the node.

If congestion is present on a link, this must be taken into account by the split optimiser. To enable this, the proportion of the previous cycle that was congested is included with the degree of saturation used by the optimiser when making its decision. The congestion term will enable a congested link to tend to obtain more green time whatever the degree of saturation shown in the model. The degree to which the congestion term will have an effect is determined by the link’s congestion importance factor (see 8.43).

2.4.2 Offset Optimiser (Difference in “time now” between nodes)

Once per cycle the offset optimiser uses the Flow Profiles to predict the stops and delays throughout the cycle for all the links upstream and downstream of a particular node. This allows the best overall offset for the node to be established and the ‘time now’ for the node to be adjusted to move towards this best point. This can clearly be seen by considering Profile A in Figure 10. This shows the cyclic profile over the detector and the profile of the flow arriving at the stop-line after platoon dispersion and the journey time from the loop to the stop line have been taken into account. If the stage start time was advanced a few seconds, the few vehicles that start queuing at the end of the red time in the diagram would not have to wait at all.

The optimiser does this prediction for each link and sums them together for the node. The choice is then made for a move towards the offset giving minimum delay and stops.

The congestion on a link is also used in the offset optimiser so that a congested link can be given priority over links without congestion. The degree of priority is related to the congestion weighting factor. See 8.45.

2.4.3 Cycle Time Optimiser (Node Capacity)

The Cycle Time Optimiser operates on a region of nodes that can sensibly be expected to have progression between them. The Engineer chooses this grouping.

The cycle optimiser usually runs every 5 minutes for each region, although this can be varied by the user in versions 4 and later. There is provision within SCOOT for the optimiser to run twice as often if a trend of rising or falling flows has been established. At this time it will work out the degree of saturation for all links for each node in the region. If any links are above the ideal saturation level (user configurable but typically 90%) the minimum practical cycle time (MPCY) for the node is increased by a small fixed step. If all are below the ideal saturation level, the MPCY of the node is reduced by a small fixed step. The optimiser assesses all the nodes’ MPCYs and considers all cycle times from the MPCY of the critical node up to the maximum permitted region cycle time before making a decision to increase or decrease the region cycle time.

To reduce delays at very lightly loaded junctions the cycle optimiser will 'double cycle' nodes if the delay is reduced in the network by this action. Because such a change can show reductions in delay if the cycle time is changed by large amounts, the cycle optimiser is the only optimiser that looks at the effect of large changes.

2.5 Congestion

2.5.1 How SCOOT sees Congestion

Congestion is identified within SCOOT as occurring when a detector has been continually occupied for one full interval of 4 seconds. The number of full intervals in a cycle is measured and in conjunction with the congestion importance factor for the link, is used by the Split optimiser to weight the calculation for the merit values of that link, in effect asking for more green time. The number of congested intervals is smoothed from one cycle to another so that should the detector suddenly become clear for a whole cycle the congestion algorithm does not suddenly stop working. The W10 message (see 9.6.10) if set can show the congested intervals on a link.

It is a good practice to create congestion maps of the network using the graphics editor. Each node can be simply represented by a number and each link with the link congestion facility represented by a line with an arrowhead. Then if congestion occurs the affected links will change colour according to the severity of the congestion. This diagram is also useful for showing exit blocking and faulty links. The default colours are:

green	- no congestion
yellow	- some congestion normally 1 to 25%
white	- congestion in the range 25 to 50%
magenta	- severe congestion 50% and greater
red	- detector faulty on link
cyan	- background cyan indicates that exit blocking is occurring.

2.5.2 Avoiding the onset of congestion

Congestion is the accumulation of queues in the controlled network which cause further lack of capacity by their presence. Any good control system gives a high priority to avoiding congestion. This enables greater flexibility in the control mechanisms available to the Traffic Engineer. SCOOT has a good record of increasing the capacity in towns at the most congested time of day. Often the survey results indicate reduction in delay at morning or evening peak with the best performance at the most congested time of day.

SCOOT will run the traffic timings for the network at the lowest viable cycle time and this will reduce queues. However the control algorithms will quickly raise the cycle time if the capacity is needed. SCOOT can double its cycle time from 60 seconds to 120 seconds in 20 minutes if required (quicker in Version 4.2 if required). This is about the time a fixed time plan needs to clear the delay caused by a crash plan change. SCOOT does this with very little disturbance to the flow thus keeping ahead of the onset of congestion.

One cause of congestion can be a bad offset. This is very dependent on the pattern of traffic, which changes from time to time. A switch of volume between ahead and turning traffic can change the required offset and ruin even the best calculated fixed time plan. Of course in a network, offsets have to be a compromise around a junction. SCOOT allows the Traffic Engineer to indicate the relative importance of offsets and will then determine the best offset compromise required for the current conditions. It does this by looking at the shape of the flow profile. Offset biasing and offset weighting can be applied to achieve desirable offsets.

Often a further cause of congestion is a poor split of the green time between stages. SCOOT always attempts to keep the saturation of the most heavily loaded approaches around the junction balanced. It does this by adjustments to the green split several times a cycle. SCOOT makes its adjustments without destroying the co-ordination that avoids the onset of congestion.

2.5.3 Immediate action

When congestion occurs it may have a cause that is still removable by change of offset or split. Sometimes a vehicle breakdown or unreasonable parking may change the capacity of an approach. SCOOT detectors are placed and designed to detect the build up of slow moving vehicles which signals the beginning of congestion. Because it can detect the congestion and the situation on the street may be unusual it puts progressively more importance on the elimination of this congestion. The split and offset optimisers use the same calculations as before to arrive at the least delay solutions but include also a congestion weighting towards the most heavily congested approaches.

It can be seen that in these situations SCOOT changes its control strategy. SCOOT becomes a closed loop control system trying to eliminate the detected congestion. This continues until the congestion disappears or the optimiser hits a limit. The Split optimiser cannot give more green to a link when it finds congestion on all approaches to a node for example. The Cycle Time optimiser will typically stop rising at 120 seconds. In these situations the method shown below are used.

The congestion around a node does not have equal precedence. Therefore the weighting includes a user configurable part so that the Traffic Engineer can determine the reaction of SCOOT to the detection of congestion. For example if the network includes a closed loop of one-way streets then exits from this gyratory must be given priority over entries when congestion occurs. Thus SCOOT congestion weightings allow you to indicate the way you want congestion dealt with. This means that while the traffic is moving the minimum delay solution can be used without compromise. If congestion is detected then SCOOT deals with it correctly only in the area required.

The same facility (to use detected congestion) is available on any other link. This means that congestion on a link can affect green splits at its own stop-line and on a link further downstream. Thus if the Engineer decides a link can hold a queue without a penalty then congestion can be ignored but when the next link is affected both links get priority to remove the congestion.

2.5.4 Exit blocking

Exit blocking occurs in the model when the main downstream link of a link shows congested intervals. During exit blocking SCOOT models the upstream link as if it were at red.

To see where exit blocking is occurring within the network the W08 and W09. messages can be set for all links. See 9.6.8 and 9.6.9.

2.5.5 Short links

Where links are short and the normal queue for the signals at red is likely to extend onto the detector, the congestion importance factor should always be set to 0. In these cases it is worth considering siting another detector further up the link for detecting congestion. This would then be nominated as the congestion link of the first link and would have its own congestion importance factor (CLIF). This link would not necessarily be validated and could be nominated as an exit link within the database.

Where signals are close and congestion is likely to occur it is possible for the offset optimiser to drift away from the ideal offset. To overcome this the facility exists to make the offset move towards a specified value (CGOF) which will only start to operate if there are congested intervals on the link. The strength of this is determined by the congestion weighting factor (CGWT).

2.6 Additional Features of the STC Implementation

2.6.1 Physical proximity of controllers

Where junctions are physically close a variety of solutions are available. As the distance reduces separate nodes can have fixed offsets. At closer range, two or more controllers can be made part of one node. Finally, the two junctions can be controlled by one controller. In each method time of day adjustments to the linking can be made.

Where 2 or more controllers form a single node the UTC stage times may be offset by either a fixed length UTC stage or by the use of a fixed length SCOOT stage. Between close nodes dummy links without detectors but with offset weightings can be introduced.

2.6.2 Stage Translation Plans

Use of stage translation plans allows more than one UTC stage to be allocated to a SCOOT stage.

Up to six translation tables are available for each node allowing for different translations to be defined for different times of day.

2.6.3 Node Transfer

The node transfer facility allows the movement of a node from one region to another. This feature may be useful where the conditions in the network at different times of day mean that a node is better controlled in one region at one time and a different region at another, e.g. at a region boundary in the morning and evening peaks.

2.6.4 Re-Establish SCOOT Timings After An UPDA [ESS Licensed Facility]

The UTC system has a facility which can preserve SCOOT timings over a re-start. This avoids having to begin from database/timetable settings which may not be wholely appropriate.

If the region level CHAN parameter RSCT (Resume SCOOT Timings) is set to YES (the default value), then following an UPDA that causes the system to closedown or a REIN, the region cycle time and the node plan lines will be initialised to the values in force immediately prior to the action. The RSCT parameter may also be baselined with a RUBA command

During SCOOT initialisation a message will be output for every region for which restored SCOOT timings are being loaded. For example:

Tu 12:23:45 Resuming SCOOT timings for RAD

When the saved timings are re-loaded, checks are made to ensure they are still valid as the UPDA may have changed something important (for example a SCOOT stage added or minimum stage length increased). In such cases the values are either re-scaled so they are in range or they are discarded. In cases, where they are discarded a message is output. For example:

Tu 11:04:57 Not using saved SCOOT timings for N03411. Timings not valid in new configuration

Operator commands, such as NODT, CHAN MINS, or CHAN MAXS, which are not timetabled may result in the saved timings not being implemented after the UPDA.

The saved SCOOT timings are used only if they are less than 5 minutes old. This should not normally be a consideration as UPDA & REIN should not normally take this long. The facility would also restore SCOOT timings following a reboot if this can be achieved within the 5 minute limit.

The value of the RSCT parameter is tested when the SCOOT timings are saved during UTC/SCOOT shutdown not as part of the subsequent SCOOT initialisation. This allows the user to temporarily override the default RSCT action with a CHAN RSCT command prior to the REIN or UPDA.

For example, to force the default timings (DEFS, IRCT, NSST parameters) to be used following a REIN for one time only the user can do the following

CHAN RSCT R* NO

XSCO R*

REIN

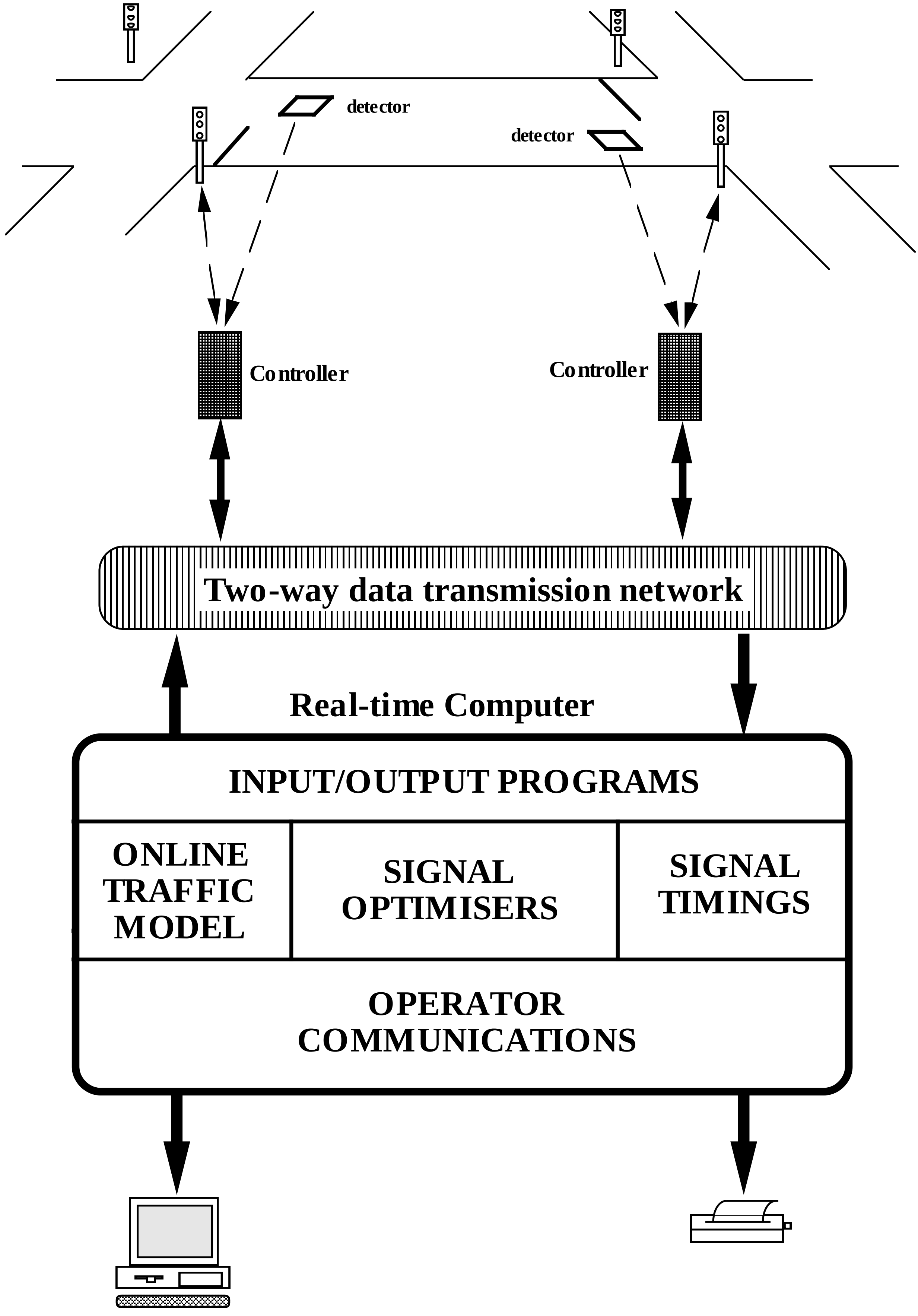


Figure 3 - SCOOT Information Flow

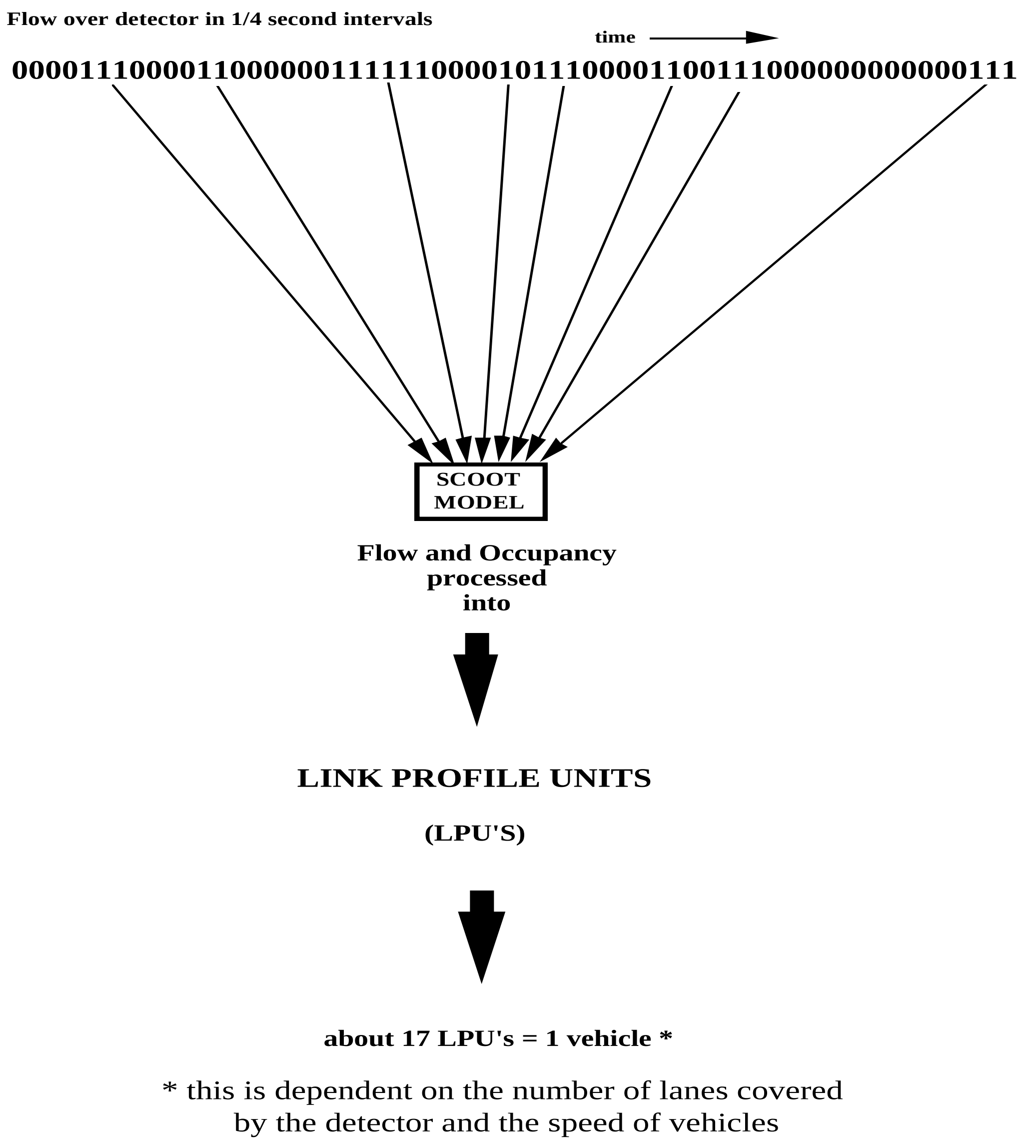
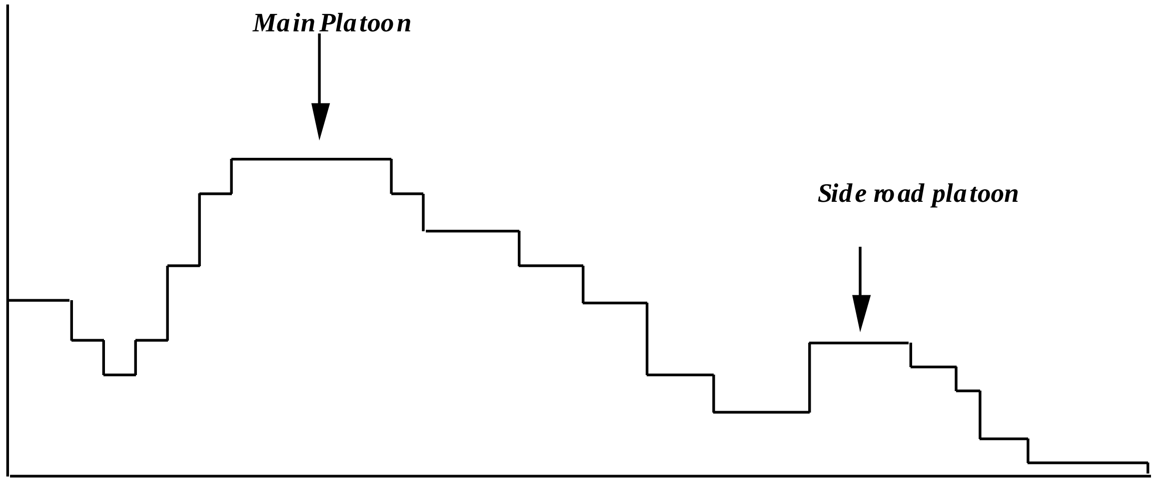
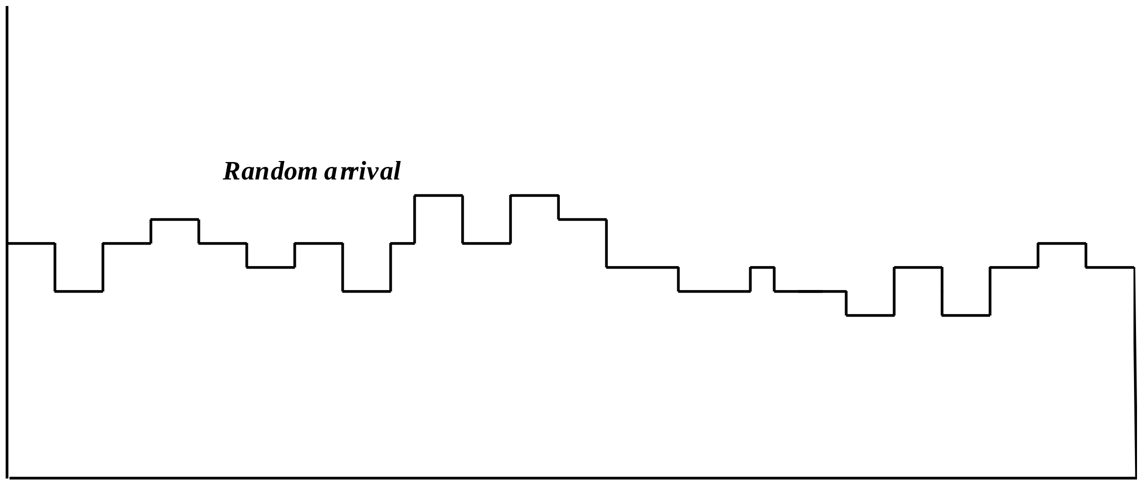


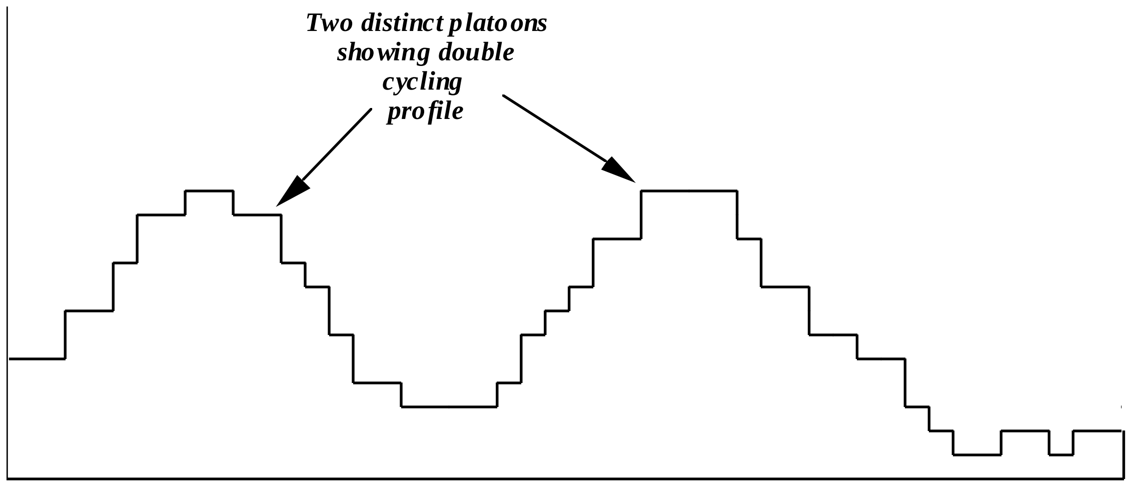
Figure 4 - Processing of Detector Data



Profile A



Profile B



Profile C

Figure 5 - Cyclic Flow Profiles

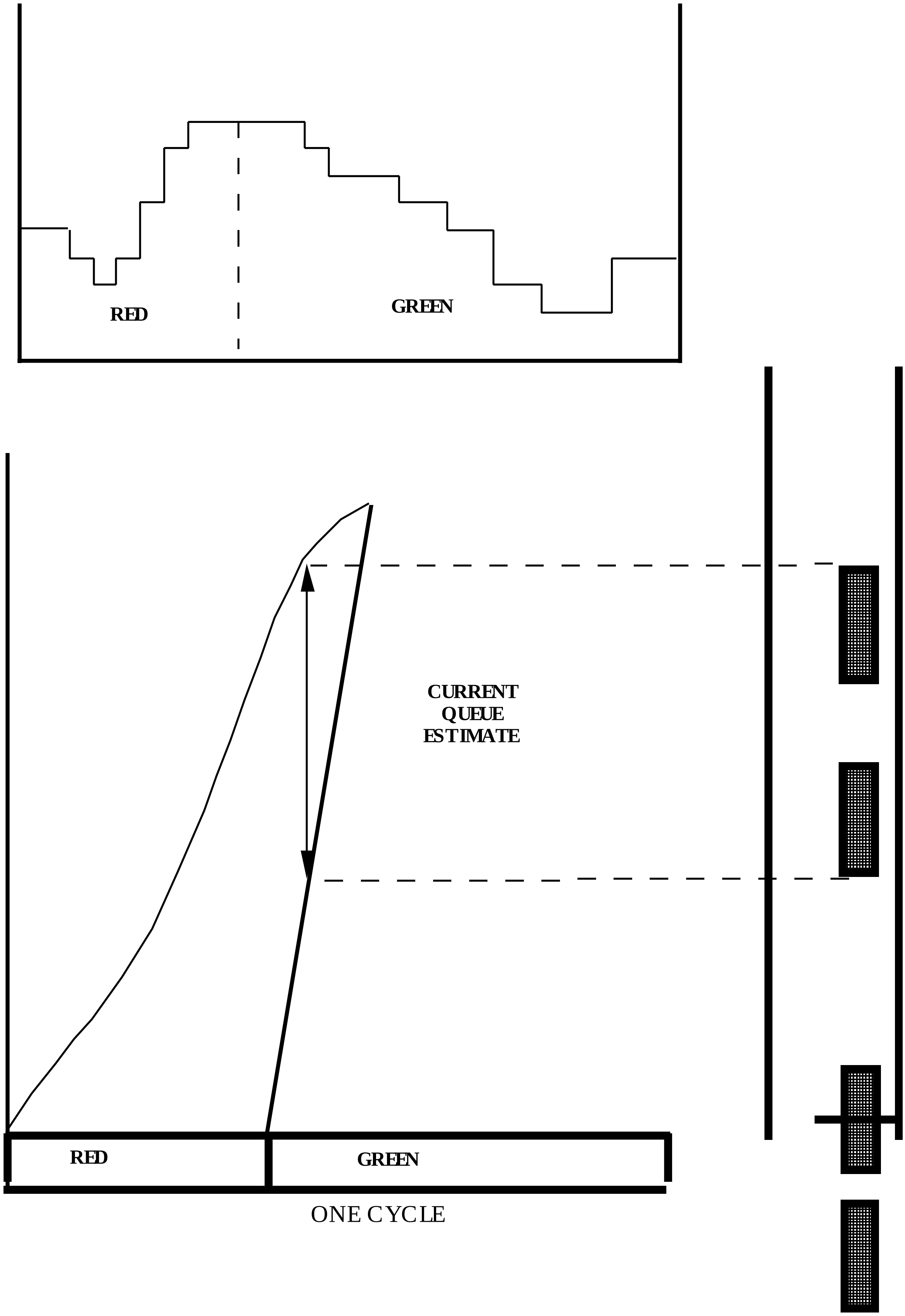


Figure 6 - VEGA Profile

Change Authority

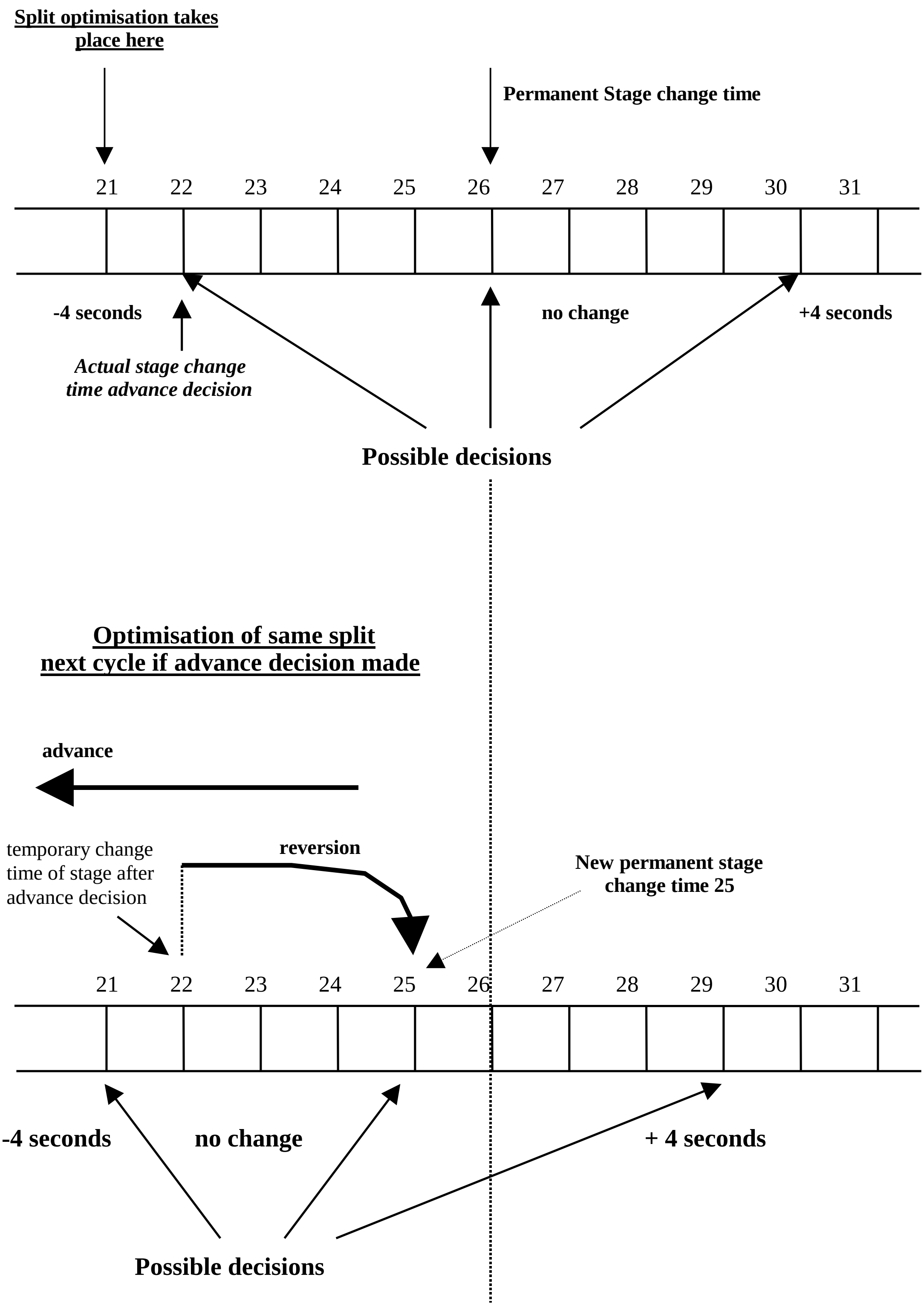
Optimiser	Frequency	Max change		Min change
		(seconds)		
SPLIT	Every Stage change	4		1
OFFSET	Once per cycle	4		4
		Possible Changes		
CYCLE TIME	Every 2.5 or 5 Mins	16 from 120 upwards	8 from 64 upwards	4 from 32 upwards

NOTES:

1. If there was a stay decision then obviously there would be no change in split or offset. The values shown above are for advance or retard decisions.

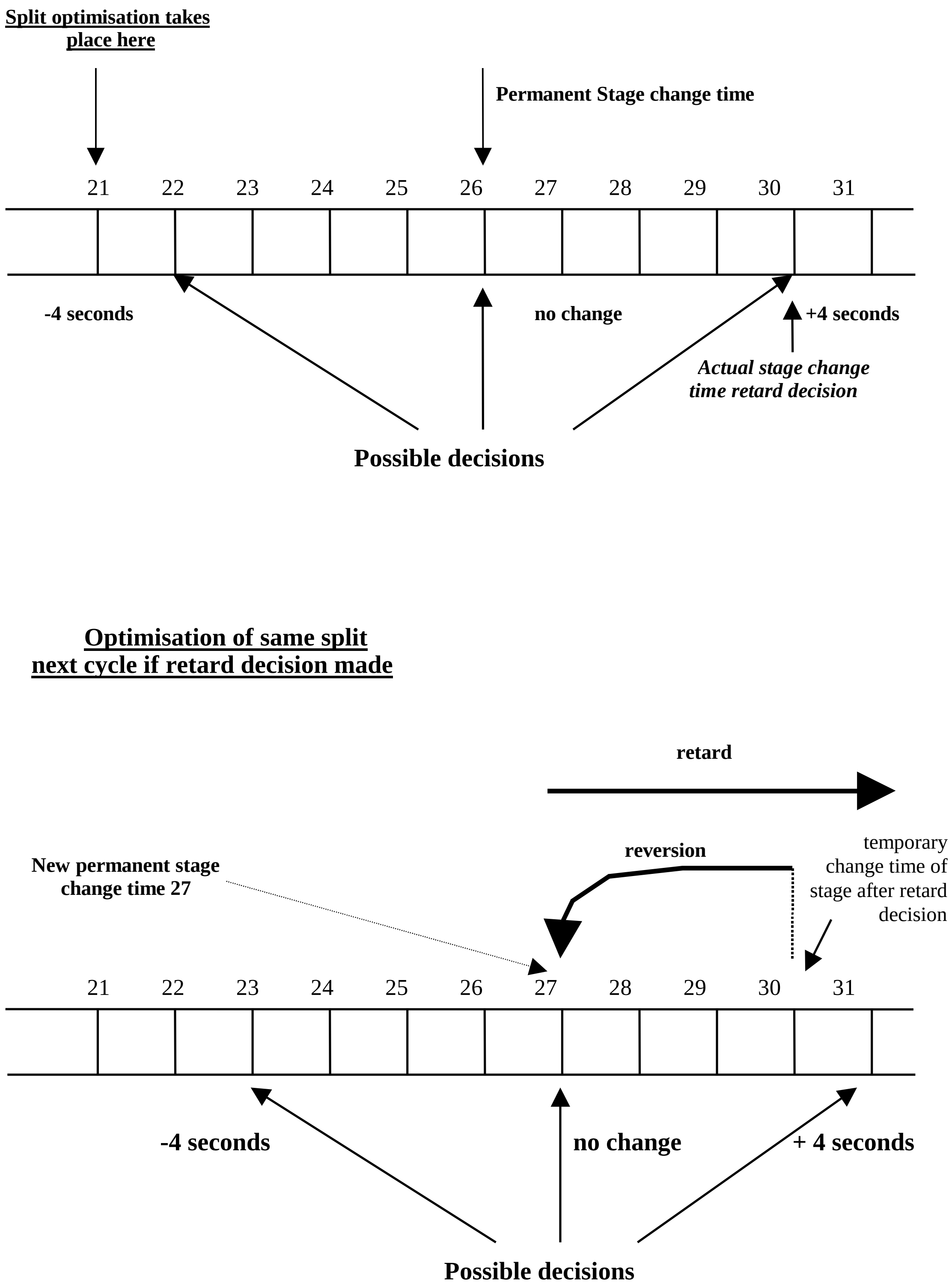
2. The change values are defaults. These may be modified by the user in version 3.1.

Figure 7 - The SCOOT Optimisers



NOTE:
The figure assumes that the default change authority values are used. These may be altered by the user in SCOOT 3.1, as described in the section "Configurable Optimiser Authorities".

Figure 8 - Split Advance Decision



NOTE:
The figure assumes that the default change authority values are used. These may be altered by the user in SCOOT 3.1, as described in the section "Configurable Optimiser Authorities".

Figure 9 - Split Retard Decision

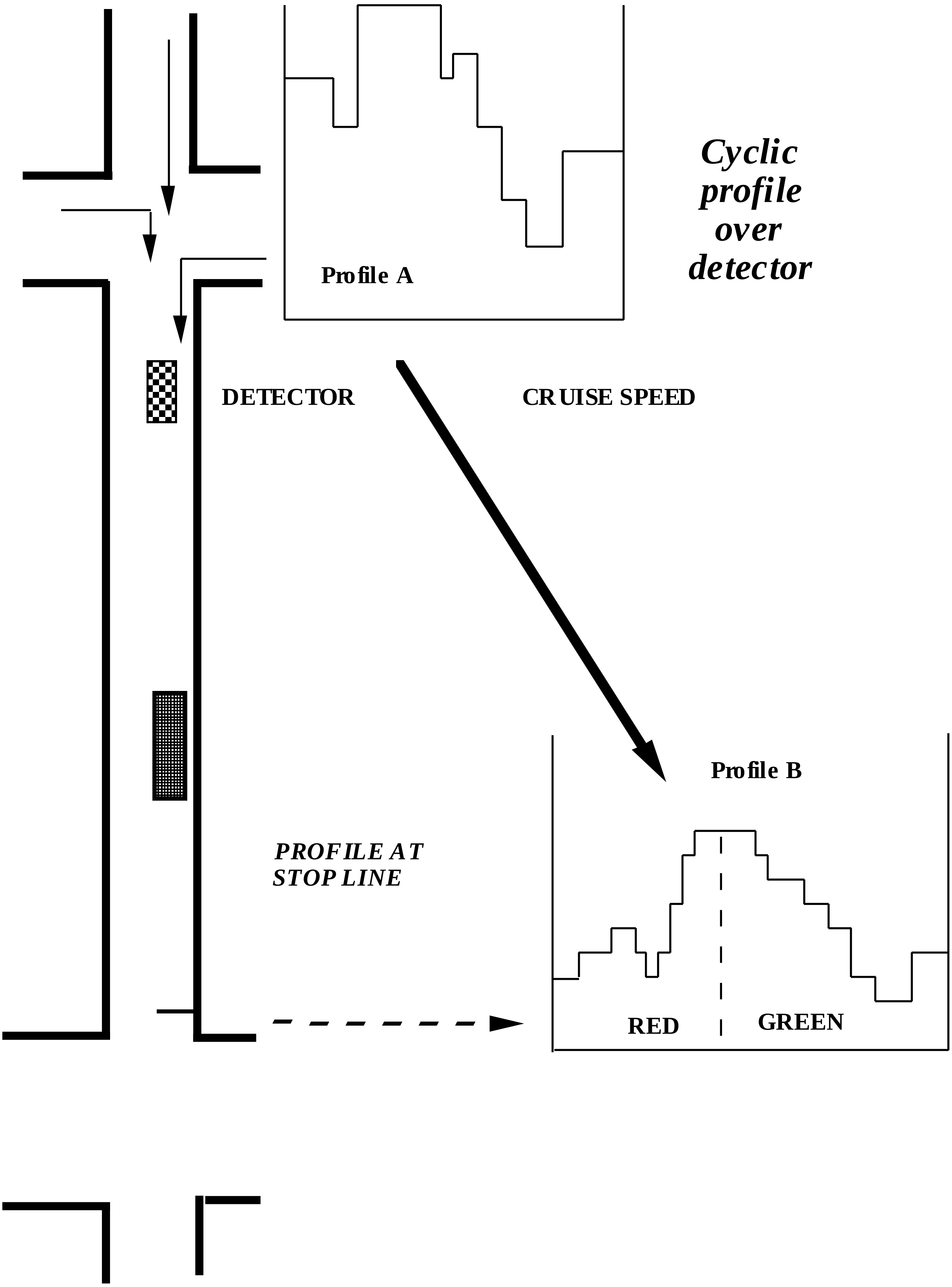


Figure 10 - Flow Profile Offset

3. Development History (Versions and Facilities)

3.1 Introduction

The first commercial implementations of SCOOT in the early 1980s used Version 2.2. This version contained the facilities which were tried and tested as part of the original development and field trials.

Since then, a regular programme of developments has been in place which has seen many enhancements to the algorithms which have subsequently appeared in a number of releases. The following sections identify the significant features which have appeared in each of these releases.

3.2 SCOOT 2.4 Facilities (circa 1990)

3.2.1 SOFT – Saturation On-line Flow Technique

This is an optional facility which can be used to improve the accuracy of modelling, particularly under certain abnormal circumstances.

The saturation occupancy of a link is determined during validation from queue discharge timings measured on street. The value then remains fixed. If implemented, SOFT gathers information from detectors at the exits from the node and makes an assessment of the end of queue. This enables the saturation occupancy value to be adjusted in real-time. An example of where this might be effective is where one lane out of two on a link is temporarily closed for road-works.

The SOFT technique is only applicable to a proportion of the links in a SCOOT network, where sufficient downstream detectors are available, are well positioned and where these measure good queue dispersal with a “clean” end of queue.

The main features are:

a) A saturation flow is measured on every cycle, subject to certain conditions being met.

b) A saturation flow to saturation occupancy conversion factor is calculated when the queue clear time is well defined.

c) A saturation occupancy is estimated every cycle.

A detector chosen for SOFT can be set to mandatory (SMAN). This means that should it go faulty then the SOFT algorithm is suspended for that link.

The journey time (SJNY) is measured for a vehicle to leave the stop-line and cross the detector. Each detector used for a soft link will have its own journey time.

SOFT is turned on by the CHAN SOFT command which can be set to OFF, LIMBO (calculate but do not implement) or PERM (implement changes).

Changes to the STOC can be observed by watching M26 messages. The limits that determine the variability of saturation occupancy under SOFT can be set using the SMIN and SMAX parameters.

M21 can be used to monitor the detailed measurements made by SOFT. Information on its values can be found in section 9.2.13. Message M22 provides greater information regarding the SOFT calculation of STOC detailed in section 9.2.16.

3.2.2 Feedback

3.2.2(a) Introduction

In the early versions of SCOOT the model and optimisers assumed that the requests made by SCOOT would be implemented as expected on street. However, where UTC offers the capability of demand dependency, SCOOT's assumptions would not always be correct.

The Feedback facility provides information on the actual stages run on street, from which the link green times may be more accurately determined. Feedback enables SCOOT to continue to model queues effectively in spite of unexpected stage changes or durations due to Green Waves, demand dependant stages, priority calls etc.

Feedback is enabled by default in all systems but can be inhibited on a per node basis by the user. Examples would be in a complicated multi-node or where reply indications are unreliable or often late in arriving. In these cases the MFBI parameter should be set to YES.

3.2.2(b) Problem areas

When validating it is quite possible that the engineer will discover links that are not going to green or not going to red. This problem is almost certainly associated with feedback and can normally be rectified on a temporary basis by setting MFBI to YES for the node. To investigate further the M35 message should be set for the node to see if the UTC request, UTC confirmation and UTC choice fields are compatible.

The choice mask is set from the UTC stages that are being sent:

00000001	sending UTC stage 1	choice=2
00000010	sending UTC stage 2	choice=4
00000100	sending UTC stage 3	choice=8
00001000	sending UTC stage 4	choice=16
00000011	sending UTC stages 1 and 2	choice=6

Provided that SCOOT sees an acceptable UTC reply that matches the choice then a link will be set to green. An example of a link not going green would be if a UTC stage has a very short minimum green (perhaps 3 seconds or less) and SCOOT is trying to run this stage to a minimum. In this case the confirmation of the new stage from the street may not be received by the UTC system before the SCOOT model changes to the next and alters the choice mask. The typical solution in this case is to increase the SCOOT minimum stage length by 1 or 2 seconds to allow the stage reply to be seen in spite of the transmission delay.

3.2.2(c) The Split Optimiser

Feedback information can also be used by the Split optimiser. In this case, Split can review a previous decision when it next runs based on the stages that actually ran on street. In order for this to be effective, the reply data from the street must be available to the optimiser when it runs, i.e. several seconds before the end of the stage. This might not be the case where a stage consists of a long intergreen and a short green.

The Split Feedback Inhibit Flag (SFBI) is used to determine whether Split uses feedback information. The default is NO (use feedback).

3.2.3 Gating

Gating is a facility available to the user which allows a degree of demand management. An example would be on an arterial entry to the network. Here a trigger link near to the centre could show when high levels of saturation/congestion occur (suggesting that there is limited capacity available). A gated link at the start of the arterial could then have its green time reduced to decrease the flow into the network. The result would be queue relocation from the centre to the outskirts of the network.

The first objective is to identify “trigger” links in the network. When a trigger link measures saturation or congestion above a defined limit, the user wishes to cause a mitigating effect somewhere else in the network. Gated links need to be identified to react to the triggers. A gated link may be told to either increase or decrease its green time when the trigger conditions are detected.

The engineer can nominate one or more trigger links which are combined into a cluster (CLUS). When at least one link reaches the specified level of either saturation (GSAT) or congestion (GCON) gating will be activated on one or more gated links which are associated with the same cluster (GCLU). Gated links can be set to either increase or decrease green under gating (GGAI).

For each trigger link, decide the critical degree of saturation and/or congestion above which you expect problems to occur. Next, for each gated link, decide whether more or less green would be required when gated and, if less, determine whether there are minimum green lengths below which it is not desirable to run (set the GLMG and GUMG appropriately). Finally decide what percentage of trigger links in a cluster need to be active for gating to become active (GCAT) and inactive (GCIT).

To observe gating in operation, use NFTD or the M08 message to observe current saturations and congestion levels. Use the S04 and G01 messages to see what if any action is being taken by gating.

A simple example of gating is shown in the following figure. The trigger link, (also known in early SCOOT versions as the bottleneck link), is at node N01211. The intention here is to check for the saturation on this link going above the pre-determined threshold and then to reduce the green time on the link at N01241 to reduce traffic entering a busy area.

A full description of gating, the use of parameters, tuning and troubleshooting can be found in the SCOOT Traffic Handbook, reference 1.3.1, chapter 0473.

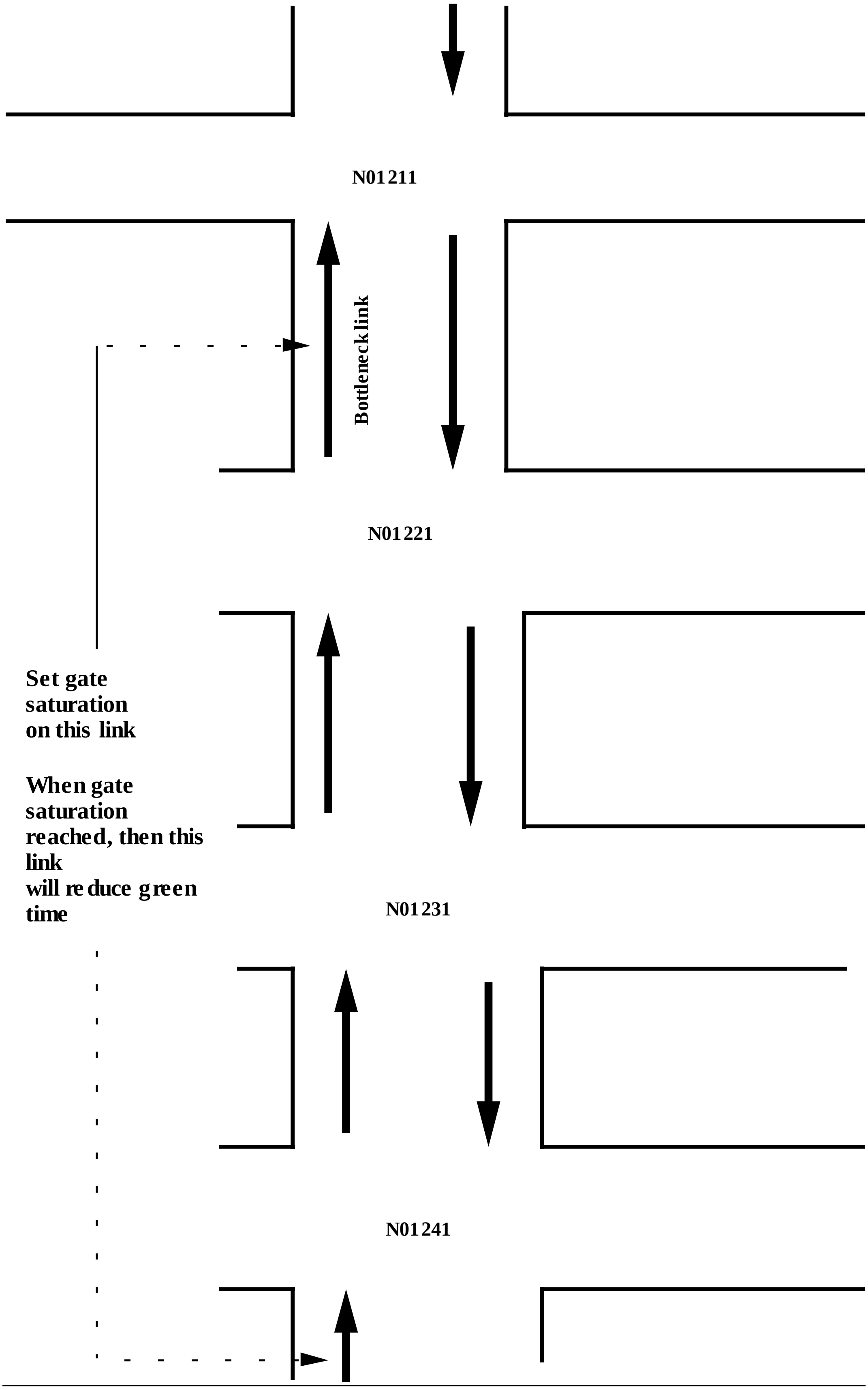


Figure 11 - Gating

3.2.4 Bicycle SCOOT

Bicycle SCOOT is a facility designed to allow the definition of bicycle only links in a SCOOT network. These should be used if a stage length at any time of day needs to be determined by the number of bicycles on an approach, i.e. when the bicycle queue is still discharging after the motor vehicle queues have gone.

3.2.5 Congestion Offset

Under congested conditions SCOOT may not be able to determine the best offset for a link as the model less accurately represents the prevailing conditions. Also, there are often sound traffic engineering reasons for needing a pre-determined offset at such times.

This facility allows the user to specify a congestion offset and a weighting factor which will encourage the offset optimiser to choose this offset when congestion is present.

3.3 SCOOT 3.1 Facilities (circa 1995)

3.3.1 Bus Priority

Bus Priority can make use of Active Vehicle Location (AVL) Systems or Selective Vehicle Detection (SVD) to detect the presence of an approaching bus. SCOOT then determines the best method of giving priority to the bus, either by providing extensions to the current running stage or issuing recalls to return to the appropriate stage. Once priority has been completed, SCOOT can then use a number of methods to rapidly return the optimal offset for the prevailing traffic conditions.

In this version of bus priority, the integrity of the SCOOT cycle is maintained, i.e. all stages must be called in the normal sequence.

Bus priority is described further in section 7.

3.3.2 User Configurable Optimiser Authorities

This facility provides the user with control of authorities for the Split and Offset optimisers. The authority is the amount by which the optimiser can affect the offset (in the case of the Offset optimiser) or the stage change point (in the case of the Split optimiser). In previous versions of SCOOT these values have been part of the “compiled” database and have provided the generally recognised values as shown below:

Offset	+/- 4 seconds	(OFFSET)
Split Temporary Change	+/- 4 seconds	(SPLIT TEMP)
Split Permanent Change	+/- 1 second	(SPLIT PERM)
Split Filter Temporary Change	+/- 2 seconds	(FIL TEMP)
Split Filter Permanent Change	+/- 1 second	(FIL PERM)

This facility allows the user to define a number of different sets of authorities which can vary by cycle time and be allocated on a per node basis.

3.3.2(a) The Authority Table

The authority table is a data structure, which holds all user configured authority values. The table has the capacity to hold 10 different lines of data for each of the five authority types listed above. Line 0 is reserved for the default values that are pre-set by the system and are based on the values above. This enables the system to operate without the need for the user to create any new data.

The table has two versions. One is used by the on-line system. The other is used for data configuration. Data is added to the configuration part of the table and can be brought on-line by use of the UPDA command providing the data contained in the table is consistent (see rules below).

Lines 1 to 9 of the table are available to the user. There are several rules that apply to data configuration and these are described below. All commands affecting the authority table use the AUTH command, the syntax of which is described in the Operator's Handbook (although some examples are included here).

Each line of the table consists of a number of data segments that must be entered independently. A data segment consists of the authority value(s) which are required to be used at or below a particular SCOOT cycle time. The order of parameters is cycle time first with values following in ascending order. As many values and as many data segments as are required may be entered for each line of the table subject to the overall limit of 50 parameters per line. Each line must include an entry for the maximum SCOOT cycle time (240 seconds in most systems).

By entering a value (positive) the equivalent negative value will automatically be assumed when optimisation occurs, i.e. a value of 2 will cause both +2 and -2 to be considered.

An example of setting up line 2 for the Split temporary authorities is now given. Let us assume that the requirements are to consider 1 and 2 second changes up to 64 seconds, 2 and 4 seconds up to 128 seconds and 4, 8 and 16 seconds up to 240 seconds. The sequence of commands to be entered would then be:

```
AUTH  SPLIT_TEMP  2  64  1  2
AUTH  SPLIT_TEMP  2  128  2  4
AUTH  SPLIT_TEMP  2  240  4  8  16
```

The result of these operations can then be verified by:

```
AUTH  SPLIT_TEMP  2
```

which should produce output similar to

```
002     64  1  2  128  2  4  240  4  8  16
```

Provided the above rules are followed, any line created for the Offset optimiser will be immediately valid and will be ready for incorporating with an UPDA. For Split, lines are only valid when all four Split authority types have consistent data. Consistency is defined as having a data segment of each type for all the required cycle times and for each cycle time data segment to have the same number of values for that cycle time. Also, for any data segment, values for permanent entries must be less than or equal to the corresponding temporary entries.

Below are two examples of completed Split lines. In the first, SPLIT_PERM has no values for 64 seconds, FIL_TEMP has only 2 values at 240 seconds and FIL_PERM values at 128 are larger than FIL_TEMP.

Invalid Example

SPLIT_TEMP 2 64 1 2 128 2 4 240 4 8 16

SPLIT_PERM 2 128 1 2 240 1 2 3

FIL_TEMP 2 64 1 2 128 1 3 240 2 4

FIL_PERM 2 64 1 2 128 2 4 240 1 2 3

Valid Example

SPLIT_TEMP 2 64 1 2 128 2 4 240 4 8 16

SPLIT_PERM 2 64 1 2 128 1 2 240 1 2 3

FIL_TEMP 2 64 1 2 128 1 3 240 2 4 6

FIL_PERM 2 64 1 2 128 1 2 240 1 2 3

3.3.2(b) Selection of entries from the table

Once valid entries have been set up in the authority table and have been introduced into the on-line system, they are available for use. Lines are selectable on a node basis for both optimisers by use of the appropriate parameters as shown in the following examples:

CHAN NOAP (node offset authority pointer) N12345 2

CHAN NSAP (node split authority pointer) N12345 2

As with most SCOOT parameters the values are available for view and change by operator, timetable and CAST and can also be "baselined" using the RUBA command.

3.3.2(c) Health Warning for Offset Authorities

It is important to be aware of the relationship between offset authorities and minimum stage length for the named stage of a node. The UTC system automatically adds 4 seconds to the minimum length of the named stage at data preparation time. This is to allow the offset optimiser to shorten the stage by 4 seconds without causing compliance problems. Therefore if offset authorities greater that 4 are configured, users are advised to consider the implications for the minimum of the named stage and to increase the value appropriately. A typical example would be an authority of 6 seconds. In this case the minimum length of the named stage should be increased by 2 seconds.

3.3.3 User Configurable Target Saturation Levels

Target saturation levels for normal and entry links are now node based and user configurable. This allows the previously "hard-coded" values of 90% (80% if the trend flag was set) to be varied by the user, giving a greater degree of flexibility in the configuration of SCOOT. The bounds on the lower and upper target saturation for filter links, previously set at 40% and 80% respectively, are also now user configurable.

3.3.4 Split for Faulty Links

In earlier versions SCOOT would run the split for a faulty link at the Default Stage Length (DEFS). The handling of faulty links is improved in three ways.

3.3.4(a) A link with a faulty detector will still move towards the default stage length (DEFS) but is allowed to go higher if the demand on a link sharing the same stage is high.

3.3.4(b) A user configurable flag (INLD) is included so that a link can be inhibited from the optimisation process if it goes faulty. This is important if there are two links controlling a stage but one is relatively unimportant.

3.3.4(c) Use of historic, smoothed profiles collected by the ASTRID.

This facility needs to be turned on in advance by the user. For example, if it is assumed that detector N12345A1 has become faulty and it is required to use historic data from ASTRID, the following commands should be used:

CHAN HDLP N12345A YES

CHAN CHDI N12345A NO

In order to make use of this facility, link profile data in the form of the M45 message needs to be stored in ASTRID for each link as are required. Since the profile data is day of week based, ASTRID should have been running for at least one week with this message active before attempting to use this facility.

The data that is being used by SCOOT can then be seen by turning on the M47 message. The M47 message will only be generated when the link is faulty.

The VALU HIST command (Ref: 8.97) may be used to check the availability of ASTRID historic data and if it is in use. In the Node Fine Tuning Display (Ref: 5.12.1) the link letter will flash if historic data is being used on that link.

To try this facility choose a known good link and follow the instructions given below:

Start the M47 and M12 messages. M12 messages should start appearing immediately. Make a note of the OCC values for one cycle so you know what typical values should be.

Make the link faulty by setting one of the link's detectors to faulty:

CHAN DSTS Nnnnnnan FAULTY.

M47 messages should start appearing more or less immediately. The appearance of the M47 messages indicates that SCOOT has ASTRID feedback data available for the current day and time.

A message should be output which indicates when the use of historic occupancy data started and also when the use of such data finishes.

M12 messages will contain OCC(upancy) values calculated from the ASTRID data. Watch it for a cycle. You should see two sets of OCC values - one from when the upstream link is green, the other for when it is red (plus some intermediate values in the transitions). If the link does not have an upstream link then only one value will be used. These values should broadly correspond with the average of values seen when the link is non-faulty.

If no M47 messages appear, check the HDLP and CHDI values once again. You may also try turning on the M46 messages. These should be output every 15 minutes when the data for a new period is loaded from ASTRID.

If the M47 message is found to contain all -1s this shows that there is no valid data for this link for this period. If the message contains all -1s except for the last value, this shows that the link has no upstream link or that the upstream link data is not valid.

3.4 SCOOT 4.2 Facilities (circa 1999)

3.4.1 Emissions Modelling

Using SCOOT's model of stops, delays and flow, together with actual measurements of link length, new formulae have been added to **estimate** the total emissions of vehicles on each link. The formulae provide data on CO2, CO, NOx, VOC and PM. A standard mix of vehicle types is assumed for each link although this can be modified by the user on a per link basis.

3.4.2 Cycle Time Optimiser Enhancements

(a) It is now possible to specify that a group of nodes shall always have the same cycling status, i.e. shall always single cycle or always double cycle. The optimiser will then decide which is appropriate based on an assessment of the whole group.

(b) ASTRID data is now available to the optimiser. This can be used to influence the decisions based on historic trends, i.e. what can be expected to happen at this time on this type of day. An example would be to try and anticipate the onset of peak periods where SCOOT might otherwise not be able to react quickly enough.

(c) An increase in minimum region cycle time by the user (MINC) can now cause the optimiser to jump to the new value rather than moving through the traditional steps. A flag (CMJI) is provided to enable/disable the facility at the user's discretion.

(d) The minimum practical cycle time (MPCY) will now be evaluated twice during each optimiser period, e.g. every 2.5 minutes whilst the period is 5 minutes. This will enable nodes whose MPCY suddenly becomes inappropriate, e.g. after node transfer, to gain a better value more quickly.

(e) The user can now modify the optimiser period. This is the interval between optimisations, traditionally set to 5 minutes. The range of values allows for shorter periods (to enable faster reaction to change) and longer periods (to provide more stability).

3.4.3 Stop-line Detection

Algorithms have been included to make use of existing stop-line detection. Clearly modelling using detection at the downstream end of the link is less effective than normal, but for less important links where costs of installing additional detection in the traditional position would be high, this offers a practical alternative.

3.4.4 Flared Links

The modelling of links that have additional lane capacity at the downstream end is now more flexible. Parameters are established to allow for the extra lanes in terms of the number and length. Validation of the saturation occupancy for the link is then by the same process as usual.

3.4.5 Recovery from absolute priority

Some new algorithms have been created to allow SCOOT to recover more effectively from special priority pre-emption such as LRT.

3.4.6 Reduced detection modelling

Enhancements to the model now allow SCOOT to model some links without any real detection. This is achieved by deriving a flow profile from upstream links that are instrumented. This facility would typically be used at quiet junctions within the network and would provide a saving of installation and maintenance at a cost of a partial reduction in efficiency in not having real flow information.

3.5 SCOOT 4.5 Facilities (circa 2003)

3.5.1 Supplementary Detection

Note: in this section items of 4 letters in capitals are CHAN parameters, see section 8 for further details.

This facility is designed to allow improved modelling of "difficult" links. In this instance, a difficult link is one where there are significant, irregular sources and/or sinks of traffic such that the on-street queue is often different to that modelled by SCOOT when using a single detection point in the "traditional" position.

The facility requires the provision of additional detection. Each significant source or sink should be detected separately and it is possible to have several per link.

The link is modelled by SCOOT using a Composite link. This has the same attributes of the main link (see below) but has no detection in the SCOOT database.

The SUPT=MAIN link is set up as normal for SCOOT. It has COMP=Composite link.

A SUPT=ADDITIVE link is designed to measure traffic from a source with positive journey time to the stop-line. It has link type Entry and has COMP=Composite link.

A SUPT=SUBTRACTIVE link is designed to measure traffic going to a non-signalised sink It may have either a positive (includes 0) or negative (historic, but entered as positive) journey time to the stop-line. If positive, it has link type Entry, if negative it has link type Exit. It has COMP=Composite link.

A SUPT=FILTER link is designed to measure traffic going to a sink only when the signals are green to the main link. It has a negative journey time (again entered as positive) and is defined with link type Exit. It has COMP=Composite link.

To cater for different traffic speeds/behaviour over the different detectors on a link it is possible for any or all of the supplementary links to have an LPU/vehicle factor calculated and input using the LPUV parameter. To measure an LPU factor see the Operator Handbook, reference 1.3.2, commands SSSU/ASLD.

Once all the above has been configured, validation of the composite link continues in the normal way.

The Supplementary detection facility is also described in more detail in the SCOOT Traffic Handbook, reference 1.3.1, chapter 0491.

3.5.2 Enhanced Bus Priority and Statistics

Enhancements have been made to bus priority. There are now 7 levels of importance (0-6) that a bus may have which will cause SCOOT to give increasingly more aggressive priority dependent on the importance. However, a method of supplying a priority value is required (for example a bus management system). For most existing bus priority implementations the System will assume each bus has an average importance of 3.

Priority is now optimised on a link basis rather than a node as in previous versions.

In addition, a number of extra Event Messages are available to provide summary statistics of bus priority in operation. These are detailed in section 9.7.

Bus priority is described further in section 7.

3.5.3 Enhanced Gating Logic

Enhancements have been made to the gating logic. This is now more flexible and allows a number or gated links to be activated by a number of related trigger links. The degree of gating can be determined by the percentage of active triggers.

Gating can also now be triggered by congestion as well as percentage saturation. There are new limits available to the engineer so that stages which would otherwise be gated to their minimum can now be limited to a higher, more acceptable value.

Gating is described in section 3.2.3 and in the SCOOT Traffic Handbook, reference 1.3.1, chapter 0473.

3.5.4 Offset Optimisation by Emissions

The Offset Optimiser has additional functionality to allow optimisation based on emissions estimations. Research has shown that this provides little benefit over the traditional delay/stops method which are already emissions friendly.

To activate this function use the OOEW parameter with the CHAN command and determine the percentage contribution (0 to 100) that emissions are to make to the optimisation of each node.

3.5.5 Multiple Concurrent Models (Simplified STOC Validation)

This facility is designed to make STOC validation more efficient. When activated, SCOOT will provide the user with a range of queue clear times for STOCs above and below the chosen value. Hence it should be possible to select the correct STOC without having to go through an iterative process.

More details of this facility can be found in section 5.10.

3.5.6 Optimisation of Un-demanded Stages

When a SCOOT stage has a UTC demand dependent component, the user has to select the alternative should there be no demand. This is done in the translation plan. Often there is an obvious alternative, e.g. main road. Sometimes, however, it is less clear which alternative is best, and it may vary from cycle to cycle.

The un-demanded stages facility allows SCOOT to recommend whether it is better to run the previous stage or next stage if a demand does not appear, based on the relative saturations of links that run in those stages.

The facility is enabled by SCOOT stage using the DDFL CHAN parameter. The translation plan is expected to be of the form:

Example 1: {A 0} 1 {B 0, AB 1} 2 {C 0} 3 {D 0} 4

where SCOOT stage 2 = UTC B is demand dependent. The plan could also be written with stage 2 as {B 0, BC 1}.

If SCOOT recommends running the alternative to that in the plan, i.e. C in example 1, the force bits BC will be sent in stage 2 rather than AB. This behaviour can be observed on the DIPM display where the AB will flash to show that a different stage combination is actually being output.

The facility is not available for multi-nodes. It also requires the alternative stages (A and C in the above example) to be non-demand dependent or demand dependent with their own demand bits, i.e. DX not allowed.

3.5.7 Filter Weighting Factor

In previous versions of SCOOT it has been difficult for filter links to compete with normal and entry links in over-saturated conditions. Version 4.5 introduces a new weighting factor to allow users to increase the importance of filter links within the optimisation process.

CHAN parameters FSAT and FMUL are now available. FSAT is the degree of saturation above which the optimiser should apply weighting to the filter. FMUL is the degree to which weighting should be applied.

For details of these parameters see section 8.

3.5.8 Cycle Time Optimiser Enhancement

A further enhancement to cycle time optimisation is present in version 4.5. The CHAN parameter DCIG (double cycle ignore) is available for nodes. When set, this will cause the Cycle Time optimiser to ignore the double cycling node in its evaluation of possible cycle times.

The purpose of this facility is to overcome some practical problems with double cycling. Sometimes SCOOT will hold a region’s cycle time high to allow a node to double cycle, whereas the remaining nodes would comfortably run at a lower cycle time. If for operational reasons the lower cycle time would be more preferable, DCIG can be set for the double cycling node causing the optimiser to ignore its contribution and reduce the cycle time.

3.6 SCOOT MC3 Facilities (circa 2006)

3.6.1 Congestion Supervisor

This feature is an on-line version of an earlier research tool known as MONACO. Its purpose is to provide continual monitoring of the SCOOT network looking for unusual, regularly occurring data which might indicate an inefficiency in performance.

Where such indications are detected, the supervisor uses a decision tree to determine the likely cause of the poor performance. The resultant recommendation is available to the user in a number of event driven messages, see section 9.11. Examples of the possible recommendations from the supervisor are:

Poor validation parameters (particularly STOC)

Poor congestion importance factor

Poor congestion offset

The supervisor is turned on/off with CHAN MINH, see section 8.151. For a full description of MONACO see the SCOOT Traffic Handbook section 0481.

3.6.2 Bus Priority Stage Skipping and Truncation

This feature builds on the bus priority facilities which have been in SCOOT since version 3.1.

Stage skipping removes the requirement for SCOOT to follow its normal stage sequence when giving recall priority to buses. Users configure the data to identify which stages can be skipped and under which conditions.

Stage truncation allows the current stage to be terminated early in order to grant priority to a bus in the next stage. This can only occur providing no stage minimum length violations will result.

Section 7 contains more details on stage skipping. Also see the SCOOT Traffic Handbook section 0471 for operational guidelines.

3.6.3 Variable Intergreeens

Algorithms have been included to provide better modelling of variable intergreens.

SCOOT can now be told to model start of green based on the arrival of a stage confirmation rather than assuming a fixed intergreen as in earlier versions. This improves the accuracy of the model but has some implications for the setting of validation values, notably SLAG.

The facility is disabled by default to provide backwards compatibility. If it is enabled for a node, the start lags need to be calculated as follows:

a) Note the time difference between the start of the phase which causes the stage green reply to be sent to the instation and the start of vehicle movements on the link. If the vehicle phase determines the reply the difference is traditionally considered to be 2 seconds.

b) Subtract the area start lag from a) (usually 2 seconds). Hence the likely start lag for a “standard” link would now be 0 irrespective of the length of intergreen.

3.6.4 Time Stamped Data

This feature has been included in preparation for changes to communications technologies which result in delayed or intermittent exchanges of data between the street and instation.

All data transfers are now expected to be time stamped with the second of generation (for replies) or the second for action (for control).

For reply data, this means that regardless of when it arrives, SCOOT will know which data belongs to which second. For control data, intelligent outstations can interpret data timed for “the near future” (a few seconds ahead) and implement it at the time specified, not when it arrives.

This feature is “invisible” to the user.

3.6.5 One-second Profiles

Similar to time stamped data, this feature is aimed at enhancing performance for new communications.

Profiles have traditionally been held and managed around the SCOOT interval, i.e. on a 4-second basis. This means that data which may be available in the first second of an interval cannot be used by SCOOT until all 4 seconds of the interval have been completed.

If a communications method introduced a small delay in receipt of data, this would further compound the delay in availability to SCOOT. To mitigate this the most recent profile values are now held on a 1-second basis to remove some of the delays attributable to the 4-second interval.

This feature is “invisible” to the user.

3.7 Summary of SCOOT V5.1 changes (MC3 SP1)

- Improvement to pedestrian control within SCOOT

  In previous versions, SCOOT allowed pedestrian stages to be run at the time that caused the least disbenefit to vehicles. The ability to give pedestrians a greater level of priority has been added to this version of SCOOT. This feature was actually trialled in 4.6 and retained in MC3 and MC3 SP1 (5.0 and 5.1).

- Stage confirm arrives late

  The SCOOT kernel has been modified so that when it detects the stage confirm arriving late or not at all, it will disable feedback for the affected stage. When the kernel detects the stage confirm arriving regularly, it will re-enable the feedback for the stage (subject to user allowing feedback).

  New CHAN Parameters:

  Allow Stage Arrive Late Logic: ASAL

  Max Clear Late Stage: MCLL

  New Message:

  M44

- Split optimisation when stages on minimum

  When a stage is on its minimum, the following stage only has split optimisation. With four (or more) stages it is difficult to move green time from stage 3 to stage 1 if stage 4 is on its minimum and there is a large demand for stage 2.

  New CHAN Parameter: Split Minimum Optimisation Inhibit: SMOI

New Messages:

S25, S45-S51

- Bus priority on filter links

  The SCOOT kernel software has been amended so as to allow buses detected on filter links to be given priority. Previously this was not possible. Priority will be given through providing extensions and recalls in a similar way as for ordinary links.

- Bus priority – long journey times

  New CHAN Parameter: Bus Distance Optimisation Limit: BDOL

  Modification to parameter BSEL.

  New Messages:

  B74-B80

- Bus priority – cancel detection

  Developed from the Transport for London IBUS system for bus priority at traffic signals. In particular, the bus priority logic in SCOOT is enhanced to allow for multiple detection points on the approaches to traffic signals, including a cancel detector when the bus passes through the junction. It will also allow bus journey times greater than the previous maximum value of 30 seconds. The aim is to increase the level of priority that buses can be given and improve the efficiency of the control resulting in less disruption to other traffic.

  New CHAN Parameters:

  Bus Link Has Cancel Detection: BLCD

  Bus Link Has Secondary Detection: BLSD

  New modes for parameters BSEL, BERL

  New Messages:

  B81-B83, X61-X77

- Improved exit blocking

  A running average effective saturation occupancy is calculated through each green by factoring the validated value by the current estimate of exit blocking. This effective saturation occupancy will then be used in the model.

  New CHAN Parameter: Allow Improved Exit Blocking: AIEB.

  New Message:

  M92

- Maximum queue clear time on long links

  The SCOOT kernel is modified to calculate the Maximum Queue Clear Time (MQCT) of links.

New Message:

M93

3.8 SCOOT MMX (V6.0) Facilities (circa 2011)

3.8.1 Cycle Time Independence (Node and Region)

The main new facility in SCOOT MMX is node and sub-region cycle time independence. This allows a node or a sub-set of nodes in a region to run at a different (lower) cycle time than the region. Cycle time independence can be enabled or disabled through operator/timetable command or automatically through the use of cycle time independence triggers. In some cases, cycle time independence will make existing uses of the Node Transfer command unnecessary.

Sub-Regions

Sub-regions have been introduced with SCOOT MMX to allow a group of nodes in a region to run independently of the region but run with a common cycle time. Sub-regions have SCNs like normal regions and they can be used in similar ways.

To define a sub-region, use the HTML Data Entry Sub-Region form. The only item that needs to be specified apart from its name is the parent region (which must be a normal region not a sub-region). Though regions and sub-regions share the same SCN space, the following naming convention is suggested; if the normal region is called RAA, then its sub-regions should be called RAA1, RAA2, etc. To select nodes for a particular sub-region, enter the sub-region SCN on the node form in place of normal region SCN. It is important to note that the node is still a member of the parent region and that continues to be the primary relationship - it just also happens to be a member of the sub-region.

Operationally, the sub-region SCN can be used in mostly the same ways as a region SCN can be. For example RAA1N* will refer to the group of nodes in the sub-region.

Not all commands and parameters that are valid for regions are valid for sub-regions. For example, the MINC parameter is available for sub-regions but MAXC is not.

Node Transfer

Nodes can be transferred into and out of sub-regions with the NODT command. To transfer a node that is in a sub-region out of the sub-region specify the SCN of the parent region.

Node Independence

A single node can be selected for cycle time independence. The SCOOT CHAN/RUBA parameter OPNI (Operator Node Independence) selects the cycle time independence mode. This can be set to AUTO, YES, NO, or NEVER. Use AUTO to allow SCOOT to make the decision on when to run the node independent. If set to YES then the node will run independent assuming it will run at a lower cycle time than the region. NO and NEVER both disable cycle time independence. They differ in that when OPNI is set to NO, SCOOT will continue to calculate the values used by the cycle time independence triggers and NEVER stops these calculations. This can improve the performance of the triggers if OPNI is switched between NO and AUTO by time of day. (When reading the SCOOT Traffic Handbook, setting OPNI to NEVER is equivalent to setting the internal 'allow independence' flags to NO.)

When a node is running independently the cycle time will be the minimum practical cycle time (MPCY) of the node.

Node independence is only permitted for nodes that are not in a sub-region.

It is an important point to note - a node or sub-region can only become independent if it will run a cycle time lower than the region - or more precisely the MPCY of the node is lower than the highest MPCY of all the nodes in the region. A typical use of Node Transfer is to move a node that is holding the region at an artificially high cycle time into its own region; trying to replace this use of Node Transfer by setting the OPNI to YES for the critical node will not work. Instead, the other nodes in region would need to be in a sub-region, and cycle time independence enabled for the sub-region.

Sub-Region Independence

A sub-region can be selected for cycle time independence. The SCOOT CHAN/RUBA parameter OPSI (Operator Sub-Region Independence) selects the cycle time independence mode. It takes the same values as OPNI (see above).

A sub-region's independent cycle time is calculated in a similar way to the region cycle time - it is the highest MPCY of all the nodes in the sub-region.

Cycle Time Independence Triggers

When OPNI/OPSI are set to AUTO, SCOOT switches between non-independence and independence by working out the delay ratio - the ratio of the predicted delays when the node/sub-region is running at the region cycle time and at the independent cycle time. When the delay ratio > 1.0 then this indicates that independence will yield less delays; when the delay ratio < 1.0 then this indicates that non-independence is the better choice.

SCOOT has two mechanisms for calculating the delay ratio - complex and simple. The simple method only appears to be of benefit in being less CPU intensive than the complex method but at the cost of less accuracy. For PC SCOOT, no CPU loading issues have been seen with using the complex method so its use is recommended and it is the default.

The delay ratio can be seen on the C52/C53 messages. The independence and non-independent threshold parameters (INTH, NITH) specify the thresholds above which or below which the node/sub-region independence status is changed. The recommended values and defaults are 115% (or 1.15) and 95% (or 0.95); i.e. when the delay ratio is > 1.15 then node/sub-region independence will be enabled. When the delay ratio drops below 0.95 then cycle time independence is stopped.

The calculation of predicted delays is described in some detail in the SCOOT Traffic Handbook but a simplistic description follows. The benefit of running a node at the region cycle is that timings are coordinated and better overall flow (less delay) is achieved. When node cycle time independence is enabled this benefit is lost. It is necessary to quantify this benefit. When the node is running at the region cycle time it knows the delays for non-independence (it is the current delay) and it is possible to predict the delays that would result in running independently (by averaging all the delays calculated at all possible offsets) but the converse is not so easy. When the node is running independently, there is no intrinsic way to determine the benefit of coordination. SCOOT handles this by calculating a ratio called the factor or FAC whilst the node is running at the region cycle time which records this benefit as last seen. This is used subsequently when the node is running independently to predict the delays for non-independence. For sub-regions, a similar process occurs but because sub-regions have internal coordination then it is necessary to have two factors - one for independence and non-independence.

There are a number of SCOOT parameters that control the behaviour of the cycle independence triggers but the good news is that all these values can be left at their defaults.

Parameter	Description
CATR	Calculation Trigger Method
CRTH	Cycle Time Ratio Threshold
DRSM	Delay Ratio Smoothing Factor
FASM	Factor Smoothing Factor
INTH	Independence threshold
NITH	Non-independence threshold
ROTR	Root Trigger Method
SIDF	Simple Delay Factor

Monitoring

There are many new cycle time optimiser messages that have been added for cycle time independence. The most useful are:

C42/C43 Node / Sub-Region independence status has changed

C52/C53 Node / Sub-Region smoothed Delay Ratio updated

To see the FAC values use:

C65/C67/C68 Node / Sub-Region smoothed non-independence / independence factors updated

The cycle time independence status for sub-regions is shown on the RFTD screen. Additionally, the independence state is shown for nodes with an ‘I’ appearing alongside the node. The node independence status is also shown on the NFTD screen.

3.8.2 Ghost Staging - Reduced cycle time at quiet times using a Ghosted Stage

On some sites, SCOOT might be running at a higher cycle time than is wanted because the minimum cycle time has to allow for all stages that may potentially run, even though some of these SCOOT stages might be for pedestrian stages or side roads that rarely run - particularly during quiet periods.

SCOOT MMX allows the user to nominate SCOOT stages as ghosted stages. When a SCOOT stage is ghosted, SCOOT doesn't allocate time for the stage in the plan and in the calculation of the minimum node cycle time. This has a corresponding effect on the calculation of the minimum region cycle time. It is important to note that a ghosted stage is not removed from the SCOOT plan - i.e. the stage is still given the opportunity to run. SCOOT does this by truncating the ghosted SCOOT stage length to 2 seconds (P) - which is the typical demand window period.

SCOOT enables or disables ghosting of a stage by watching how often the corresponding UTC stage is run. It makes its decision by looking at the last 15 (P) cycles. If the UTC stage didn't run at all (P) in the last 15 cycles, SCOOT enables ghosting of the stage at the start of the next cycle. At that point the stage length is set to 2 seconds. Once the stage is actively ghosted, SCOOT *internally* models the node as having the lower minimum cycle time. *Internally* SCOOT also models a lower minimum region cycle if that is appropriate. SCOOT disables ghosting once it sees the ghosted stage appearing 4 (P) times in the last 15 (P) cycles.

The following SCOOT CHAN/RUBA parameters apply to change the above default values marked with (P)

GSTG	Stage Level	Yes/No	No	Allow SCOOT to ghost the specified SCOOT stage
GFSL	Area Level	2-4	2	Ghost Fixed Stage Length
NGAC	Node Level	10-15	15	Number of Ghost Assessment Cycles
LTGC	Node Level	0-2	0	Lower Trigger Ghost Stage (if ghost stage appears this many times or less, then ghosting can be enabled).
UTGC	Node Level	4-10	4	Upper Trigger Ghost Stage (if ghost stage appears this many times or more, then ghosting will be disabled).

In most cases, setting GSTG for the particular stage to YES is all that is required. The default values for the other parameters are suitable in most scenarios.

In practise, this is what happens.

Given the following SCOOT translation plan line:

```
{A 0} 1, {B 0 AB 2}2, {C 0}3
```

where stage 2 is declared as a potential ghost stage - SCOOT will force a sequence like the following whilst stage 2 is ghosted.

```
00:00 A
…
00:19 A
00:20 B
00:22 C
```

Assuming that stage B doesn't run, SCOOT runs normally. However, what happens if the UTC stage does run?

As soon as SCOOT sees the ghosted stage running, it freezes the SCOOT 'time now' node plan counter and continues to freeze it for the ghosted minimum stage length. It has to do this as the SCOOT plan does not accommodate time for the ghosted stage to run. Freezing time now has the effect of changing the SCOOT offset. This can be seen on DIPM or a node split pie chart. When the ghost stage is run, the plan offsets will increment 1 each second whilst SCOOT freezes 'time now'. The offset change is unwanted but a natural consequence of how the feature works. However, ghosting is to improve performance at quiet times when good offsets are not so important and assuming that the stage doesn't run regularly, then the negative impact will be minimized.

Plan Compliance: When stage B runs, it will prevent stage C running when it is forced 2 seconds later. Without intervention a plan compliance fault would occur. Plan compliance faults are therefore automatically inhibited for the period that the ghosted stage can appear for. There is no necessity for enabling plan compliance faults longer as by freezing the plan, SCOOT allows the system to 'catch up' with the controller.

Demand Dependent Stages: If the ghosted stage is followed by another demand dependent stage, then it can be seen that there could be problems when the ghosted stage runs.

```
{A 0} 1, {B 0 AB 2} 2, {C 0 AC 2} 3
```

would give the following control sequence assuming stage 2 is ghosted

```
00:00 A
…
00:19 A
00:20 B
00:22 C
00:24 AC
```

If stage B runs then the demand window for stage C will be missed and the controller may go to A instead. Therefore, where the ghost stage appears and time now is frozen, the UTC plan interpreter will reset the plan control bits for the current SCOOT stage to the first event for that stage and hold them until time now resumes. In the example, this will result in something like the following, assuming time now is frozen for 14 seconds.

```
00:24 AC
00:26 C      (Stage B confirm seen – start freezing time_now).
00:40 C      (Stop freezing time_now)
00:42 AC
```

TRL specify that a non-forced demand dependent stage should not follow a ghosted stage. However, with the above mechanism in place, no such restriction applies to the Siemens implementation.

Restrictions

A ghosted stage should not follow another ghosted stage. Adjacent stages may be nominated for ghosting, but as soon as one of those stages starts ghosting then it effectively disables ghosting for adjacent stages.

The ghosted stage logic should not be used with the pedestrian invitation to cross feature (PINV); the SCOOT stage cannot be the named stage; the ghosted UTC stage should only appear once in the SCOOT translation plan.

The intergreen from the ghosted UTC stage to any of the following UTC stages must be less than the minimum stage length of the SCOOT stage following the ghosted stage.

Multi-Nodes

Ghost stages should be used with multi-controller SCOOT with caution. In particular, a ghosted stage should be one that is demand dependent in only one of the controllers.

SCOOT Messages.

The ghost messages are G20-G26. The most useful being message to be G20 which outputs a bit mask specifying the stage confirm history. E.g.

```
Fr 10:26:50 G20  N01131/1   StgConfHist 1111111111111110  PotGhostStg 0 GhostStg 0
Fr 10:27:10 G20  N01131/2   StgConfHist 0000000000000000  PotGhostStg 1 GhostStg 1
Fr 10:27:12 G20  N01131/3   StgConfHist 0000000000000010  PotGhostStg 1 GhostStg 0
Fr 10:27:32 G20  N01131/4   StgConfHist 1111111111111110  PotGhostStg 0 GhostStg 0
```

StgConfHist (Stage Confirm History) indicates for the last 15 cycles whether the UTC stage associated with the SCOOT stage ran or not. The Left most bit represents the oldest cycle. The right most bit is always zero so ignore it. PotGhostStg (Potential Ghost Stage) can be set whether ghosting is enabled for that stage or not. GhostStg is set, once ghosting is actively enabled for a particular stage.

Trouble-Shooting

G20 StgConfHist shows that the stage has not been seen for 15 cycles and GSTG is set to YES but stage ghosting doesn’t start.

There are several reasons for this. The system performs various checks to see whether ghosting should be allowed. If any of the checks fails then SCOOT will not allow ghosting.

- The UTC stage that services the ghosted stage must not service any other SCOOT stage.
- An adjacent stage is currently being ghosted (two consecutive stages cannot be ghosted simultaneously).
- Variable invitation-to-cross (PINV) is enabled on the stage. This facility cannot be used with stage ghosting at the same time.

- Plan compliance faults occur when ghosting is enabled and the ghosted stage makes an appearance.
- Check that your minimum stage lengths are appropriate for the SCOOT translation plan.
- If the intergreen from the ghosted stage to any of the subsequent UTC stages is longer than the SCOOT stage length of the following stage then this could cause plan compliance faults because SCOOT won't see the stage confirm for the ghosted stage until 2 SCOOT stages later and therefore ignores it. The solution in this case is to increase the minimum stage length of the stage following the ghosted stage to ensure this can't happen or to not use stage ghosting.

3.8.3 Zero Demand Queue

This new feature in SCOOT MMX clears the queue associated with demand dependent stages if the stage did not run when it was called - the idea being that if the stage didn't run then there can't be any demand and therefore no queue.

It's a simple feature which can be either switched on or off with the ADZQ area level SCOOT parameter. The default is for it to be enabled.

The SCOOT message M94 can be used to indicate when a queue has been cleared.

3.8.4 M18 message enhancement

In SCOOT MMX, the M18 message has been modified to provide a more useful and consistent measure of the link offset. This is particularly useful for storing and graphing in ASTRID. The changes only apply to SCOOT MMX so ASTRID is not updated automatically to record link offset.

To manually set up ASTRID to collect this data, go into ASTRID and click *Options*. On the Options windows click the Messages button.

On the Messages form that appears enter the following information into the right hand columns.

Data Name	offset
Message Number	M18
Data Parameter	5
Fault Parameter	0
Fault Test	None
Period Parameter	0
Maximum valid period	300
Accumulation method	AVE
Collect for this site levels	L

Multiplier	1
Divisor	1
Smoothing Factor	20
Rejection data name	
Rejection sample size	
Rejection std deviation	
Rejection smoothing factor	

Click Add, followed by OK.

On the Options window click the Graphs button.

On the Graphs window enter the following in the right hand columns.

Data Name	offset
Full Data Name	Offset
Factor to multiply data to convert to data units	1
Y scale for one or more site levels	120
Data units	seconds
Use LPU Factor	No

Click Add, followed by OK.

That should be ASTRID setup now. The only additional thing you need to do is to send M18 to ASTRID. In the CAST in which all the other MESS >ASTRID commands are stored, add the following command.

```
MESS M18 N** >ASTRID
```

Use the ACAS command and run the CAST immediately to start the data collection.

3.8.5 Variable Pedestrian Invitation to Cross (Please see disclaimer)

Disclaimer

This facility is included as part of the MMX upgrade, however Siemens believe that this facility has only minor benefits for the majority or our Users.

This new SCOOT facility is intended to give priority to pedestrians, primarily at intersections with a pedestrian only stage.

In response to increased pedestrian demand, this facility will increase the pedestrian variable invitation to cross time - namely the SCOOT stage length for the stage designated as the ped stage. To take advantage of this benefit the controller must be configured to support variable pedestrian invitation to cross - i.e. keep the green man on whilst the F bit for the ped stage is present. (This is not always the case. Often the ped stage is configured as a fixed length stage with perhaps a variable clearance time). For controllers configured as a Pedestrian Controller rather than a Junction, this is not an option.

When applying an extension, SCOOT ensures the extension won't result in a higher minimum practical cycle time. This is useful because, in contrast to vehicle traffic, increased cycle times penalise pedestrians. This is achieved by specifying an upper target saturation against which any potential extension is tested.

To use this facility, a SCOOT link representing the ped stage should be created. The link should be defined as an entry link with no detectors. The link UTC stage green can specify the pedestrian stage, though this isn't essential. The SCOOT ped stage should be defined as a fixed length stage (i.e. the minimum and maximum length should be set to the default pedestrian stage length). The following CHAN/RUBA parameters should be set.

APVI	Allow Pedestrian Variable Invitation	Set to YES for the node.
PVIL	Pedestrian Variable Invitation Link	Set to YES for the pedestrian link.
PVIS	Pedestrian Variable Invitation Stage	Set to YES for the SCOOT stage that controls the pedestrian stage.

Pedestrian Priority

The pedestrian priority is a number 0-4 where 4 specifies the highest pedestrian demand / priority and 0 indicates none. The pedestrian priority can be specified manually with the PVLP parameter but would be more normally calculated automatically. The method SCOOT uses for calculating pedestrian demand is to measure the time from the when the pedestrian stage finishes to when the pedestrian push button is pressed again (ped call time). A smoothed average of this time is recorded. Shorter values indicate higher pedestrian demand. There are three CHAN/RUBA values that are used to convert this time into a priority.

PVUD	Upper Demand time. This is the threshold for highest priority. If the ped call time < this value, then the pedestrian priority is 4. Default is 5s
PVLD	Lower Demand time. This is the threshold for the lowest priority. If the ped call time >= this value, then the pedestrian priority is 0. Default is 30s
PVSM	Smoothing factor applied to the ped call time. The default and recommended value is 90%.

Note, PVUD should be lower than PVLD (because lower ped call times indicate higher demand). The thresholds for the remaining priorities are proportionally spaced between the upper and lower thresholds.

The pedestrian priority is then used to extend the ped stage using the following CHAN/RUBA parameter:

PVUE	Upper Extension. This specifies the maximum extension available for the pedestrian SCOOT stage when the priority is 4. The extensions for the remaining priorities are worked out proportionally. E.g. if PVUE is 8 seconds then when the priority is 2 the extension will be 4 seconds. The extension actually applied may vary subject to cycle time and saturation constraints. The default is 8 seconds.

The way that SCOOT applies the extension is somewhat strange. As described above, the minimum and maximum length for the ped stage should have been set to the default ped stage length. When SCOOT applies the extension it does this by internally increasing the minimum and maximum stage length by the required amount and thereby forcing the ped SCOOT stage to become the same length.

The pedestrian priority is used to increase the ideal saturation for the node using the following SCOOT parameter.

PVUS	Upper Saturation. This specifies the target saturation to use for the node when the priority is 4. The extensions for the remaining priorities are worked out proportionally as the difference between the normal target saturation and PVUS. E.g. if ISAT (or TSAT) is 80% and PVUS is 120%, then when the priority is 2, the target saturation will be 100%. The calculated target saturation will never be less than the normal target saturation so 0 can be specified if no change is required. The default is 110%.

Messages

There are three messages available.

P25	Displays a number of things, ped button status, ped button call time, smoothed call time, and the current ped priority.
P26	Displays the actual extension being given, the target saturation being used.

P27	displays the trial MPCY

3.8.6 Changes to CHAN TPLN/MINS/MAXS/DEFS and Node Transfer

A number of changes have been necessary to CHAN TPLN/MINS/MAXS/DEFS and NODT as a result of implementing SCOOT MMX. However, these changes apply to all versions of SCOOT not just MMX.

CHAN TPLN: Previously, when a translation plan was selected that removed a SCOOT stage, the minimum node cycle time was not reduced. The reason for this was to ensure that the node was always running a cycle time that would allow the removed stage to be restored. With SCOOT MMX, when ghosting is enabled, SCOOT can calculate its own minimum cycle time which means that CHAN TPLN can no longer rely on the region cycle time being high enough when the removed stage is restored. Consequently, CHAN TPLN has been modified so that when a stage is removed the node minimum cycle time is reduced accordingly. When restoring the SCOOT stage, if the region cycle time is too low for the node (having restored its original minimum cycle time), then the node cycle time is changed to the closest value supported and the SCOOT cycle time optimiser for the region is forced to run. The cycle time optimiser will calculate a new region cycle time that supports the new node minimum (which it will normally perform within a second).

NODT: A similar improvement has been added for NODT. Previously if a node was transferred to a region that was running a running a cycle time too low for the node, the NODT request would be rejected. With the new release, the NODT will proceed and the cycle time optimiser forced to run to calculate a new cycle time for the region.

CHAN MINS: If a CHAN MINS command would raise a node's minimum cycle time above the current region cycle time then the same process is used to update the region cycle time.

A further change to CHAN MINS/MAXS is this. Previously, CHAN MINS/MAXS would not change the current stage timings if the current stage timings were outside the newly specified range. In this release, the stage timings will be updated immediately.

CHAN DEFS: Previously, default stage lengths were checked to be in range of the minimum/maximum stage lengths. These checks have been removed as they are no longer considered appropriate.

- When SCOOT uses the default stage lengths, it will always put them in range of the current minimum/maximum settings when scaling to the required cycle time.
- For some nodes that do not support a cycle time of 120, it is impossible to have default stage lengths that add up to 120 but are also in range.
- Loss of accuracy can otherwise occur when scaling the default stage lengths to target cycle times especially if CHAN MINS/MAXS is routinely used.

The best way to think of the default stage lengths is as being like percentage stage splits - except rather than being based on 100% they are based on 120. In this way, it can be seen that the absolute value is not important; it's the proportion that is.

3.8.7 Change to Checking of Maximum Stage Lengths

An error was found in the code in Data Preparation that checks the sum of the maximum SCOOT stage lengths are at least as high as the maximum node cycle time. The error was that the check incorrectly included the 4 seconds (the default offset authority) that is subtracted from maximum length of the named stage. For example, a node with two stages that has maximums of 80 and 40 seconds, and a maximum node cycle time of 120 should be rejected, because after 4 seconds is subtracted from the named stage, the sums would be 116. It is not anticipated that this will affect many customers but to ensure minimal disruption, the checking code will only output a warning for this specific scenario and will adjust the maximum length of the named stage accordingly.

Note, this only applies to the checking of maximum stage lengths entered on the SCOOT stage form - not CHAN MAXS.

3.8.8 SCOOT Maintenance release 5.1-19 31st May 2011

This release contains a fix for SSR/11/05. The fix affects all versions of SCOOT. The fault could have resulted in some rare scenarios in stage lengths violating their minimums.

3.8.9 SCOOT Maintenance release 5.1-20 30th June 2011

This release contains a fix for SSR/11/04 that has the following description. The fault applies to SCOOT MC3 SP1.

“Scheduling of SCOOT Kernel modules when using UG405 MIB.

When using the default in the UG405 MIB to return 4 seconds of detector data in one SNMP message, the scheduling of SCOOT Kernel modules is incorrect. The store occ and profile update modules no longer run in the same second and also fail to synchronise with queue update."

This fault would have resulted in poor modelling of junctions connected to UTMC type 2 Outstations when using a communications profile that has SCOOT detector batching enabled such as the wireless profile

3.9 Summary of SCOOT V6.1 changes (MMX SP1)

- Journey Time Reliability (JTR)

  For many authorities, Journey Time Reliability (JTR) is a key performance outcome along key corridors. There are many contributing components to JTR including planned interventions (such as roadworks and events) and unplanned occurrences (such as accidents).

  Cause and effect are not fully understood, but studies have shown that the saturation of SCOOT corridor links and the self-healing ability of these links are major contributing factors to JTR, so saturation levels (demand/capacity ratios) of corridor links are of significant.

To assist engineers in maintaining JTR, a facility has been developed to help them control the SCOOT link saturation level more effectively. It will be possible to specify a maximum level of saturation for a link or series of links (e.g. 80%) and SCOOT will attempt to maintain the degree of saturation at or below the specified level. This should provide a more outcome-based version of SCOOT.

The facility was originally developed for Transport for London (TfL), where it is called JTR – GOLD (Journey Time Reliability – Games Operation Led Development), to assist them in controlling the journey along key corridors in London. Its first intended application was within the Olympic route network.

The facility is only applicable to ‘normal’ or ‘entry’ links’.

New CHAN Parameters:

ALMS - Allow Area Link Maximum Saturation

LMSM - Link Maximum Saturation Multiplier

LMSO - Link Maximum Saturation Override

LMSS - Link Maximum Saturation Stay

LMSV - Link Maximum Saturation Value

NLMS - Allow Node Link Maximum Saturation

RLMS - Allow Region Link Maximum Saturation

Modified messages:

S26, S35 and M20

New Messages:

J25, J26, C26, C27, S52, S53, S54

3.9.1 SCOOT Maintenance Release 5.1-21, 6.0-7 29th November 2011

This release contains a SCOOT maintenance release from TRL - versions 5.1-21 (MC3) and 6.0-7 (MMX). These versions of SCOOT contain fixes to the output of M29 and other messages when using UG405 outstations with SCOOT batching enabled.

3.9.2 SCOOT Maintenance Release 5.1-22, 6.0-8 19th December 2011

This release contains a SCOOT maintenance release from TRL - version 5.1-22 (MC3) and 6.0-8 (MMX). This release contains a fix for the following fault.

A link with a negative start lag receives significantly less green time than a very similar link with a lag of 0, causing problems on street. The scenario is that there is a negative start lag, which requires the model to be suspended so that the lag can be timed correctly. The problem arises when the model has also been suspended for some other reason, e.g. a demand-dependent stage. At the end of intergreen the model comes out of suspension, but is then immediately suspended again to handle the negative start lag. This is not correct and gives rise to the problem. The model should not be suspended again and the negative start lag can be handled immediately.

3.9.3 SCOOT Maintenance release 6.0-9 - 28th May 2012

This release includes a new version of SCOOT MMX containing a fix for the following fault.

"The values shown for queue clear time in M77 message may be different from those shown in the M11 message."

This would most likely affect users using Link Validation when they have the feature enabled that allows multiple values of sat occ to modelled simultaneously (control-E). This fault only affects SCOOT MMX and not earlier versions

3.9.4 SCOOT Maintenance release V5.1-23 and V6.1-5

The release of PC SCOOT includes a fix for SSR/11/19 that has the following description:

"Following on from SCOOT software report SSR/11/17, “M19 fault with UG405 communications”. Messages M02, M03 and M04 and several emissions messages may also be affected. The problem arises because the region timer reg_timer counts time regularly but, with UG405 communications, the detector data and green replies used in calculations do not arrive regularly. So the accumulation of data is not synchronised with the calculation and message output."

Essentially, this fixes some issues that users may have seen with the above SCOOT messages for sites on UTMC type 2 OTUs, especially if SCOOT detector batching was in use.

3.9.5 SCOOT Maintenance release V5.1-24 and V6.1-6

This release of PC SCOOT includes a fix from TRL for SSR/11/18. This has the following description:

"Split Minimum Optimisation Fault: At a junction in Slough, using SCOOT version 5.1-18, stage 1 can be forced for a very long time causing the controller to drop-off control."

This fault had previously been reported in the release notes for V32.3 (see 2.4.4 Stages on Minimum Split Optimisation) with a workaround which was to change the default value for SMOI (Split Minimum Optimisation Inhibit) from NO to YES. We have decided to retain this default but users should feel free to set SMOI to NO if required.

3.9.6 SCOOT Maintenance release 5.1-25 and 6.1.7 January 2015

This PC SCOOT release contains SCOOT maintenance releases V5.1-25 (MC3) and V6.1-7 (MMX).

These SCOOT versions contain a fix for when improved exit blocking is enabled which can cause SCOOT to model links as having half the queue capacity when half-exit blocking has been detected.

Improved Exit Blocking is enabled with the AIEB CHAN/RUBA parameter.

3.9.7 SCOOT Maintenance release 6.1.8 February 2015

This release contains SCOOT maintenance release 6.1-8 (MMX) from TRL. This release contains a fix for SSR/15/1 which has the following description.

Cycle time independence large delays

This fault was identified by Transport for London, who observed occasional large delay values in cycle time independence messages.

Example of messages recorded in London:

```
16:15:23.01 C48 N09/066m Coord 0 Delay 34.093 Mmod 1.320 Ave
flow 1.295 Gn 26 Calc indep 0

16:15:23.01 C48 N09/066m Coord 0 Delay 42.377 Mmod 1.320 Ave
flow 1.295 Gn 8 Calc indep 1

16:15:23.01 C48 N09/219d Coord 1 Delay 3997797703483392.000
Mmod 1.225 Ave flow 1.364 Gn 10 Calc indep 0

16:15:23.01 C48 N09/219d Coord 0 Delay 4503599627370496.000
Mmod 1.225 Ave flow 1.364 Gn 10 Calc indep 1

16:15:23.01 C48 N09/219x Coord 1 Delay 48.515 Mmod 1.045 Ave
flow 1.500 Gn 10 Calc indep 0

16:15:23.01 C48 N09/219x Coord 0 Delay 53.145 Mmod 1.045 Ave
flow 1.500 Gn 10 Calc indep 1
```

3.9.8 SCOOT Maintenance Release 5.1-27, 6.1-10 - July 2015

This release of PC SCOOT contains a fix for SSR/15/3 which has the following description:

Incorrect Simplified Validation

Switching on simplified validation messages M75 to M79 can cause differences in queue modelling.

Without M77 switched on

```
00:13:10 M13 1111A Time 51 Occ 9 Lq 344 Bq 360 Eb 0 Light 1

00:13:11 M13 1111A Time 52 Occ 7 Lq 340 Bq 360 Eb 0 Light 1

00:13:12 M13 1111A Time 53 Occ 8 Lq 336 Bq 360 Eb 0 Light 1

00:13:13 M13 1111A Time 54 Occ 8 Lq 332 Bq 360 Eb 0 Light 1

00:13:14 M13 1111A Time 55 Occ 7 Lq 328 Bq 360 Eb 0 Light 1

00:13:15 M13 1111A Time 56 Occ 7 Lq 324 Bq 360 Eb 0 Light 1
```

With M77 switched on

```
00:13:10 M13 1111A Time 51 Occ 9 Lq 344 Bq 360 Eb 0 Light 1
00:13:11 M13 1111A Time 52 Occ 7 Lq 340 Bq 360 Eb 0 Light 1
00:13:12 M13 1111A Time 53 Occ 8 Lq 336 Bq 360 Eb 0 Light 1
00:13:13 M13 1111A Time 54 Occ 8 Lq 327 Bq 360 Eb 0 Light 1
00:13:14 M13 1111A Time 55 Occ 7 Lq 318 Bq 360 Eb 0 Light 1
00:13:15 M13 1111A Time 56 Occ 7 Lq 309 Bq 360 Eb 0 Light 1
```

3.9.9 SCOOT Maintenance Release 5.1-26, 6.1-9 - March 2015

This release contains SCOOT maintenance releases 5.1-26 (MC3) and 6.1-9 (MMX). This contains fixes for SSR/15/02 which has the following description:

The modelling of link colour does not always handle errors robustly. Errors can occur when the UTC stage confirmation (green reply) from street does not match the UTC stage choice.

This results in the link colour being modelled incorrectly. The link colour might be corrected at the next stage change or it might remain incorrect for a long period. If a bus is detected at a critical time, it could result in a long stage.

3.10 Summary

The advantages of SCOOT being used in difficult traffic situations include the following:

(a) The traffic model at the root of the SCOOT technique reflects from moment to moment the actual traffic behaviour in the street. This means that there are fewer assumptions about the traffic flow in the network. The effect of signal settings can be predicted accurately whatever the traffic pattern. Consider again the profile A in fig 5 the position of the green time in the cycle is clearly important. However the Profile B would show (under analysis by the offset optimiser) no preference for a particular offset. These traffic patterns could be made by the traffic on the same link at different times of day. The optimiser does not need any data other than the traffic data from the detector to decide whether the link needs an offset or not. The operator does not normally have to make any decisions. The engineer does not have to estimate the time of day when the link will have high dispersion. This is just one example of how SCOOT accommodates a traffic flow change.

The changes that occur due to sports events, road works or accidents will be reflected in the SCOOT traffic model and taken into account by the optimisers. User's experience, gained with a large number of systems, confirm that SCOOT is extremely effective in coping with such events.

(b) Because the SCOOT traffic model is separate from the optimisers the engineer who is installing the system has a clear objective. SCOOT loop design and positioning has the one aim of producing a real time model of the traffic crossing each stop-line. However different the traffic situation is in one city from another the requirement to be met is that the traffic model reflects the traffic demand on each link.

(c) SCOOT takes growth and change in traffic patterns into account. Towns with volatile traffic choose SCOOT for two principal reasons. Firstly, any growth will make fixed timings for the critical junctions inadequate in a short time. Secondly, the solution to traffic problems often involves traffic management solutions that cause the traffic patterns to change. This changes the flow balance on both the 'new' and 'old' routes. SCOOT will produce the best possible solution by taking such changes in demand automatically into account as they occur and by using the capacity that exists in the junction design (and controller configuration).

4. DATA PREPARATION PARAMETERS

4.1 Introduction

This section covers the various important parameters that are used to set up the basic SCOOT network using the UTC data preparation facility (DBAS). For some of these the values can be displayed or changed on-line using the VALU or CHAN commands (mnemonic inside round brackets). Values which are critical to validation or fine tuning or which are used to enable specific SCOOT facilities have more information in later sections.

4.2 Area Data

4.2.1 AREA END LAG (AELG)

The average time between the green signal terminating (start of amber) until the last vehicle crosses the stop-line. The standard default for this value is 3 seconds.

4.2.2 AREA START LAG (ASLG)

The normal start-up delay for traffic. The time from the signals changing to green to when traffic has started to move across the stop-line. The standard default for this value is 2 seconds.

4.3 Region Data

4.3.1 INITIAL REGION CYCLE TIME (IRCT)

The cycle time at which a region will start when SCOOT is first implemented. If SCOOT is in operation on a region 24 hours per day then the only time that this value is used is at a restart of the computer. The value must be within the SCOOT cycle time range: 32 to 64 in 4 second steps 64 to 120 in 8 second steps, 120 to 240 in 16 second steps. The timetable should contain changes to the IRCT for the AM Peak Off/Peak and PM Peak to match the cycle time that is normally run at these times. This can only be achieved after SCOOT has been commissioned and snapshots of timings carried out for different times. Then should the system have to be restarted the start-up cycle time will be suitable for the prevailing conditions.

4.4 Node Data

4.4.1 MAXIMUM CYCLE TIME

This is the value of cycle time above which the node shall not be allowed to run.

4.4.2 CYCLIC FIXED TIME (CYFX))))

This is otherwise known as "lost time" to those familiar with Webster calculations. It can be defined as the effective red time at an intersection when no traffic is flowing. It will normally be made up of the sum of each intergreen -n (where n is the number of intergreens) + any time for all red stages such as pedestrian movements.

The value can be left as 0 in the database and the SCOOT model will calculate the value automatically. However the value is not variable if, for example, a demand dependant stage is not called.

4.4.3 INITIAL CYCLING STATUS

This value determines whether the node shall start up at half the region cycle time (double cycling) or at the region cycle time (single cycling).

4.4.4 FORCED CYCLING STATUS (FORC)

This affects the action of the cycle time optimiser for each node. A node may be allowed to:

(a) determine its own cycle time, either equal to or half of the region cycle time. This is unforced and is referred to as RELEASE.

(b) always run single cycle at the region cycle time, referred to as SINGLE in the database.

(c) always run double cycle when the region cycle time allows, that is half the region cycle time, referred to as DOUBLE in the database.

A node may not double cycle if the region cycle time is less than twice the minimum allowed cycle time of the node. If the saturation of the node is low, then when the region cycle time reaches twice the minimum cycle time the node will automatically start double cycling. Pelicans are often set to FORCE DOUBLE cycle to avoid delays to pedestrians.

4.4.5 NAMED STAGE (NSTG)

This is the stage during which the offset optimiser runs. It is normally the main or longest stage at a node, not necessarily the stage which traffic progresses through from one junction to another. SCOOT will automatically add 4 seconds to the minimum stage length of the named stage to allow the offset optimiser to make an advance decision. On no account should a fixed length stage be chosen.

4.4.6 REMOVABLE STAGE(S)

A SCOOT stage may be removed by time of day. A change of translation plan (TPLN) together with the values in data preparation will determine whether or not a removable stage is used. An example of omitting a stage could be a right turn overlap in the off peak. The removed stage may not be the named stage.

Two removable SCOOT stages per node are allowed These stages may be removed singly or together. Neither may be the SCOOT "named" stage.

4.4.7 EQUIPMENT TYPE/EQUIPMENT SCN

The SCN of equipment to be associated with this node. A valid junction or pelican is required.

4.5 Stage Data

A SCOOT stage is one in which link greens start or stop. A SCOOT stage may consist of one or more UTC stages. The allocation of UTC stages to SCOOT stages is carried out by the SCOOT translation plan in use at the time. The plan line may look like:

{A 0}1, {B 0 BC 2}2, {C 0} 3

This example shows SCOOT stage 1 allocated to UTC A, SCOOT stage 2 allocated to UTC B or C subject to on-street demand and SCOOT stage 3 allocated to UTC C.

{A 0}1, {B 0 C 10}2

This example shows SCOOT stage 1 allocated to UTC A and SCOOT stage 2 allocated to UTC stages B and C. UTC B would be of fixed duration (10 seconds) and therefore not extendible under SCOOT control. An example would be a pedestrian stage.

4.5.1 MAXIMUM STAGE LENGTH (MAXS)

The maximum value to which SCOOT will allow a stage to increase. The value used will normally be equal to the maximum node cycle time. If the stage is of fixed length such as a pedestrian stage then the maximum will be the same as the minimum. Traffic engineering judgement may well decide that it is not desirable to increase a stage length beyond a certain value, say 30 seconds, in which case the maximum should be set to this value.

4.5.2 MINIMUM STAGE LENGTH (MINS)

This is the minimum value that SCOOT will run for that stage. It is normally made up of the preceding intergreen plus the minimum UTC stage length. If the SCOOT stage covers a number of UTC stages as in a multi-node (see 6.5) then the value will be the sum of all preceding intergreens plus each UTC stage minimum green. If the stage has been allocated as the NAMED STAGE then 4 seconds will automatically be allocated onto the value that is entered to allow for offset optimisation. The sum of minimum stage lengths must add up to at least 28 seconds, as the lowest SCOOT cycle time is 32 seconds.

4.5.3 STAGE CHANGE TIME

The point during the cycle when the stage is to start. This value is only used on UTC system start-up if no default stage lengths have been defined.

4.6 Link Data

4.6.1 LINK LETTER

The letter used to identify a SCOOT link. All upstream and downstream links at a node must use a different suffix. One system is to use A, B, C, D at the first junction then E, F, G, H at the adjacent junction and then A, B, C, D at the next junction and so on. For ease of memory, a system such as A for the North arm, B the East arm etc is recommended. It is good practise to give filter links and congestion links a suffix outside of the normal sets (e.g. PQRS) to remind the engineer that these are links of a different type.

4.6.2 TYPE

The type defines the nature of the link, i.e. whether it is an entry, exit, normal, filter etc.

4.6.3 CLASS (CLAS)

The class defines whether the link is for vehicles or bicycles.

4.6.4 STOP-LINE [4.2 or later]

This defines whether the link has detection in traditional locations or at the stop-line.

4.6.5 STOP-LINE UPLINK [4.2 or later] (SLUL)

This defines the upstream link for a link of type stop-line normal.

4.6.6 UPSTREAM NODE

The node feeding traffic onto the link for normal links only.

4.6.7 UPNODE THROUGH STAGE (UNTS)

For a normal link, this is the stage at the upstream node which feeds the majority of traffic onto this link. It is used by the offset optimiser under faulty or biased conditions to select the appropriate offset. The DEFAULT OFFSET is the target value used in these circumstances and represents the time difference between the start of the UPNODE THROUGH STAGE and the start of the DOWNODE THROUGH STAGE. See 8.66.

4.6.8 DOWN NODE THROUGH STAGE

This is the SCOOT stage that first gives green to the link.

4.6.9 MAIN DOWNSTREAM LINK (MDSL)

The main downstream link is that SCOOT link going away from the node which, if showing a standing queue, would cause the upstream link difficulty in discharging (exit blocked). This condition will continue for as long as there is stationary traffic on the loop. During this condition SCOOT will not increase the green time to the upstream link. When this occurs, SCOOT models the upstream link as if the link was red. It is normally the link that most of the traffic discharges through.

If there is no obvious main downstream link the value should be zero.

4.6.10 CONGESTION LINK (CLNK)

This is a link that provides additional congestion information for another downstream link. If congestion occurs on either or both links the congestion term will be included in the split optimiser for the link. If an engineer has to site a loop too close to the stop line for whatever reason that loop would normally have to have a congestion importance factor of 0 because the standing queue at red would be queued back onto the loop. In these cases it may be desirable to site a further loop upstream which, although it may not register all the traffic arriving at the stop line, will come into effect if the queue comes back to the loop. The congestion link could be an entry or a normal link for another stop-line.

4.6.11 UTC EQUIPMENT TYPE/SCN

This is the junction or pelican that gives green to the link.

4.6.12 UTC STAGE GREENS

For junction nodes, this is the stage or stages that give green to the link.

4.6.13 BUS EQUIPMENT TYPE/SCN

This is the junction or pelican to which a bus detector is connected.

4.6.14 BUS DETECTOR NUMBER

This relates to loop detection for bus priority. In the equipment word format for a junction / pelican controller, up to four bus detectors can be configured. These are input as bits BD1 up to BD4 in the reply format. The bus detector number here associates the link with the appropriate bus detector 1, 2, 3 or 4.

4.6.15 SOFT DETECTOR

This is the detector or detectors that are to be used in the SOFT algorithm.

4.6.16 GREEN START STAGE

This is the stage that starts green to the link. The SCOOT model will start discharging the queue in the model for that link after the addition of the start lag to the time of the start of the SCOOT stage. The model will also be looking for the UTC stages that have been nominated to run through this SCOOT stage before modelling the link as green if the feedback option is enabled.

4.6.17 GREEN END STAGE

The SCOOT stage that terminates the green to the link in the model. The end lag is then added on for the actual end of green on the street.

4.7 Detector Data

4.7.1 DETECTOR EXTERNAL SUFFIX

This number identifies the number of each detector on a link. A link may have up to 9 detectors associated with it. It is very rare to find more than 3.

4.7.2 OUTSTATION SCN/WORD/BIT

This defines the 4 reply bits that the SCOOT detector will use. The outstation SCN is specified together with which of the 16 bit reply words is relevant and which nibble (0-3) within the reply word is to be used.

5. VALIDATION

5.1 Introduction

This section deals with the initial setting up of the basic SCOOT data parameters. After this process the engineer should proceed to follow the guidelines laid down in the next sections - Network Validation (Fine Tuning) and Customising. It is not sufficient to carry out basic link validation and run SCOOT without carrying out these subsequent processes.

5.2 Parameters

Validation is the process of setting up SCOOT so that it accurately models what is happening on the street. Each link in the system must be validated independently. The process will typically take about an hour for each one. Parameters a) - f) could be validated before commissioning of the UTC system, assuming the detectors have been installed. The parameters that have to be accurately assessed are:

a) Main downstream link (MDSL)

b) Default offset (DFOF)

c) Journey time (JNYT)

d) Queue Clear Maximum Queue (QCMQ)

e) Start lag (SLAG)

f) End lag (ELAG)

g) Saturation occupancy (STOC)

It is important that items c) - f) are established before an attempt is made to validate the saturation occupancy as any error with them is likely to cause problems arriving at a correct value.

Once a link has been validated, the values likely to require further change during fine tuning are the saturation occupancy and journey time. Thereafter it is only advisable to check a few values perhaps once a year to see if they are still valid. If the network is changed at all, i.e. the road is widened or the phasing arrangement at the signals is altered, then those links that have been affected must be revalidated.

5.2.1 **Main Downstream Link** - (MDSL)

The main downstream link is that link into which an upstream link discharges most of its flow, see 8.148. It is sufficient to check if the correct value has been inserted into the database when it was first built, but remember that the purpose of MDSL is to detect exit blocking. If there is no clear link into which traffic is discharged then the MDSL should be set to 0.

5.2.2 **Default Offset** - (DFOF)

This value will only come into effect if a detector on a link goes faulty or if an operator BIAS is imposed. The value held in the database should be the best offset for the link, see 8.66, measured from stop-line to stop-line.

A value could be obtained for this by using the M18message and taking the SCOOT offset for the link. It is probably better to measure the value on-street using common sense.

5.2.3 **Journey Time -** (JNYT)

This is the time taken by a free flowing vehicle, preferably in the middle of a platoon, to travel from the detector to crossing the stop line. Users will find the initial database value for this parameter is large, typically 127 seconds. This is to make it obvious to anyone looking at the database that this value has still to be validated.

With short links one observer can measure this value, but for long links or where the detector is out of sight around a corner, two people will have to communicate using mobile phones or radios. The observer at the detector (Ob. 1) should warn the second observer (Ob. 2) that a platoon is coming and then tell Ob. 2 to start the stopwatch "now". Ob. 1 should then describe the vehicle that he/she has chosen by colour and type, and Ob. 2 will then stop the watch when that vehicle crosses the stop-line. Where possible, the behaviour of that vehicle along the link should be observed, and if it is going too fast or too slow that reading should be discarded. About 10 readings should be taken and if possible these should include a representative selection of vehicle types. After 10 readings study the results and discard any that are considerably different from the norm. The validated journey time is then the average of ten readings.

Where the detector is downstream of the link, i.e. in an historic position, the journey time is the time from the vehicle starting to move to when it crosses the detector. For a right turning vehicle this would be from the position the vehicle is waiting to turn right (left turn in most overseas countries) in the middle of the junction to when it crosses the exit detector.

The SCOOT model uses journey time to determine arrivals at the stop line. Long journey times will be subject to platoon dispersion, in a similar way to those in TRANSYT.

5.2.4 **Queue Clear Maximum Queue** - (QCMQ)

This is the time in seconds for the link to clear if it were completely full, i.e. for a vehicle stopped over the detector to clear. For short links an accurate measurement can be taken.

For long links it may be impractical to wait for the link to be filled completely with vehicles. In these cases the observer should measure the length of the link and take the time for a known number of vehicles to clear the stop line. Then using the basis that an average vehicle occupies 6 metres it is possible to calculate the queue clear time for the link from:

$$\text{QCMQ} = \frac{\text{Link length (m) x queue clear time}}{\text{number of vehicles x 6}}$$

Care should be taken for multi-lane links where the number of lanes may vary along the link. Essentially, the time taken to clear the slowest full-length lane is the best value to measure.

If links are sufficiently long that a full queue would not be able to discharge in a single green, the formula above tends to over estimate the QCMQ as queuing behaviour leads to some moving traffic on some parts of the link during red. In such instances the value calculated above should be multiplied by:

cycle time / (cycle time + green time)

where "cycle time" is the largest cycle time likely to run at the node and "green time" is the average green time to the link at this largest cycle time, so if the node can run at 120s and the link gets 60s green out of the 120, multiply the measured QCMQ by 120/(120+60)= 2/3. The result will be more accurate but may lead to an under estimate, so it may be sensible to take a pragmatic view and choose a value between the two estimates.

5.2.5 **Start Lag** - (SLAG)

The start lag is the time in seconds from a SCOOT stage starting to the first vehicle crossing the stop line.

It is used in the model as a timer from the SCOOT stage starting to the queue in the model beginning to discharge from the stop line at the saturation rate (STOC).

For junctions, when measuring this on street you must be aware what starts a SCOOT stage. It could be an amber leaving a previous UTC stage or the termination of a green man. You should try and take up a position where you can see both the preceding UTC stage terminating and the new one starting. You should then measure the time it takes from this amber or green man terminating to the first vehicle crossing the stop line. This will typically be the intergreen + 2 seconds. This can vary according to several factors such as gradient and pedestrians taking time to clear a crossing in front of the stop line. Once established, subtract the default SCOOT intergreen of 5. Then subtract area start lag (usually 2).

For pelicans an estimate will have to made for the start lag. This would be measured as the time from the flashing amber starting to the first vehicle crossing the stop-line. This will obviously depend on the pedestrian flow and a there may be a large variation by time of day. Fortunately pelican crossings are not normally critical within a network.

In SCOOT MC3 a new "variable intergreen" facility has been introduced. If this facility is activated for a node, the calculation of start lag will be different.

5.2.6 **End Lag** - (ELAG)

This is the time from a SCOOT stage finishing to traffic ceasing to travel over the stop line. SCOOT uses this value in the model to determine when a link goes red and vehicles cease to be discharged.

It is usually sufficient to assume that vehicles continue discharging for the length of the amber period, but you should be aware of the method of control on the street and whether there are any phase delays in operation. i.e. the link may continue green for a few seconds on the street to allow a clearance. Once established, subtract area end lag (usually 3), meaning that most "standard" links where there are no phase delays will have ELAG=0.

5.2.7 **Saturation Occupancy** - (STOC)

This is the discharge rate for a SCOOT link from the stop line measured in Link Profile Units (LPUs) per second. It can be equated to the saturation flow, which is normally measured in vehicles per hour. The model uses this value to determine how quickly vehicles discharge when the link is green.

This is probably the one parameter that people find hardest to understand and to measure. It is also probably the most abused. If the final value arrived at is not sufficiently accurate then SCOOT will not be reflecting correctly what is happening on the street. If the STOC is too low then SCOOT will think there is a queue, when none exists on the street. If the STOC is too high then SCOOT will think there is no queue when in practice there may well be. Hence there is a separate section for STOC validation later in this chapter.

5.3 Validation Planning

Validation is a time consuming business and every effort should be made to ensure that it is carried out in a well organised manner. The following items should be born in mind:

5.3.1 Assess the network before you start.

Try to begin with easy links that are in a less congested part of the network and preferably entry links. As experience is gained so you can progress on to the difficult ones. It may not be possible to validate some links at certain times of day, typically due to either not enough or too much traffic. Each validation engineer should be given a link map of the entire network. Everyone involved in validation should have a traffic background and preferably be equipped with adequate common sense!

5.3.2 Equipment

Validation requires either a remote terminal or phone/radio communication between the computer and site, unless you are particularly fortunate and have good CCTV coverage. If a radio system is used it must not be subject to a lot of interference and you should preferably have sole use of the channel. If radios or phones are used then 3 staff will be required, one inside with the computer and two on the street. If a remote terminal is used then one or two people on the street will be sufficient. Each validation team should contain one engineer who is experienced in SCOOT and is capable of analysing all the problems that are likely to occur.

Make sure that each person on-street has:

- a supply of pencils
- a stopwatch
- suitable clothing including PPE
- clipboard and paper

5.3.3 Site Management

When on site try to park your car so that it does not affect the traffic flow on the link you are going to validate. Try to be inconspicuous. It is Murphy's law that the weather will always be bad when validating, so take suitable clothing as most validation is a stationary process. Two hours is probably the most time you should expect to spend on site without a break, although this can be extended if validation is possible from inside a car.

5.4 Detector Verification

Verification of a detector consists of checking it is functioning and is correctly associated with the link. This may seem unnecessary but time wasted trying to validate a link using the wrong detector can be considerable. It may be worthwhile spending a day before the main validation takes place checking all the detectors are connected correctly and are associated with the correct links in the database. It is not uncommon for maintenance engineers to connect loops up to the data transmission incorrectly or have the wrong sensitivity settings on the loop pack. See Section 0 for further information.

Flow over the detector should be compared with the computer using the LMON, MONI or LVAL display. This is one area where the availability of a roving terminal can be extremely useful. With this you can position yourself alongside the loop and watch the display at the same time. Without this you will have to rely on a radio contact with someone at a VDU in the control room. A typical delay of 3 seconds should be allowed between a vehicle crossing the loop and the same vehicle appearing on the MONI display for that detector. A vehicle travelling at about 30 kph should register a pulse of about 0.75 seconds, while a bus would probably be 1.5 seconds. It is important that you look at these values as not only will you get a feel for how SCOOT is collecting the data but also whether the detector data is accurate.

5.5 Validation Process - Methods

There are now a number of different ways of setting up a system to commence validation. They are:

5.5.1 Roving Terminal

Using a remote terminal with the LVAL facility. This is the preferred method because it not only saves on manpower but also allows the newcomer to SCOOT to fully appreciate what is happening. A remote terminal is used to start the link validation display which enables the observer to input measurements to the computer and the computer to calculate its own estimate of the saturation occupancy. A full description of this display is given in section 5.9.

5.5.2 No Roving Terminal - LVAL

If no remote terminal exists and the LVAL facility is available then the instation operator should use this.

5.5.3 No Roving Terminal and no LVAL

A third method is for the instation operator to use the LMON display that can be used to start all the necessary SCOOT messages for validation. Communication between the street and the control centre is by radio. Santiago and Beijing use this technique. It will still be necessary for both the instation operator and outstation observers to keep separate records of each reading.

5.5.4 No Roving Terminal and no displays

The instation operator starts each SCOOT message individually and communicates values to the observer on the street. It will be necessary for both the instation operator and the street observer to keep separate hard copy records. Validating by this technique can take up 50% longer and lead to problems of misunderstanding between operator and observers especially if radio communications are poor.

5.6 Validation Process - Activity

Whatever process is used the following SCOOT messages are required for each link. The LVAL facility will automatically set up its own interpretation of these messages in a format that can be readily understood.

M14 - This is a link message which is output every 4 seconds and shows the length of queue, the back of queue and whether the link is green or red. See 9.2.8.

M08 - This message is output at the end of green to a link and shows the amount of queue that is left standing at the stop line. If the queue clears completely within the green time then this will show 0 queue. See 9.2.5. This message also gives the degree of saturation of the link.

M10 - This shows the length of queue LPUs waiting at the stop line when the link goes green. See 9.2.6.

M11 - This shows the amount of time the model takes to discharge the queue in seconds. This is output during the green time when the last delayed vehicle is modelled as crossing the stop line. If a link fails to clear in the available green time then the value -1 is output with this message at the end of the link green. See 9.2.7.

When all the values for the DFOF, JNYT, QCMQ, SLAG and ELAG have been obtained they should be input into the computer using the CHAN command or via LVAL. An initial value for the STOC should also be implemented. Typical starting values would be:

1 lane between 8 and 12

2 lanes between 12 and 16

3 lanes between 16 and 22

These values are only suggested as a guideline and in practice could vary according to gradient, position of the detector, speed of traffic and the sensitivity of the detector. The validation process will take all these factors into account.

STOC validation can be carried out without SCOOT being the method of control. This is in fact the preferred method as it generally means there will be no co-ordination with other nodes. If the local area is under the control of a fixed time plan it may be advisable to change plan for the node to break co-ordination. If SCOOT is enabled during validation, the first action of the observer is to place all the optimisers (Split, Offset and Cycle time) in LIMBO for the node. It is important to carry this out as SCOOT will start changing cycle times and green splits; without validated values this will quickly cause traffic problems. If the offset optimiser is not turned off SCOOT may well give good progression to a link making it very difficult to accumulate sufficient traffic at the stop line to carry out measurements. When experience is gained it may be possible for you to manipulate the optimisers and STOCs on other links to enhance your validation of a link. It must be stressed that this should only be attempted by experienced SCOOT engineers otherwise all sorts of problems could arise. If this link has also been defined as a SOFT link, ensure that SOFT is turned off during validation.

If there are any demand dependent stages at the junction a permanent demand may be inserted for them. Use the DEMA command to achieve this.

The next action is to compare the link you are going to validate with the M14 message to see if the link is going green and red at the same time as the model. You should then observe the queue on the street and in the model to see that it is clearing in each green. If it is not then your initial guess at the saturation occupancy may well be too low.

In certain cases the link may show stuck on red or stuck on green. This is probably a result of the feedback not modelling the UTC stages (or the wrong ones) correctly. See section 3.2.2 for further information on this. SCOOT Versions 2.4 and later utilise direct feedback from the street and each link is connected in the database to UTC stages. The observer should check to see if the link has been modelled correctly by observing the M14 and M35 messages and seeing if it is correct.

If the model has accumulated a queue because the initial STOC was too low, set the STOC to 63 for one cycle to clear the queue completely out of the model. Then reset the value higher than the previous starting value.

5.7 Measurement of STOC for Entry and Normal Links

When you are satisfied with the M14 message this can be terminated. One observer (Ob. 1) should be responsible for measuring the queue and recording its length and which is the last delayed vehicle. The second observer (Ob. 2) is responsible for timing the discharge. When the signals go green Ob. 2 should start the watch as the first vehicle starts to move and then stop the watch when the last delayed vehicle crosses the stop line. It is the responsibility of Ob. 1 to count the number of delayed vehicles when the signals change to green. Make a note of this number and then continue to watch the queue to indicate to Ob. 2 which is the last delayed vehicle.

The last delayed vehicle need not be the one at the back of the queue when the signals go green. Vehicles may be joining the back of the queue as it discharges from the front. There is a lot of argument about which is the last delayed vehicle and experience will count for a lot. The last delayed vehicle should be that one which has to check its speed significantly, perhaps down to about 20 KPH. It is not necessarily the last vehicle to stop.

In short links the queue at red may go back onto the detector. In these cases the first observer must take the vehicle standing on the detector as the last delayed vehicle. The discharge time should then be the same as QCMQ.

A typical result of one reading may be:

12 vehicles in 23 seconds

The computer may respond with a value:

164 LPUs in 32 seconds.

If the observer is using the LVAL display the count will be output in vehicles.

It is important that readings with unusual events should be discarded. These might include a learner driver or a parked vehicle causing an obstruction.

Comparing these two values tells us several things. First, that for the count of 12 vehicles the computer saw 164 LPUs. This is quite acceptable as it gives a vehicle/LPU conversion of 13.7. In practice this ratio can vary between as little as 8 and as much as 22 LPUs per vehicle. The important thing about this result is that the computer has probably seen all the flow that the observer has seen, suggesting that the journey time is probably correct.

Secondly the computer model has taken a lot longer to clear its queue than the street. The street reading was about 1 vehicle every 2 seconds which suggests a single lane discharge. Perhaps if the STOC that was chosen to start with is 9 then it ought to be increased to 10 or 11, but one reading is insufficient to determine a trend. If the second reading were to show 10 vehicles in 18 seconds and the model shows 121 LPUs in 25 seconds then a trend is clear but how much should the STOC be increased by? Well, by using a ratio of the total queue clear times it is possible to get a rough estimate for a new value of STOC.

$$\text{New Saturation Occupancy} = \frac{\text{Old STOC} \ * \ \text{Total Computer clear time}}{\text{Total street clear time}}$$

$$\frac{9 * 57}{41} = 12$$

An important rule of thumb to remember is that if the computer is higher then the STOC must go higher, if the computer is lower then the STOC must go lower. More readings are taken and by this process the observers can home in on the correct value.

Ideally at least 5 readings should be taken at the final value. Some of these readings should be both higher and lower than the computer. It may be found that a change in STOC causes the model to swing from being too low to too high. If this happens then the observer should always err on the high side, as a value that is too low may cause too much queue in the model and the junction may then think it requires a higher cycle time than necessary. If any database value is changed then new total queue clear times must be calculated from the time of the change.

Occasionally a large flow will join the back of the queue after the start of green and you may have trouble estimating the last delayed vehicle. If you are confident that most of these vehicles were not delayed but the computer showed a much larger queue clear time than the street then this is a good pointer to the journey time being perhaps only one second too short. Try increasing the journey time by one second and watch for similar occurrences. The reverse could also be true where you see the large platoon delayed and the computer clears a lot quicker. Of course, it may be that the STOC is still incorrect, or there is a variation in the start lag.

An experienced SCOOT engineer may well be able to reach the correct STOC within about 5 readings. A novice could take 20 or 30 readings to be confident of having reached the correct value. It cannot be emphasised more positively that the use of an experienced SCOOT engineer in training will save a great deal of time.

At the end of validating one link remember to make sure that the site is returned to the appropriate mode of control as was present at the outset, i.e. remove any operator imposed fixed time plans, stage demands etc.

5.8 Measurement of Filter Saturation Occupancy

The validation of a filter link should only be attempted after all the other links at a node have been validated and the node is on SCOOT control with all the optimisers running. The message M08 shows the percentage saturation of any link and is output a few seconds after the end of a filter stage.

The observer should measure the amount of green time that is used by traffic and then calculate a percentage. This is not as difficult as it sounds but a bit of engineering judgement is required. Then wait for the M08 message. Adjust the saturation occupancy until readings of within 10-15% variation of each other are obtained.

For a filter link SCOOT will try to maintain the degree of saturation between 40 and 80%. If the saturation rises above 80% then it will tend to increase the green time, if it falls below 40% then it will tend to decrease the green time.

One situation to beware of with filter links is where a 2-lane detector site is used. Here it can sometimes be difficult to distinguish individual vehicles when moving slowly over the detector due to masking. In such cases, the filter modelling will not work well and an alternative solution may be needed.

For users familiar with the NFTD display, the saturation values from the M08 message can be seen for all links. This is generally a more convenient way of viewing the data when validating filters.

5.9 Validation using the LVAL display

The Link Validation Display (LVAL) shows an interactive screen of SCOOT data for a specified link. The operator can update some of the configuration values. The display is in two sections. The top section of the display shows various SCOOT parameters, the time and date and a queue mimic. The bottom section of the display consists of a number of data records, which scroll upwards as more records appear. New values of queue length and queue clear time from SCOOT are displayed every cycle. The observer inputs the corresponding values from the street, together with an indication of validity of the data and a comment. The values from valid records are used to estimate Saturation Occupancy (STOC) values for the link, which are displayed alongside the data.

5.9.1 Modes of operation

LVAL may operate in either **MONITOR, SETUP** or **VALIDATE** modes.

In MONITOR mode LVAL updates the data on screen as it changes but no operator input is allowed. In this mode you may terminate the program when required.

In SETUP mode the basic link validation parameters are available for change.

In VALIDATE mode data may be entered into the cyclic records in the scrolling area of the screen.

The program may not be terminated while in SETUP or VALIDATE modes.

F10 or Control-V keys will cycle between monitor, set-up and validate modes.

5.9.2 Screen Layout

All of the values shown on the Link Validation Display are updated as they change in real time. The screen displays the following information:

<u>Line 1</u>

The link SCN.

The region SCN.

The SCOOT implementation flag

The green confirm valid flag

The soft status of the link (SOFT).

The model feedback inhibit flag (MFBI).

The mode.

The date and time.

Line 2

The Saturation occupancy (STOC). [*]

The Journey Time (JNYT). [*]

The Queue Clear Max Queue (QCMQ). [*]

The Start Lag (SLAG). [*]

The End Lag (ELAG). [*]

The Default Offset (DFOF). [*]

The raw data values for up to three detectors for the link, updated once per second.

Items marked [*] may be changed by the operator.

Line 3

Any error messages which may occur, e.g.

"Unable to write data to disc"

"Not receiving M10"

"Not receiving M11"

"Unable to close file"

Line 4

The current state of the link, shown as:

'G' (inverse video): lights green,

'R' : lights red,

'E' : lights green with exit blocked.

The number of vehicles in the queue.

A representation of the queue waiting at the stop line, scaled according to QCMQ and STOC. The area from the stop line to the front of the queue contains spaces; the queue is displayed as solid blocks.

Line 8 to the end of the display

This part of the screen is a scrolling region, holding the actual validation data. The header contains the region and node cycle times. Each line represents the data for a cycle and contains:

(a) The time at which data was received from the SCOOT model;

(b) The length of queue in vehicles at the start of green;

(c) The queue clear time from SCOOT;

(d) The length of queue in vehicles input from the street. {*}

(e) The queue clear time input from the street. {*}

(f) An estimated value of the saturation occupancy calculated automatically for data records which are marked 'VALID'.

(g) A 'VALID' field used to indicate which of the data records are valid for the purposes of estimating STOC values. {*}

(h) A comment field of up to thirty characters. If a SCOOT parameter has been changed, the parameter and its new value automatically appears here. If the SCOOT parameter was changed externally (i.e. not from within the display), an asterisk {'*'} follows. {*}

Fields marked {*} are input by the operator once per link green.

5.9.3 Validating a Link

The method of validating a link using LVAL is very similar to the manual process of validation. Each link green (normally 1 per cycle), new values of queue clear time and queue length become available from SCOOT. When these appear, a new record is displayed in the scrolling region of the display. With the display in VALIDATE mode, you may then enter corresponding values of queue clear time and queue length (in vehicles) as seen on street. An estimated Saturation Occupancy (Est. STOC) value is then calculated and displayed alongside the new data.

In order to allow for values arising from adverse conditions not to be included in the Est. STOC calculation (for example, a vehicle stalling) a VALID field is included. This defaults to 'N' (no) but may be changed to 'Y' (yes) to make the record's data valid.

The estimated STOC value is calculated by the formula:

$$\text{New STOC} = \frac{\text{sum of valid street queue clear times}}{\text{sum of valid model queue clear times}} * \text{Old Saturation Occupancy}$$

A record counter is shown on the left-hand side of the current data record. You may change the SCOOT parameters shown on the display (marked [*] above) during validation. The record counter is used to show the number of records since the last change to a SCOOT parameter.

Any changes to the SCOOT parameters cause the record counter to be reset and the estimated STOC calculation to be restarted from the next record. To ensure accuracy in the STOC calculation, it is normal to leave the VALID field of the next record after a SCOOT parameter change as 'N' (no).

Estimated STOC values therefore rely on previous values of the queue clear times and VALID fields input by the operator. If, for some reason, the operator changes such a value, the subsequent estimated STOC values are recalculated and redisplayed (for records since the last change of STOC value).

A comment field is included to allow you to make any notes you feel necessary during validation. For example, the conditions under which the street data was collected or reasons as to why the data entered is not valid. If a SCOOT value is changed (either by you, or by SCOOT) a comment to acknowledge this is displayed in the comment field of the record following the change.

Once validation is complete, you may exit the program after returning to MONITOR mode.

The keys

The display, once initiated for a link, is updated every second until cancelled by pressing one of the following keys. The display must be in MONITOR mode:

a) Control-Z

b) '#'

c) '-'

While this program is running:

Enter control-V or F9 to move between modes.

Enter control-R or control-W to refresh the screen.

Editing fields

Fields may only be changed while the program is in SETUP mode:

Use the cursor keys to move around the fields which may be edited (those marked [*] or {*}, above).

The cursor wraps around from top to bottom (using the up arrow key) bottom to top (using the down arrow key) right to left (using the right arrow key) and left to right (using the left arrow key) .

All fields take positive numbers as input, except:

SLAG / ELAG / DFOF fields - may be negative (use the '-' key).

Comment fields - may contain any printable character.

Press the return / enter key to finish the input.

5.9.4 Changing SCOOT fields (STOC, JNYT, QCMQ, SLAG, ELAG, DFOF)

The SCOOT fields that may be changed are on the second line of the display. Altering a SCOOT value updates the value in the SCOOT database according to the newly entered data.

Move the cursor to the field required (using the left/right arrow keys), enter the new value (within the range of allowed values in the SCOOT database) and press return.

The internal record counter is reset, and the queue clear times from any records currently on the display are not included in future calculations of the estimated Saturation Occupancy (Est. STOC).

A message to notify you of the change automatically appears in the comment field of the next record displayed. This consists of the parameter name and the new value (for example, "STOC=12"). Up to 3 such changes can be displayed in one comment field. If more than 3 changes are made to SCOOT parameters in one cycle, the extra changes will not be noted.

It is possible for a change to be made to one of the SCOOT fields from outside the program, either by another operator or by SOFT (for SOFT links). A message will also be inserted into the comment field of the next record displayed, as above. In this case, an asterisk (*) will follow the message, e.g. "STOC=12*".

Note that any changes made to the SCOOT parameters are permanent changes; they are recorded in the system log.

If at any time it is felt necessary to restore the value of a parameter to that on entry to LVAL, place the cursor over the parameter and press R (for restore).

5.9.5 Selecting an initial STOC value

Before commencing link validation it is important to select an initial STOC value. This can be done by using your judgement and the guidelines described earlier in this chapter. Alternatively, the system can calculate a best start value. This can be achieved as follows:

1) Enter SETUP mode and move to the STOC field.

2) Press S to enter dialogue mode

3) Answer the questions posed by the system

5.9.6 Termination

The link validation program will terminate under the following conditions:

Exit from the program is achieved by entering monitor mode using control-V or F9 and then using the system prompt (-).

The link goes faulty. The program will exit and notify you of the faulty link with a message.

There is a system closedown. The program will terminate and notify you.

Any SCOOT parameters that have been changed by you and have consequently become new database values will be listed on the screen after program termination along with their original values.

5.9.7 The data file

The information collected by the link validation display is saved in the form of an ASCII file written to the system disc. A new version of the file is created each time a link is validated. The filename is in the format:

UTC_OUTPUT_:[VALIDATION_DISPLAYS]xxxxx.DAT

e.g. N04441A.DAT for link N04441A.

5.10 Validation using the LVAL display – Enhancements with Version 4.5

Version 4.5 of SCOOT introduces a facility to improve the efficiency of STOC validation, i.e. to try and reduce the time taken for this part of the process. The facility involves SCOOT running multiple concurrent copies of the modelling software using different STOC values. This enables users to compare the readings taken on street each cycle with those based on a range of STOC values, not just a single one.

SCOOT produces message M75-M79 which give data on the concurrent modelling. These are employed by an enhanced LVAL display for ease of use by the engineer.

5.10.1 Enabling/Disabling Multiple Concurrent Modelling

Within LVAL, use Control-E from set-up mode or validation mode to toggle in and out of concurrent modelling.

5.10.2 Appearance on the Display

When in concurrent modelling, the usage of the bottom right part of the screen changes. Normally, this is used for comments against each cycle's readings. When in concurrent modelling this changes to a display of queue clear times. The text "comments" is replaced by the range of STOC values being considered (normally –3 to + 3 from the chosen STOC, e.g. 7 values in total). Then as each cycles data is generated by SCOOT, the 7 clear times associated with each STOC value appear under the appropriate heading.

Hence after a few cycles it should be clear which STOC value most closely matches the behaviour observed on street. If this value is not the currently selected STOC, time will have been saved by not having to change value and repeat the process.

Note: the concurrent modelling queue clear time for the current STOC may occasionally be slightly (not more than 1) different from that shown in the main part of the display. This is due to rounding and should not cause concern to users.

5.10.3 Establishing the Correct STOC in the System

After using concurrent modelling, the user should remember that if the correct STOC is not the current value, CHAN/RUBA commands should be used to set it. Alternatively, go to set-up mode in LVAL before exiting and make the change there.

5.10.4 Change of STOC whilst in Concurrent Modelling Mode

Users should be aware that if the STOC value is changed whilst concurrent modelling is enabled, the range of STOCs considered by SCOOT will not change. To effect a change in the considered range, exit concurrent modelling with Control-E, change the STOC and re-enter concurrent modelling with Control-E.

5.11 Troubleshooting

There are several problems that can arise during validation. Recognising the cause is part of the "SCOOT art".

5.11.1 There may be large discrepancies in the flow arriving. This could be due to:

a) incorrect journey time

b) vehicles joining or leaving the link between the detector and the stop line

c) a fault in the detector

d) the wrong detector has been connected

e) you are looking at the wrong link and have not checked your M14 message properly.

5.11.2 If the flow is correct but the clear times are erratic this may be due to:

a) incorrect start lags

b) incorrect end lags

c) journey time

d) the junction has a fault and has dropped off computer control. This happens more often than one might imagine.

e) observer not concentrating

5.12 Network Validation (Fine Tuning)

This section deals with the analysis of the operation of SCOOT after link validation in a region has been completed and the resolution of problems that may subsequently occur. Network validation must be carried out before SCOOT is left on line full time and will normally take about 30% of the total commissioning time.

It is important that the traffic engineer does not jump to conclusions when trying to assess the cause of a problem. Always spend some time observing the problem before making a change and even then only change one parameter at a time. There is a great temptation when trying to resolve problems to alter the saturation occupancy to achieve more green time on a link when the problem may well be a defective detector or that the saturation occupancy on another link is too low thereby wasting green time.

5.12.1 Node Fine Tuning Display (NFTD)

Whilst fine tuning extensive use should be made of this display. All links on a node are displayed. When a link is green a "+" is displayed next to the link letter. If exit blocking is occurring then a "-" is displayed next to the link letter. If the link is faulty the link letter will be shown in inverse video and if historic flow profiles from ASTRID are being used the link letter will flash. The display shows the queues building up and discharging from each link with their queue clear times. The % saturations are taken from the M08 message and show the actual % saturation at the end of the green.

5.12.2 Region Fine Tuning Display (RFTD)

This display summarises the cycle status of each node in a region. If the display is left running then the last 10 cycle times will be shown across the top of the display. The important function of this display is to show which nodes are controlling the region. The trend in Minimum Practical Cycle Time (MPCY) will be displayed by a "+" or a "-" to indicate whether it is rising or falling.

5.12.3 Splits

As links will normally have been validated by different people (some with more experience than others) and at different times of the day, some small adjustments to the STOC may have to be made. The first thing an engineer should do is to put each node on to SCOOT control in turn and check to see if the green splits look balanced. Observe the street and compare this with the values obtained for the degree of saturation on the M08 message for each link.

Users with the node fine tuning display NFTD and a remote terminal should use this. Any values in the model which show a degree of saturation greater than 90% should be checked carefully to see if this is correct. The M11 message can be set and a few spot checks on queue clear times can be carried out. When the observer is happy that the node is balanced proceed onto the next one.

Check the green times with the M17 message or the value on the NFTD display to see if they match the value on the street. It is always possible that the link has not been modelled correctly and that a phase delay has been missed when measuring start or end lags.

Attention should be paid to nodes with demand dependent stages and how well SCOOT is modelling their non-appearance. This should not be a problem provided that the database has been correctly set up.

5.12.4 Offsets

When all the node splits have been checked, put SCOOT into full operation and look at all the offsets in the region and see if they give good progression particularly on one way streets and on two way links where there is obviously a heavy flow in one direction. A small error in journey time may not show up on validation but may become obvious when the node is fully optimised. Use the M14 message to look at arrivals in the queue and also the VEGA diagram.

Check to see if the offset optimiser is working by using the O01 message. This message should come out during the named stage. Remember the named stage is not necessarily the main stage for linking but should be the stage that has the longest green time. The named stage should under no circumstances be a stage of fixed duration or one that is likely to run on its minimum stage length.

5.12.5 Cycle time

The quickest way to find nodes that may be incorrectly validated is to look at the minimum practical cycle time for each node in the region, and which ones are dictating the region cycle time. The minimum practical cycle time is that which a node would like to run on if there were no other junctions in the region. It may take 10-15 minutes for a region to settle down at a particular cycle time. Nodes where the STOC is too low will frequently be demanding a higher cycle time than necessary. If the STOCs are too high then queues will be appearing on some links, which are easy to spot. The best check on cycle time can be carried out just after or just prior to a peak. The minimum practical cycle time of each node should be changing occasionally with each cycle optimisation. Any nodes that continually show a maximum or minimum for their MPCY should be examined carefully.

It is possible that the cause of inaccurate cycle time is an incorrect value for the cyclic fixed time (lost time), see 4.4.2. If this value is set to 0 then SCOOT will calculate its own cyclic fixed time. However, if the junction has demand dependent stages that appear infrequently then this value may be too high and you should set your own value from observations.

Use the C15 message for the MPCY of each node and the C01 message to check how the region cycle time is moving. The region cycle time may not be the highest MPCY as some nodes want to double cycle, which may make the overall cycle time higher.

5.13 Flared Approaches

Some links can be difficult to validate due to an increase in the number of lanes near to the stop-line. Such links are known as flared links. The difficulties occur when the queue behaviour varies from cycle to cycle, i.e. the lane usage varies or the queue does/does not extend back past the end of the flare. In these cases, it is important to establish a saturation occupancy values which reflects the average behaviour. If the behaviour varies significantly by time of day, different STOC values may need to be measured and changed by timetable.

In version 4.2, a new facility is provided to effect a better model of flared links. The user validates the link in the normal way having first declared that the link is flared (LFLA), having specified the number of lanes before the flare (LFAL), the extra lanes in the flare (LFEL) and the time taken to discharge a full queue in the flared section only (LFMQ). With this data, SCOOT will then attempt to model the queue discharge based first on the flare capacity, then subsequently on the non-flared remainder of the link.

5.14 Reduced Detection

Version 4.2 includes facilities to allow SCOOT to operate without the need for some links to have detectors installed. This would typically be at quiet or non-critical junctions. If detection is omitted on a link, there are two possible ways of providing information to allow some approximate modelling to take place.

The first method covers entry links. Here an approximate hourly flow is provided. by measuring the flow over a timed period and converting the answer to vehicles per hour. The value is then entered as RDPF (Reduced Detection Proxy Flow). Then normal link validation can proceed.

The second method covers normal links where an upstream link that has detection provides the majority of the traffic. This upstream link is declared as the proxy link (RDPL) of the normal link. Four measurements are then taken as follows:

a) when the proxy link is at red, count the number of vehicles that enter the normal link.

b) when the proxy link is green, count the number of vehicles that leave the proxy link and enter the normal link.

c) when the proxy link is green, count the number of vehicles that leave the proxy link but do not enter the normal link.

d) the free flow journey time from proxy link stop-line to downstream stop-line.

After a number of representative cycles, sum each of the values of a), b) and c) giving A, B and C. Then assign the following:

RDFF (Reduced Detection Flow Factor) = 100 * B / (B + C)

RDFR (Reduced Detection Flow Ratio) = 100 * B / (B + A)

d) to JYNT.

Finally, the remaining validation of parameters for the link can proceed as normal.

A full description of reduced detection can be found in section 0488 of the SCOOT Traffic Handbook, reference 1.3.1.

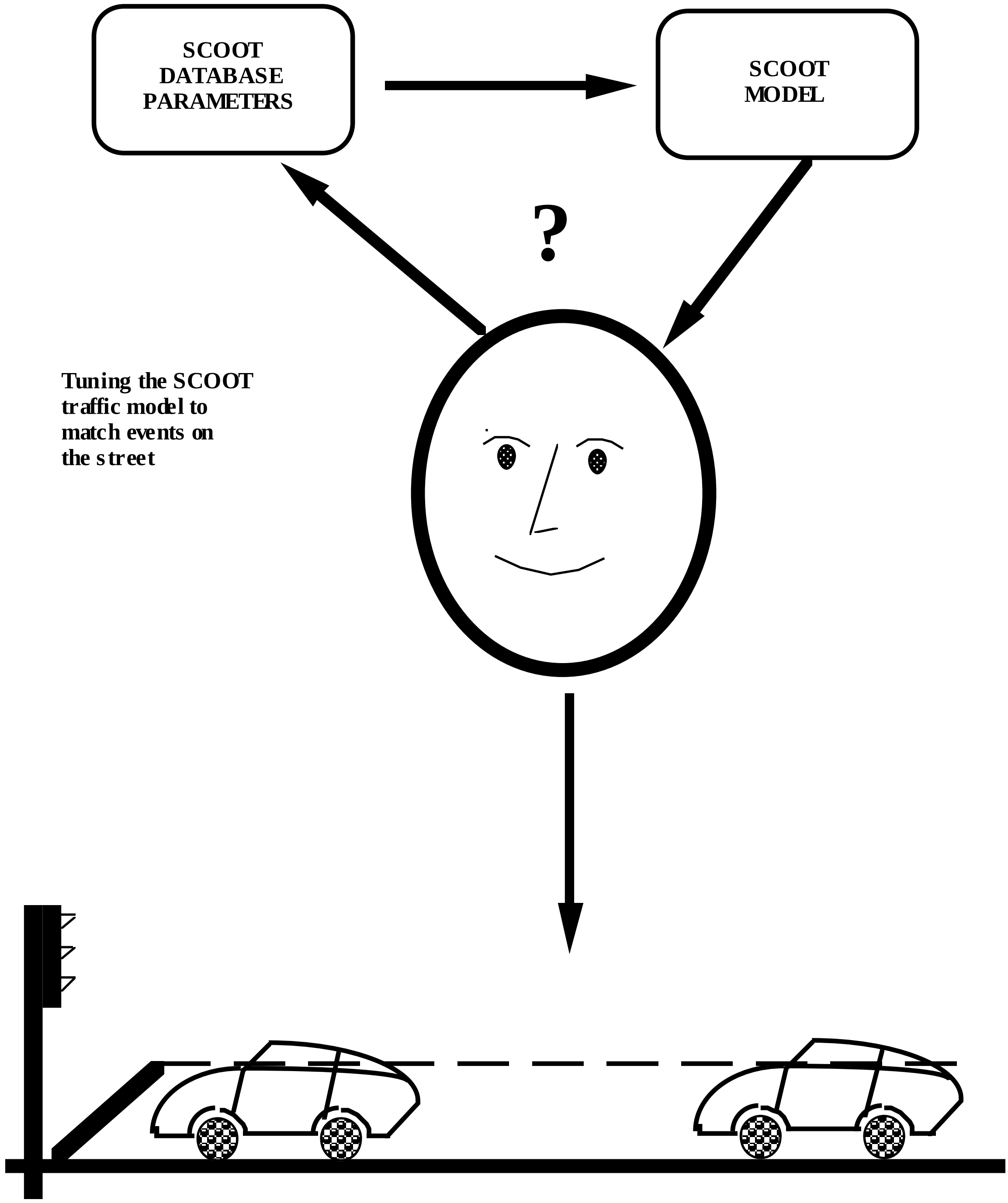


Figure 12 - Validation

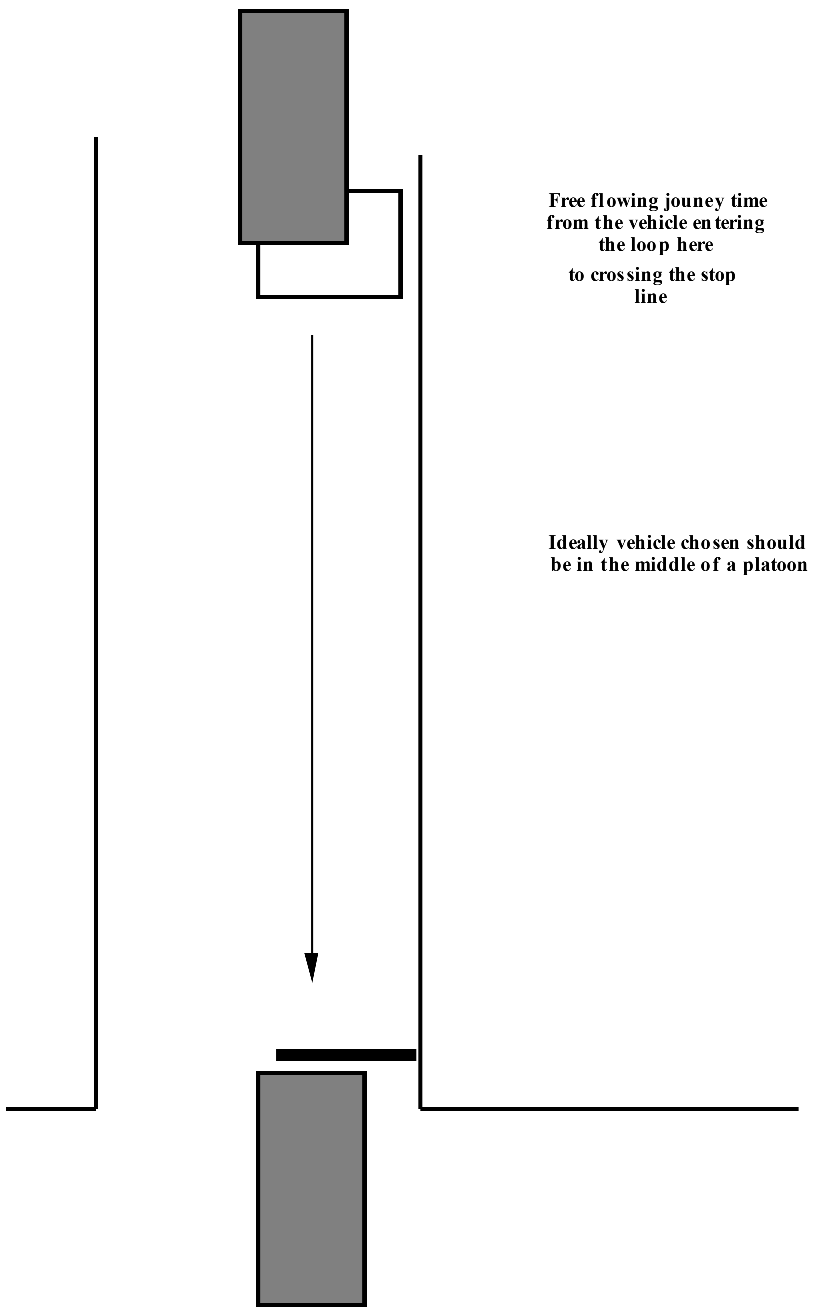


Figure 13 - Journey Time

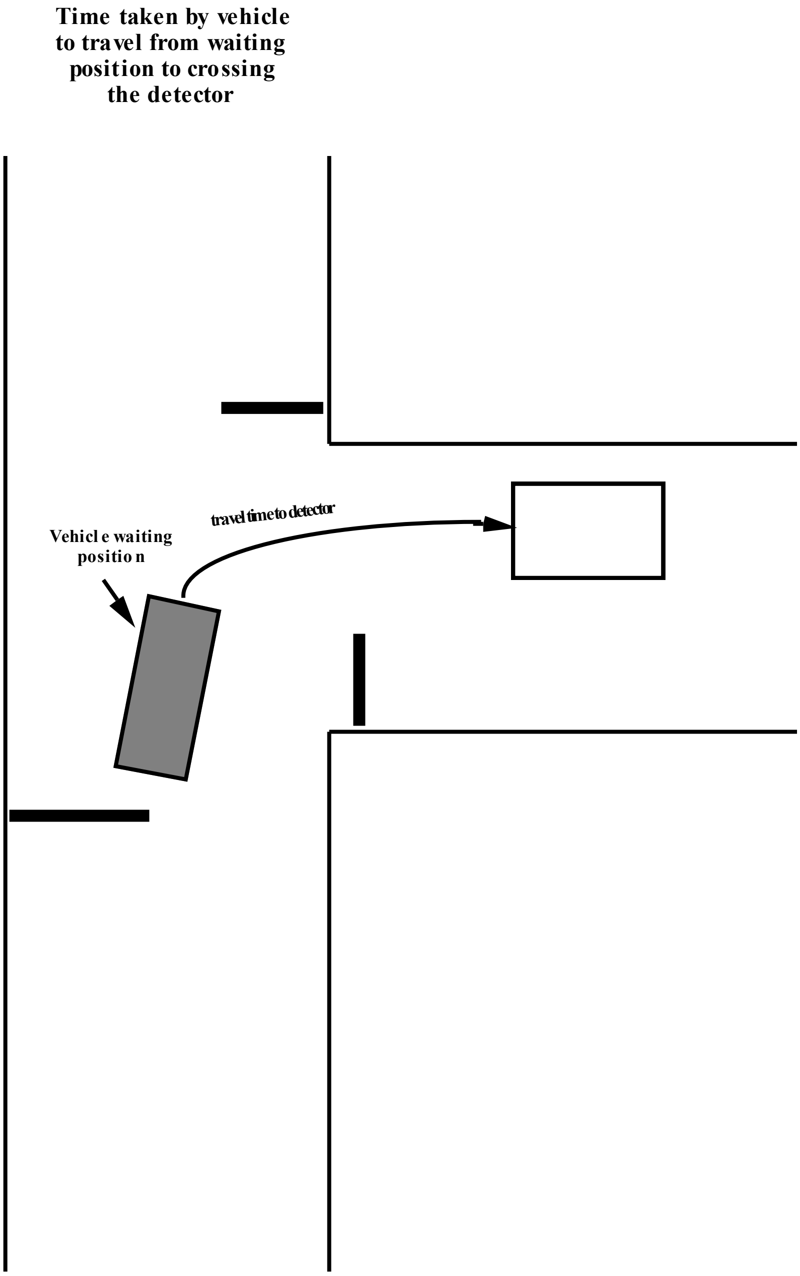


Figure 14 - Filter Journey Time

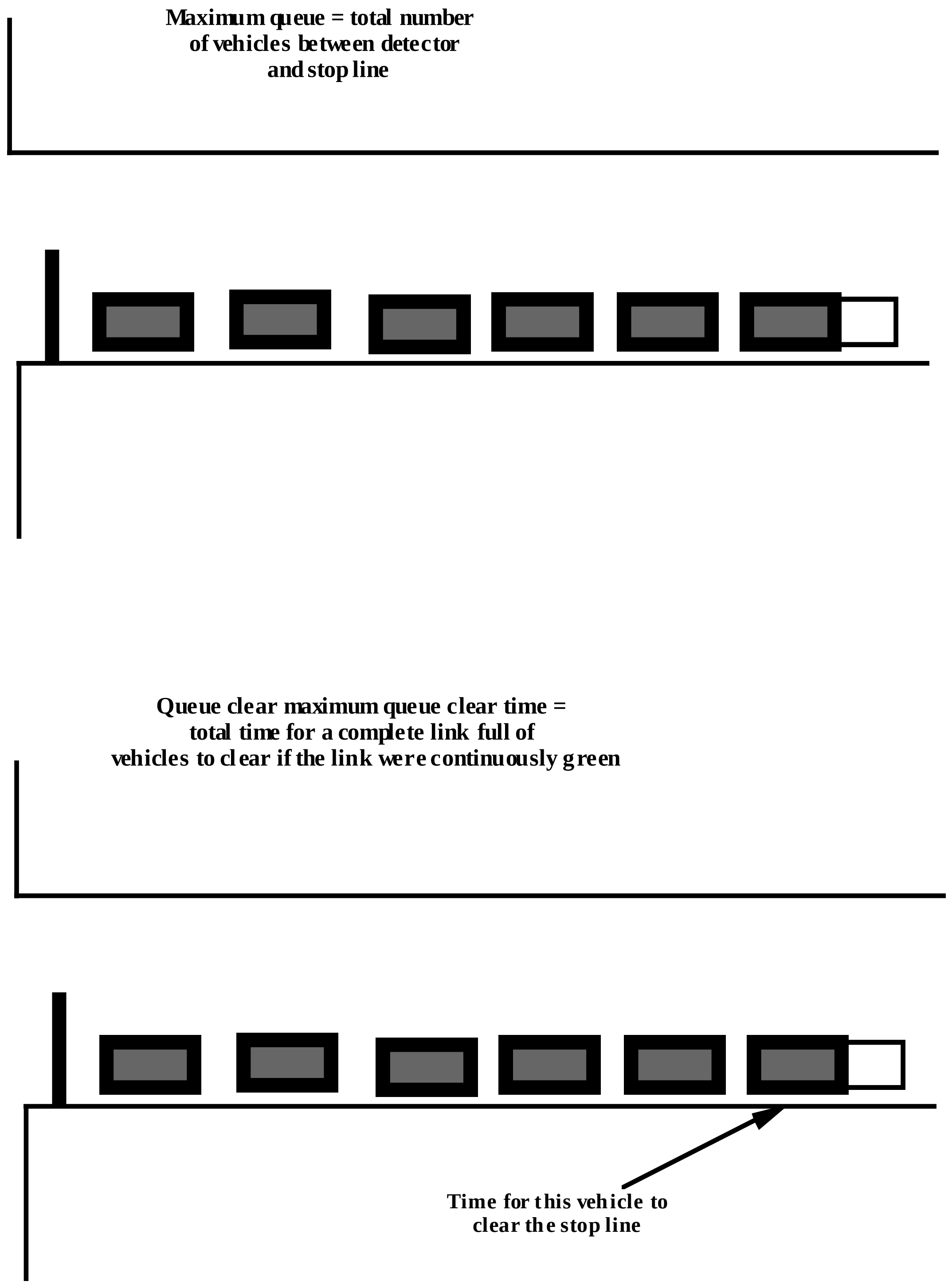


Figure 15 - Maximum Queue/Queue Clear Maximum Queue

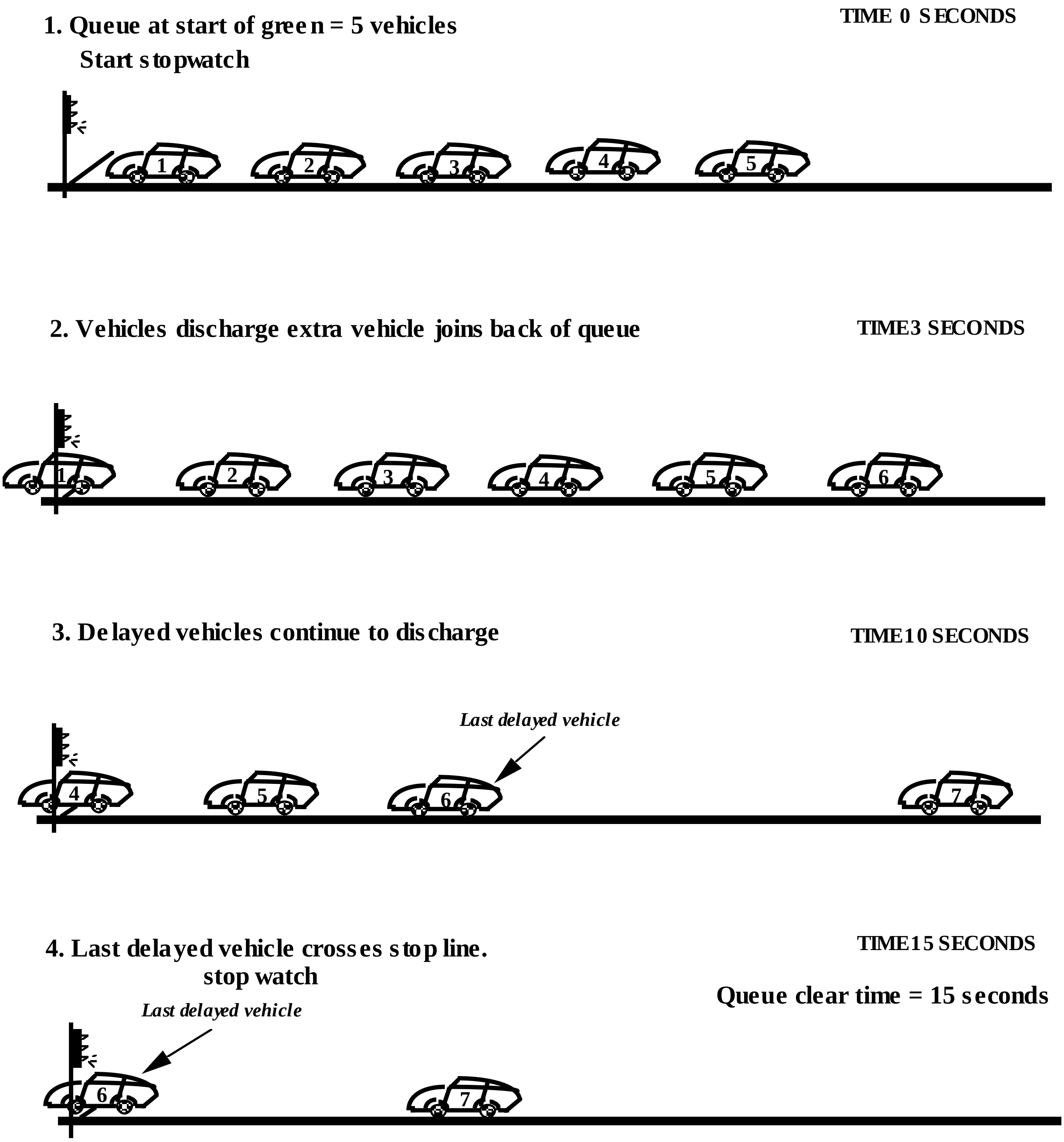


Figure 16 - STOC Validation

N01111H RAR IMPL=ON REPLY=ON SOFT=OFF MFBI=NO -VAL- 6-NOV-91 14:01:

RCYT=080 STOC=13 JNYT=009 QCMQ=023 SLAG=002 ELAG=0 D1=0110

D2=1000

R 3

	SCOOT		STREET		est.		
	Qlen	Qclrt	Qlen	Qclrt	STOC	Valid	Comment
001	132	12	13	14	0	Y	
002	190	20	15	25	15	Y	
001	80	6	5	7	0	N	STOC=13
001	121	11	10	13	17	Y	
002	160	15	12	14	15	Y	

LVAL display showing queue building up during Red period

N01111H RAR IMPL=ON REPLY=ON SOFT=OFF MFBI=NO -VAL- 6-NOV-91 14:02:

RCYT=080 STOC=13 JNYT=009 QCMQ=023 SLAG=002 ELAG=0 D1=1000

D2=0001

G 2

	SCOOT		STREET		est.		
	Qlen	Qclrt	Qlen	Qclrt	STOC	Valid	Comment
001	132	12	13	14	0	Y	
002	190	20	15	25	15	Y	
001	80	6	5	7	0	N	STOC=13
001	121	11	10	13	17	Y	
002	160	15	12	14	15	Y	
003	84						

Extra vehicles joining back of queue

LVAL showing queue discharging during green period

Figure 17 - LVAL Screen

6. CUSTOMISING

This section deals with how to get the best out of a SCOOT system, incorporating the traffic engineering tools available. It also covers day to day running of the system.

6.1 Cycle times

If the best is to be obtained from SCOOT then each region should be examined to see what is the best maximum cycle time. In areas with large pedestrian activity it may be desirable to keep the cycle time low if pedestrians are not to get frustrated and cross on a red signal. In congested conditions SCOOT will very quickly increase the cycle time to the maximum permitted 120 seconds and will also be slow to bring the cycle time back down. Every region should have a maximum cycle time set in the timetable – if not set the default will be the maximum cycle time of the node with the lowest maximum cycle time. If in doubt, 96 or 104 seconds is a good start.

Most nodes in a region should be set to single cycling to start with. Any pelican nodes can be set to force double. If nodes are left to choose their own cycle time (release) the region cycle time may be higher than the maximum minimum practical cycle time of any one node. This is because SCOOT looks at the delays associated with each cycle time and may well decide it is better to double cycle say 7 out of 10 junctions in a region at 48 seconds and increase the other 3 to 96 seconds, when the highest MPCY is 72 seconds. This situation can often lead to "hunting" where several junctions are on the borderline of single/double cycling and consequently keep changing their own and the overall region cycle time. To avoid this, set nodes to be forced single or use the Node Double Cycle Group (NDCG - 8.163) facility available in versions 4.2 and later.

Pelicans can normally be left to force double cycle because:

They are not normally critical in traffic terms

There will often be no pedestrian demand when SCOOT allows the pedestrian window to come in.

There will be less delay for pedestrians.

Forcing a junction to double cycle will not automatically force the region cycle time to a value where it can occur. If for example the minimum cycle time of a node that is forced to double cycle is 44 seconds, then that node will only start to double cycle when the region cycle time reaches 88 seconds. At this point and above it will ALWAYS double cycle regardless of the MPCY the node suggests.

Look at the way the overall SCOOT network is behaving for cycle times in each region. It may be that the initial structure of each region can be redefined. If there are one or two junctions that always require a high cycle time in a region, can these be moved to a different region without upsetting the linking too much? The facility exists within the system to transfer nodes from one region to another by time of day using the NODT command.

If the link lengths to adjacent nodes are in excess of 200 metres then there will be little harm in transferring them to another region unless the flows are very high. Similarly, look at adjacent regions. If they are always using about the same cycle time, consider merging the two regions. Linking between regions will only occur if they are on the same cycle time, and upstream and downstream links have been defined.

Nodes that are the subject of a NODT command should be implemented onto SCOOT by a "SCOO Naaaaa" type command rather than by a SCOO Rb type command. It is possible that if a NODT and a SCOO region command were actioned at the same time in the timetable, the region would be placed on SCOOT before a node was transferred into it. Thus when the node arrived in the region after the transfer it would not be running on SCOOT control.

Morning or evening peaks can start very quickly. Hence SCOOT has a trend flag (TREN) which allows the region cycle time to climb faster than normal. SCOOT will normally try to optimise all links on a node at 90% saturation (the default value for ISAT). Anything higher than that and it will try to increase the cycle time. When the trend flag for a region is on then SCOOT will optimise at 80% saturation (the default value for TSAT). This encourages the cycle time to increase earlier. The trend flag (TREN) should be set to ON in the timetable about 20 minutes before the normal start of each peak. There should be a timetable event to set it to off about 20 minutes after each peak.

There is a similar facility to the trend flag that allows the cycle time to come down at the end of a peak period. This is called the fast down flag (FDWN). The fast down flag can be set to "YES" by timetable at about the time that the peak would normally be expected to end.

In version 4.2 and later, the frequency at which the optimiser runs is also user configurable. Hence improved reaction time can be achieved by increasing the frequency whilst greater stability can be achieved by decreasing the frequency.

6.2 Splits

Split weighting. SCOOT will normally try to equalise the degree of saturation at a node. If the node is a critical one in the cycle time optimiser then critical links will be trying to balance their degrees of saturation at 90%. In the rest of the network there would be many nodes that are running less than 90% saturated. In these cases there is "spare" green time to share around. Some of this waste may be on side roads which may be undesirable. To overcome this certain links can be encouraged to run at a particular degree of saturation, thereby giving the spare green time to other SCOOT stages.

On an arterial route by applying split weighting (SSAT/SMUL) to the side roads the green will be expanded on the main road thereby aiding progression.

Another use of this facility could be to discourage motorists from using a particular link i.e. rat running. By setting a degree of saturation above 100% a queue will be formed which does not completely clear with each link green. The maximum setting is 127%. SCOOT will always try and maintain that value so it should be possible in practice to achieve a particular length of queue. It is important when doing this to realise that if the queue should go beyond the detector, SCOOT will see congestion and try to resolve it. In these cases it is important to set the congestion importance factor to 0 if congestion is to be ignored.

Links that have had split weighting allocated to them will not contribute to the cycle time optimisation of each node.

Split Authorities. Authorities are the values that determine how much the split optimiser can vary stage lengths. Traditionally, a normal stage can be varied temporarily (i.e. just for this cycle) by 4 seconds in either direction at each stage change point. The permanent change corresponding to this is 1 second. For filter stages, the values are 2 seconds and 1 second. In some cases, Split is seen to be either too reactive or not reactive enough at each optimisation. This situation can be improved by use of the variable authorities facility, see section 3.3.2.

6.3 Default stage lengths

Should a detector become faulty the associated SCOOT stage will revert to the default setting. It is very important when fine tuning has been completed that default settings are calculated for different traffic periods of the day and entered into the timetable. If a detector is faulty then SCOOT will take the default value that is based on a 120-second cycle and then ratio it according to the current cycle time.

Ideally there should be at least three different sets of default stage lengths for each node. One for the AM peak, one for the OFF peak and one for the PM peak. The default stage length can be changed on line. It is recommended that all the CHAN DEFS commands are inserted into a CAST for a particular time of day. For example a CAST called AMPRAB (for the AM peak) could be actioned at 07:00 every day and contain suitable default settings for every node within region RAB.

To set up default stage lengths, first decide in advance the desired split for each stage at a 120-second cycle time. Then enter these values in turn, starting with the named stage. Do not attempt to change the length of the last stage in the cycle - the UTC system will automatically set this value based on the other default values. Also, do not attempt to set values that would violate the minimum and maximum stage length.

The CAST would also normally contain a command to set the IRCT (the initial region cycle time). This cycle time would be an appropriate cycle time for that time of day. This cycle time would only be used as a start up value if the SCOOT system was stopped and restarted during this time of day.

Note: There is one problem with changing IRCT that should be borne in mind. All nodes in a region must be capable of operating under the chosen IRCT. If a node was initially forced to double cycle and then an IRCT was chosen at which it can no longer operate double cycling this may then cause serious problems with the region cycle time optimisation. The solution is to set the cycling status of the node to FORCE RELEASE before the timetable event to change the IRCT. Remember that IRCT is only used at system start-up.

The best method of obtaining default stage lengths is to run the CDSL (calculate default stage lengths) program which takes the current plan times from the M16 message every cycle and averages it over 10 cycles. CDSL can be left "ON" all the time and snapshots taken which can then be input directly into a CAST.

The initial stage lengths on start-up are those input into the database under stage change times. These will be superseded if any timetable or CAST default stage lengths have been set up as described above.

Note: In systems where ASTRID is available and configured, historic profile data can be used for faulty links. If this option is chosen, there is no need to have default stage lengths as described ion this section.

6.4 Offsets

Offset weighting (OFWT). This allows more importance to be attached to a particular link. This means that SCOOT will try to achieve its own best offset for that link according to the level of weighting that has been set. A particular example of this would be to help progression into town in the morning peak and then on the opposing links in the evening to aid progression out of town. Generally this facility has not been used very much as SCOOT will normally give good offsets left to its own devices.

Offset biasing (BIAS) is used to achieve a value close to that held for the default offset (DFOF). The engineer would choose to use this where junctions are close together and the desire is to achieve a predetermined value (DFOF) for the offset. The maximum amount of BIAS (127) achieves a fixed offset but only if both up and downstream nodes have only 2 stages (useful for roundabouts). Good results are usually obtained by setting the bias to 126 in other circumstances. If the junctions are very close together, it may be better to treat them as one SCOOT node, see 6.5. Figure 19 shows a particular circumstance where offset bias would be useful.

Authorities. In a similar way to Split, the authority values for Offset can be set by the user. The traditional value is 4 seconds. This can be increased or decreased to achieve more or less reaction respectively. Refer to section 3.3.2 for more details on authorities.

6.5 Multi-nodes

This is a facility within the STC system that allows junctions and/or pelicans in close proximity to be treated as one SCOOT node. The offsets between these junctions are then fixed although they can be varied by time of day (translation plan). In these cases no detectors are sited between the junctions. A SCOOT stage on the node is then a collection of UTC events at each junction.

Example 1

J01111 001 N01111 {A 0}1, {B 20}2, {C 37}3

J01121 001 N01111 {A 0}1, {A 0, B 6}2

In this translation plan there are two junctions J01111 and J01121 which are both on one node N01111. Junction J01111 has 3 UTC stages the other has 2. The SCOOT node has been designed as three SCOOT stages. An offset of 6 seconds is desired between amber leaving stage 1 at J01111 and stage 1 at J01121. Each SCOOT stage corresponds directly with a UTC stage at J01111. When SCOOT stage 2 is started J01121 continues to send UTC 1 to the street for a further 6 seconds. This fixed offset is determined by the {A 0, B 6} element, this forces stage A from the start of stage 2 until stage B is forced 6 seconds later. J01121 will continue to run stage B until otherwise forced.

Example 2

The following data is derived from a pair of junctions. One of the junctions is on the eastbound carriageway of an arterial route, the other on the west bound. The two junctions are separated by 50 feet.

<u>Controller Timings</u>

J30741 J30731

From From

MIN	B	D	MIN	B	C	D

B	7	X	7	B	7	X	X	7
D	7	7	X	C	7	7	X	X
				D	7	7	7	X

Translation Plans SCOOT minimum stage lengths

Translation Plan 1 Stage 1 14

Stage 2 14

J30741 001 N30731 {B 0}1, {B 0,D 4}2 Stage 3 14

J30731 001 N30731 {B 0}1, {C 0}2, {D 0}3

<u>Explanation</u>

Figure 19 will help you to understand the intended operation of the multi-node. There are three SCOOT stages, the main road east/west, a southbound turning movement to the east and the north/south movement. In order to clear traffic waiting to turn in the second stage before the new traffic arrives there is a 4-second clearance period on the southern junction before the north/south movement starts on the northern junction.

Calculating the SCOOT minimum stage lengths for stages 1 and 3 is straightforward, stage 1 has to satisfy stage B on J30731, whilst stage 3 has to satisfy stage D on J30731. SCOOT stage 2 is a bit more complex. On the face of it SCOOT stage 2 would require 18 seconds for J30741 and 14 seconds for J30731. The 18 seconds being derived from B's minimum plus the 4 seconds fixed duration. However we know that B occurs in the previous SCOOT stage where the minimum stage length requirement is satisfied. Hence stage 2 can simply be derived from stage C on J30731.

Note: The minimum SCOOT stage length is derived from those UTC stage(s) which only occur during the SCOOT stage in question. This may leave a number of SCOOT stages whose minimum stage length is not clear. For these SCOOT stages work out which UTC stage minimums are not satisfied and in which SCOOT stages they can be satisfied. Make sure these are covered, bearing in mind that SCOOT will not accept SCOOT stage lengths lower than 7.

The setting up of a multi-node can be extremely complex, particularly in calculating the SCOOT minimum stage lengths. The beginner should certainly consult an experienced SCOOT engineer before attempting to set one up for the first time.

In the past it has often been necessary to inhibit model feedback on a multi-node. With the New InterGreen Modelling (NIGM) method, which handles intergreens on a per link basis rather than a per node basis, this should no longer be necessary. The NIGM CHAN/RUBA parameter (see 8.164) is used to turn the New InterGreen Modelling method on or off.

When NIGM is set to YES event messages, such as M35, will display the UTC stage numbers as the corresponding controller stages. Instead of displaying simply the pseudo stage number the new system will display it as e.g. 10/ABD meaning pseudo stage 10 which is stage A in the first controller, B in the second, D in the third. The order is that in which the controllers appear in the SEED Nxxxxx display. A dash means the controller is in intergreen e.g. 11/AB-.

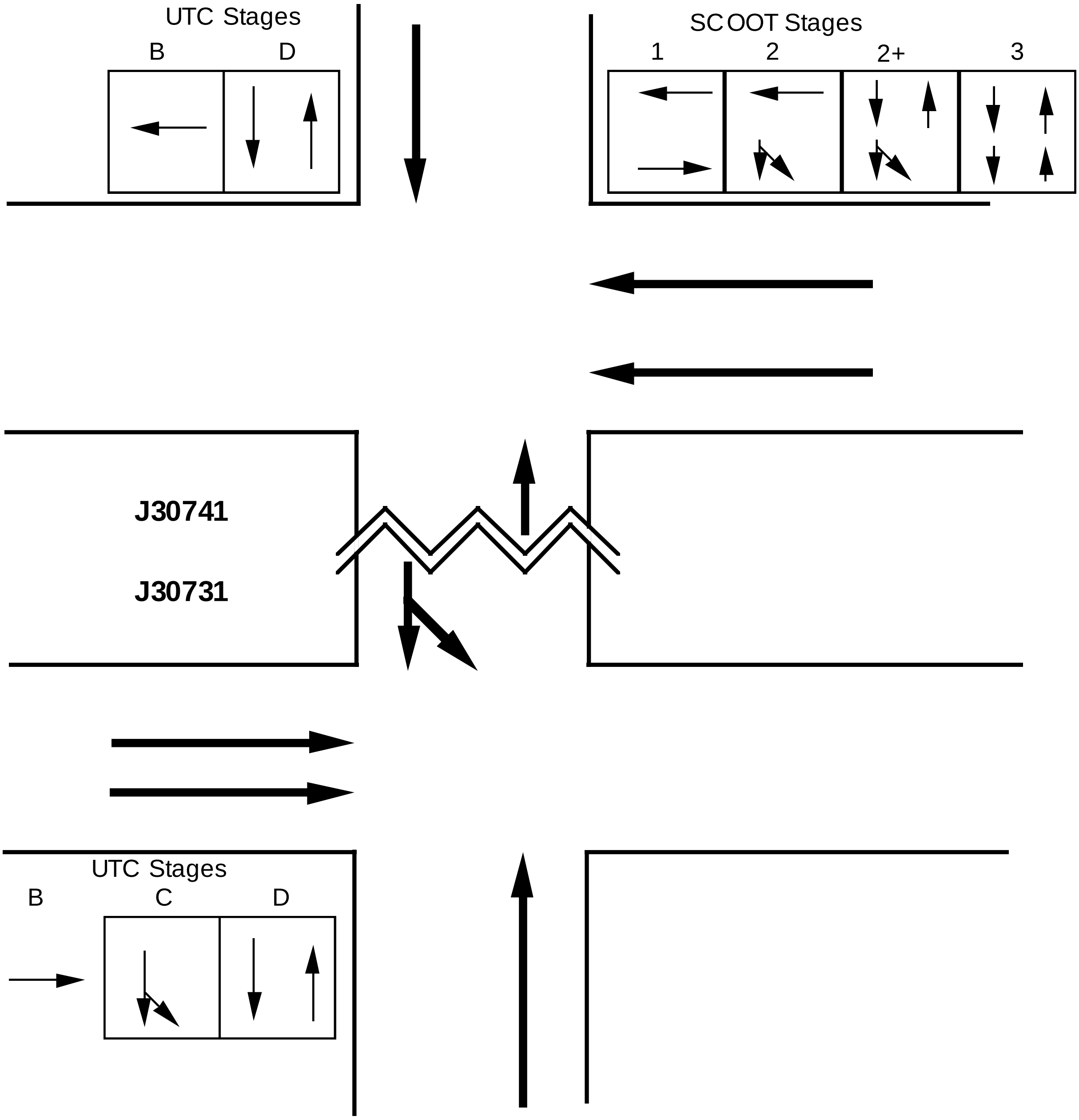


Figure 18 - Multi-Node Example

6.6 SCOOT and Roundabouts

6.6.1 Introduction

As more and more roundabouts become signalled there is increasing pressure to try and fit these into the surrounding signalled network for the purposes of linking, which inevitably means trying to make these work under SCOOT control. This section looks at the different types of roundabouts and suggests ideas that can be tried out. In most cases there is a solution given time and effort.

In the author's view roundabouts can be broken down into three types for signalling:

a) Signalling a roundabout or gyratory interchange with a Motorway.

b) Signalling large roundabouts or gyratories.

c) Signalling conventional roundabouts - say 50m diameter.

6.6.2 Motorway Roundabouts

These are probably the simplest of all to carry out SCOOT implementation. The distances apart of the internal stop lines are likely to be at least 50 to 100 metres. All of the conflict points will be dealt with by simple two-stage control. Each junction will be a SCOOT node and there will probably be no need for any special weighting such as link bias to try and hold specific offsets. Loops can be situated on the down ramps onto the Motorway to detect exit blocking. These could also be used to trigger gating and store traffic on one of the non-Motorway approaches.

Loops on the internal links can usually be sited after each exit from the roundabout, as the distances are large. On the Motorway exit ramps the loops should be at least 150m from the stop line and also have a high congestion importance factor such as 5 or 6 to trigger a quick clearance should the queue be in danger of affecting the Motorway.

Cycle times on these roundabouts can probably be allowed to run up to 96 with very few problems.

6.6.3 Large Roundabouts

As with Motorway roundabouts most of the junctions will be single nodes. Only where the roundabout is a distorted shape will it be necessary to consider forming a number of junctions into one multi node. If internal stop lines are less than say 50 metres apart then a multi node must be used or alternatively the internal stop lines combined together under a single method of control. With this type of roundabout it is quite likely that some form of link biasing will be used to try and maintain fixed offsets. Remember that fixed offsets in SCOOT will only work if both nodes have 2 stages. Care must be taken to ensure that not all internal links have been given link biasing as this will result in offsets chasing each other round to achieve the optimum.

The internal loop siting becomes critical at this type of roundabout. To obtain maximum distance from the stop line, the loops should be sited just in front of the upstream stop lines; perhaps one for each lane. Usually the lanes have specifically marked routes so the destination of traffic using each lane can be accurately predicted.

Cycle times are important with these types of roundabouts and should be kept as low as possible; perhaps no more than 80 seconds.

6.6.4 Small Roundabouts

Signalised roundabouts of less than say 50m diameter are hard to incorporate into a SCOOT system unless they are treated as one multi node or the original controller handles all internal offsets. Certainly there is no point in trying to site loops internally. The number of SCOOT stages on the multi node should be kept to an absolute minimum to try and keep the minimum stage length as short as possible. Cycle times have to be kept as short as possible preferably no more than 60 seconds. There should be at least 10 seconds degrees of freedom between the maximum and minimum cycle time to allow the offset and split optimiser room for manoeuvre.

The internal offsets on this type of control can be varied by time of day using different translation plans. Care should be taken in calculating the SCOOT minimum stage lengths, as the maximum of all the translation plans should be used.

6.6.5 General

On all types of roundabouts it is worth considering split weighting on most entries by time of day. With any circulating system it is important that internal links are kept free; use of split weighting can help to achieve this. Congestion importance factors should be implemented carefully; preference should always be given to internal links. Appropriate values would be 3 or 4. If there is any chance that the normal queue from the stop line is likely to queue back to the loop then the congestion importance factor should be set to 0.

6.7 Detectors

As SCOOT relies entirely on correct detector operation for its success, care should be taken to ensure that they are kept functioning correctly. If a detector goes faulty the SCOOT stage associated with that detector will revert to its default stage length for that time of day. SCOOT is continually checking whether a detector has gone faulty either by continuous occupancy (full intervals) or by no occupancy (empty intervals). If there has been no change in state of the detector for about 5 minutes (user configurable) that detector is set to "suspect". The associated stage will then start to revert to its default settings. If the detector starts working again then the detector is restored to "OK" and the optimisers start working again. If after about 30 minutes (user configurable) the detector is still "suspect" then SCOOT sets the detector to faulty and it then requires an operator or timetable command to reset the detector to OK.

In later versions of SCOOT, links can be inhibited from moving to defaults when faulty using the INLD parameter. A further alternative is available if ASTRID is available. Here the HDLP parameter can ask for a default profile to be extracted from ASTRID and used for the link during the faulty period.

It is recommended that there is an event in the timetable each day to reset all the detectors to OK. This will clear any detector faults that are intermittent or that maintenance engineers have repaired. It will also provide you with a list on the system log 30 minutes later of all the faulty detectors. This list should be checked daily and any new additions reported to the maintenance engineers. This is important, as it is very easy to forget and then find a backlog has to be cleared.

Modern detectors are very reliable and if care has been taken in installation and ducted feeders are used then it should be quite easy to maintain 99% availability of working detectors.

Some detector faults may not be apparent to the system. A detector may be going faulty and detecting too many or not enough vehicles. A program (CHDC see operator handbook) can be run at the same time each day (Monday to Friday) which stores the total discounted occupancy value for each detector. This then compares the new value with the previous base value and calculates the percentage difference. An adjust facility is available which allows the base line flow to be smoothed, see 8.2.

It is important that maintenance engineers are made aware of the sensitivity setting on the detector packs for SCOOT detectors. They should all be set to the same value (Siemens ST and Microsense set to 5), as SCOOT is measuring the length of time a loop is occupied. If the sensitivity is too low then the vehicle is not detected until it is well within the loop, if the sensitivity is too high then it is detected well before it enters the loop. An incorrect setting could well affect whether SCOOT sees congestion or even sees congestion when none occurs.

For the Sarasota MT38Z the setting should be switches 1 and 2 OFF, switches 3 and 4 ON. This will give a sensitivity setting of 0.08.

Another problem that has been found with SCOOT detection is the metal content of the road surface. This will give the appearance of short pulse lengths from the detector which is even more pronounced if the depth of cut is greater than 60 mm. If metal content in the road is known then it is recommended that the depth of slot be no greater than 40 mm.

The length of the feeder cable will also affect the inductance of the loop and result in short pulse lengths from the detector. Consideration should be given to siting a remote housing on any loop over 120m from the controller.

Some links may have very light traffic flows at particular times of day. In this case SCOOT may see the detector as faulty empty. To overcome this there is a facility within SCOOT to inhibit the checking of faulty empty by time of day. This is known as the Traffic Period flag (TRAF). This flag can be enabled/disabled on a per detector basis. Experience has shown that it is only necessary to set this parameter to check for faulty empty about one hour a day when there is maximum traffic in the network; say the evening peak between 5 and 6 p.m. Most detectors fail "full" if the loop is damaged. Experience has shown that faulty empty is an extremely rare occurrence.

Use of the W03 and W04 messages can indicate detectors that are regularly going suspect faulty and then clearing quickly.

6.8 Timetables

After a SCOOT system has been customised, the timetable for a typical weekday should look something like this:

00:01:00	PLAN	A01000	5	
00:01:00	ACAS	OPRAB		
00:01:00	SCOO	RAB		
00:01:00	CHAN	MAXC	RAB	96
02:01:00	CHCK			
06:30:00	ACAS	AMRAB		
06:30:00	CHAN	TREN	RAB	ON
06:30:00	PLAN	A01000	1	
06:30:00	CHAN	DSTS	N***	OK
06:40:00	CHDC			
07:15:00	CHAN	TREN	RAB	OFF

09:15:00	ACAS	OPRAB		
09:15:00	PLAN	A01000 2		
16:00:00	PLAN	A01000 3		
16:00:00	ACAS	PMPRAB		
16:30:00	CHAN	TRAF	ON N***	
17:30:00	CHAN	TRAF	OFF N***	
18:00:00	CHAN	FDWN	RAB	YES
19:00:00	ACAS	OPRAB		
19:00:00	PLAN	A01000 2		
19:00:00	CHAN	FDWN	RAB	NO

This example only deals with one sub area A01000 and one region RAB. In practice there will be a lot more than this and many events can be wild-carded. e.g. event 3 the SCOO event could be SCOO R*. This is the bare minimum number of events that should be placed in the timetable. The engineer may decide to change SCOOT parameters such as split weighting by time of day, there may be events to close car parks, switch secret signs, enable dial up terminals, etc. Refer to the Operator Handbook for all the commands that can be placed in the timetable. Events that all occur at the same time of day can be incorporated into one CAST. It is much simpler and quicker to add or delete an event from a CAST than to have to modify the timetable file and prepare it and then implement it.

The following paragraphs give a brief explanation of each event.

6.8.1 00:01:00 PLAN A01000 5

This event selects fixed time plan 5 for sub area 1. As there is a SCOO event at the same time this plan only runs in the "background" and would only take control if you implemented an XSCO command. There are a group of events all at the beginning of the day that will maintain control should the system be started up from scratch. In the event of a power failure the journal would be maintained from the previous day and these events would not be necessary. However in the unlikely event of a database update being carried out in the small hours of the morning the journal is automatically cleared, so it would be wise to maintain a set of events at 00:01:00.

6.8.2 00:01:00 ACAS OPRAB

This event actions the off-peak CAST for region RAB. This CAST would contain a set of CHAN commands to change all the default stage lengths appropriate for this time of day. It may also contain a CHAN for the translation plan if nodes were going to be modelled differently at night with, perhaps, stages removed or made demand dependent.

6.8.3 00:01:00 SCOO RAB

The SCOO event places all the nodes in region RAB on SCOOT control and supersedes the previous PLAN event. This time makes SCOOT fully operational 24 hours a day, unless there is an XSCO command elsewhere in the timetable.

6.8.4 00:01:00 CHAN MAXC RAB 96

This makes the maximum SCOOT cycle time in RAB 96 seconds.

6.8.5 02:01:00 CHCK

Starts the controller checks program.

6.8.6 06:30:00 ACAS AMRAB

Before the start of the morning peak a CAST is actioned which changes the translation plan if necessary, a new initial region cycle time and the default stage lengths to values appropriate for the morning peak.

6.8.7 06:30:00 CHAN TREN RAB ON

The trend flag is set for a faster response to a rapid rise in traffic flows.

6.8.8 06:30:00 PLAN A01000 1

The background plan for sub area 01000 is changed to plan 1.

6.8.9 06:30:00 CHAN DSTS N*** OK

All the detectors in the whole area are reset to "OK". Any that are definitely faulty will go suspect after 5 minutes and be reported as faulty on the system log after 30 minutes.

6.8.10 06:40:00 CHDC

This starts the SCOOT detector checking program and runs for one hour. You can then output the results to a printer with the DCOU command. The time the program is run may vary from one system to another but the engineer should choose a time of day when the flows are unlikely to vary much from the previous day and when congestion will not occur. Obviously there would be no point in running this program on Saturdays and Sundays.

6.8.11 07:15:00 CHAN TREN RAB OFF

The trend flag is reset to off. To leave it on may mean junctions running a higher cycle time than necessary, as they will be equalising their degrees of saturation at 80% instead of the normal 90%.

6.8.12 09:15:00 ACAS OPRAB

At the end of the morning peak an off peak CAST is implemented which changes the defaults to a value appropriate for the off peak situation.

6.8.13 09:15:00 PLAN A01000 2

The background fixed time plan for sub area 1 is changed to plan 2.

6.8.14 16:00:00 PLAN A01000 3

The background plan for sub area 1 is changed to plan 3.

6.8.15 16:00:00 ACAS PMPRAB

The CAST for the evening peak is implemented.

6.8.16 16:30:00 CHAN TRAF ON

The check for detectors becoming faulty empty is enabled. This is probably the best time of day to carry this out, as there is most traffic on the road.

6.8.17 17:30:00 CHAN TRAF OFF

After one hour the check for faulty empty is terminated. Any detectors that are faulty with this condition will have been reported on the log.

6.8.18 18:00:00 CHAN FDWN RAB YES

The fast down flag is set enabling the cycle time to come down quickly when the evening peak flow drops off.

6.8.19 19:00:00 ACAS OPRAB

The off-peak CAST replaces the evening peak defaults.

6.8.20 19:00:00 PLAN A01000 2

The background fixed time plan for sub area 1 is changed to plan 2.

6.8.21 19:00:00 CHAN FDWN RAB NO

The fast down flag is turned off.

6.9 SCOOT Link Greens

6.9.1 Methods of display in the UTC System.

The link green indicator shows when the SCOOT model is treating the link as effectively being green. This does not necessarily coincide with the associated signal stage showing green, particularly in the case of a filter link.

An MMI picture can show a link green as a line. The NFTD screen shows link green by placing a '+' sign after the link letter. The Link Green indication is derived from the M14 message. Since the M14 message is output every 4 seconds the change of link state from red to green or vice-versa could have occurred at any time within the preceding 4 seconds.

The model suspends for a link if:

(a) feedback is enabled, and

(b) a G bit is lost, and

(c) it is not possible for SCOOT to determine if the link will change colour.

The model catches up when a new G bit is detected. If the model has suspended, a number of M14 messages will come out at the same time.

The M31 message indicates an expected change of link colour because a G bit has changed.

6.9.2 Filter Links

In the case of filter (or historic) links the points at which the SCOOT model considers to have changed from red to green and from green to red may be significantly different from that which is seen on the street. These differences are caused by a number of delays that are inherent in the UTC System and the SCOOT modelling process. The length of green and its position relative to the measured occupancy (as seen in the M14 message) are important, not the exact start of green.

6.9.3 Phase Delays

Users should bear in mind the fact that the UTC System is stage based and that the existence of phase delays in a controller may effect the time that a green signal aspect appears or disappears on street.

6.9.4 Frequently Asked Questions

Q The NFTD display shows a link to be green all the time; what can I do?

A The SCOOT minimum stage length is too short. The System is not seeing the UTC stage confirm bit for long enough and hence model feedback is failing to work. This can be checked by turning off model feedback (CHAN MFBI N12345 YES) and seeing if the NFTD display shows the links as not being green all the time.

The M35 message may be used to find which stage is not confirmed, i.e. its minimum is too small. When this has been identified the appropriate minimum stage length should be increased until the problem is solved.

Q The NFTD display shows that a link never goes green.

A There are a number of possibilities:

a. The link is a demand dependant stage that is not called

b. The link is not configured to go green in any UTC stage in the current plan.

c. The stage minimum is too short for SCOOT to see the confirmation of green

Q SCOOT is making bad decisions.

A The link stage data is not able to model the street correctly. This may be caused by:

a. A database error

b. A correct database which is using the wrong method of control. In other words, the data may be an accurate representation of what the user wants to happen on the street but SCOOT is unable to control the junction in that way. See the example below:

```
A |-----------|
  |           |
B |-----------|----------|
        1          2
                 FIXED
```

SCOOT does not optimise for link B in stage 1 because it thinks that it can do so in stage 2 but cannot because stage 2 is a fixed length stage.

The way around this problem is to configure link B to run only in stage 1 and add a dummy link, say Z, which runs in stage 2. The end lag of link B can be then adjusted to accommodate the extra green needed for the original stage 2.

```
A |-----------|
  |           |
B |-----------|
  |           |
Z |           |----------|
       1           2
                 FIXED
```

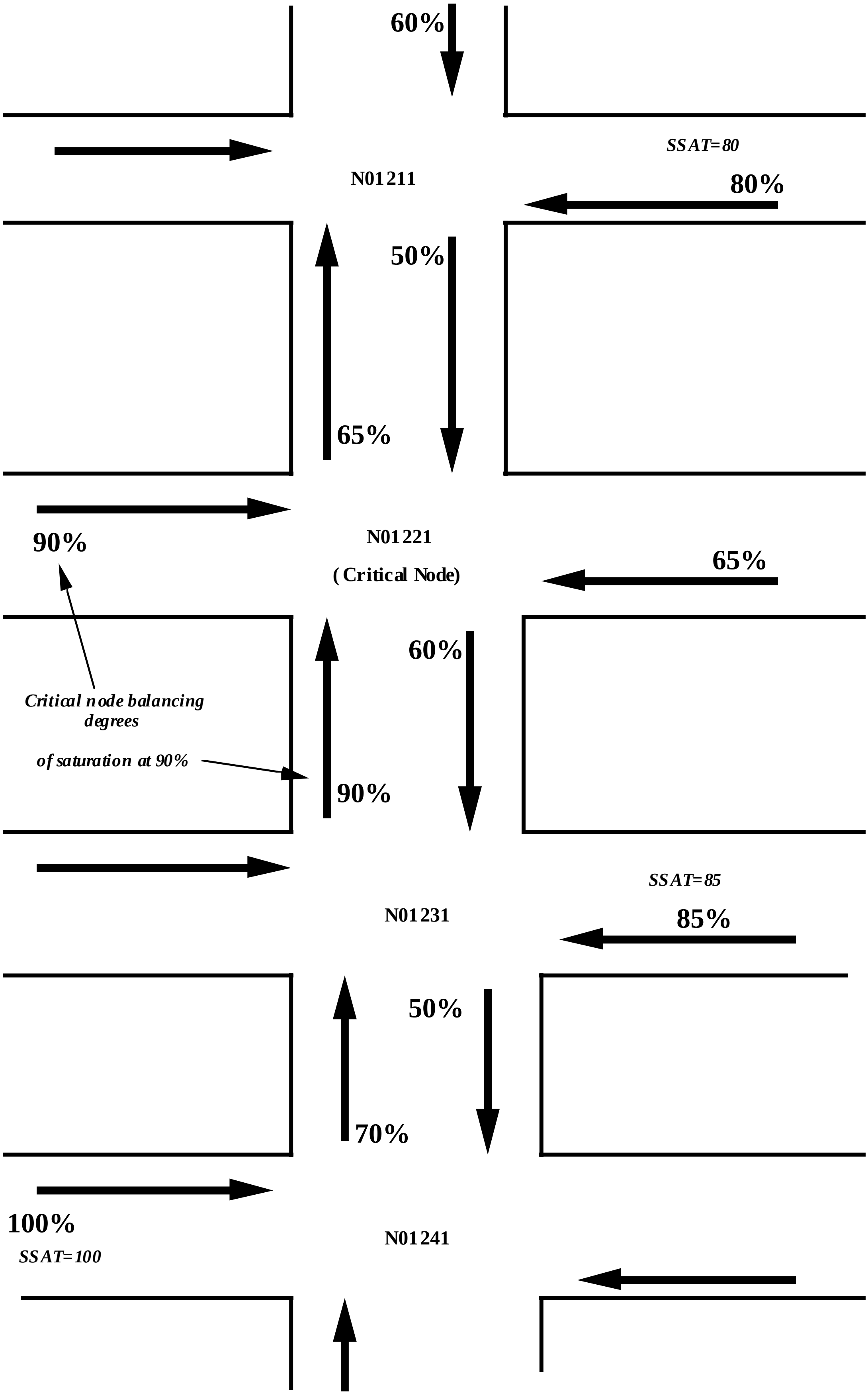


Figure 19 - Split Weighting

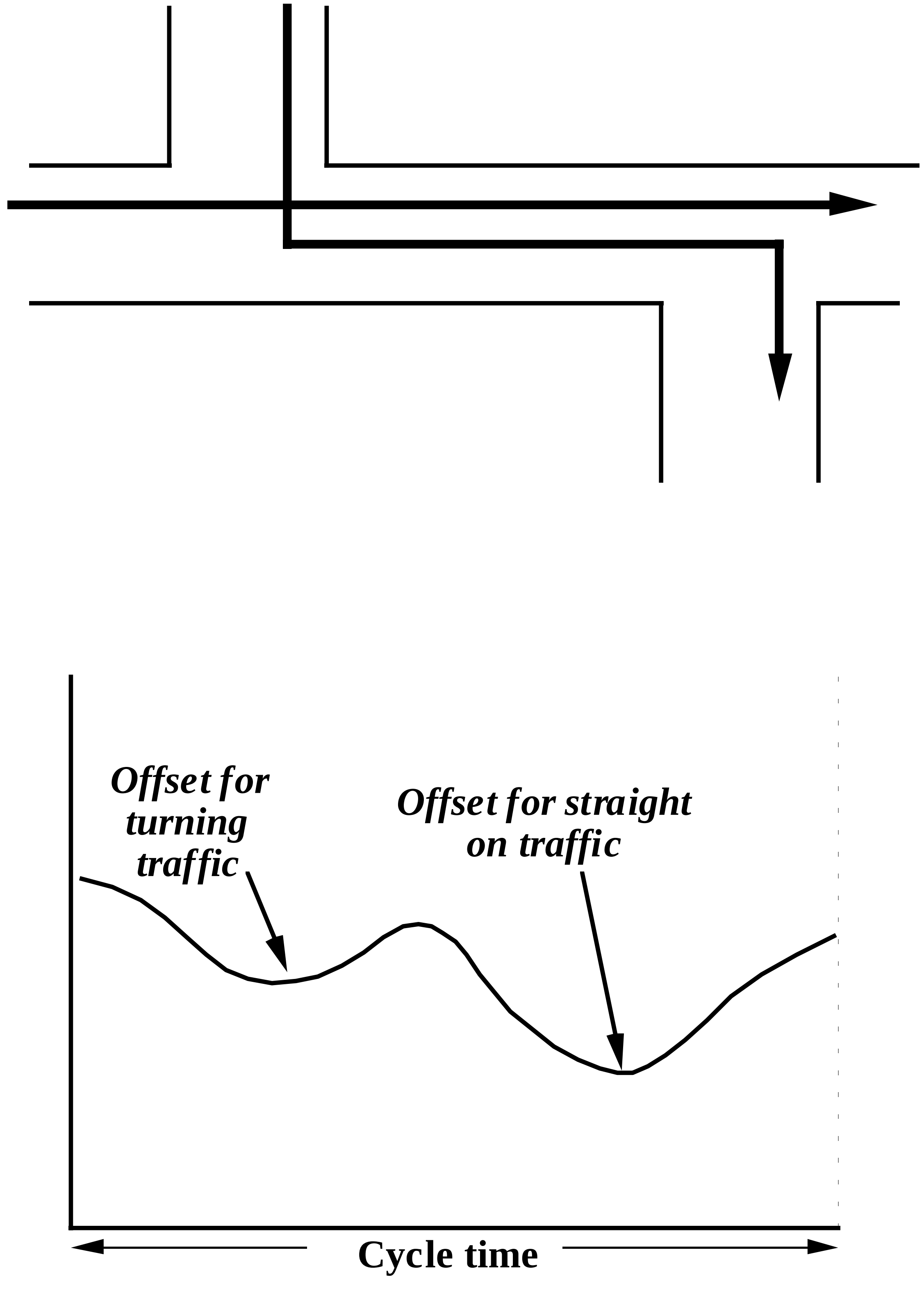


Figure 20 - Offset Bias

7. BUS PRIORITY

7.1 Introduction

Version 3.1 of SCOOT introduced facilities to provide bus priority. The design was such that the principles of SCOOT stage order and minimum/maximum stage lengths were preserved.

SCOOT MC3 extends the bus priority facilities to allow stage skipping and stage truncation.

Detection of buses can be either by inductive loops (or some other static detection methods that use a standard UTC data transmission interface) or via an Active Vehicle Location (AVL) system.

Priority for buses can be provided by extensions and/or recalls. An extension will be implemented when a bus is detected at a point on a link from which it could make use of the current green if this were held for a few seconds longer than usual, subject to a defined upper limit. A recall will be implemented when a bus is detected at a point on a link from which it is calculated that arrival at the stop-line will coincide with a red signal, i.e. the link is currently on red or a maximum length extension will not be sufficient to allow the bus to cross the stop-line. In this case the system will attempt to cycle the node as quickly as possible in order to return to a stage which provides green to the bus.

In order to achieve priority successfully, it is important for SCOOT to know the free flow journey time of a bus from the point of detection to the stop-line. This value can be measured on-street using traditional validation methods or calculated by other means, so long as the value used is reliable and consistent.

Providing bus priority in the manner described above is clearly disruptive to the normal traffic flows through the network, as the offset between the priority node and its neighbours will be disturbed. In order to address this problem, the system has a number of “recovery” methods that are used immediately after the passage of a bus. This allows the node to return to the correct offset for the prevailing traffic flows in an efficient manner.

7.2 Loop Detection

In order to use loop detection of buses, via the standard UTC data transmission system, the following parameters must be set up:

- The bus detection signal must be connected to an input on an OTU that is configured with a junction or pelican controller.
- The UTC database must be amended to include a BD (bus detector) reply bit associated with the relevant junction or pelican. A total of four BD bits (BD1.to.BD4) may be assigned to a junction or two BD bits to a pelican.
- The UTC database must be amended so that the SCOOT link on which the bus will be travelling when it is detected is associated with the relevant junction and BD bit as defined above.
- The free flow journey time of the bus from the detector to the stop-line must be measured and entered into the system.

Buses detected in this way are presented to SCOOT with average importance (3 out of 6).

7.3 AVL Detection

If AVL detection is to be used, the link between the AVL System and the UTC System will normally be commissioned by STC at the time of installation.

In order to create the correct data inputs to SCOOT for priority using AVL detection the following must be set up:

- The average cruise speed of the bus on the link must be measured and entered into the system.

Buses detected by AVL may have variable importance (0-6) if the supplying system is capable of differentiating in this way. If not they too should have importance of 3.

7.4 Standard Configuration (no skipping/truncation)

There are a considerable number of parameters that are available to the user that will affect the operation of bus priority. Some are essential to the successful operation of priority and must be set to the appropriate values. Others are optional and need only be used if required. All of the parameters used are described briefly below and are split into two sections on the basis of being either mandatory or optional parameters.

7.4.1 Mandatory Parameters

7.4.1(a) AVLL Area Level AVL Lag.

This parameter must be set if detection is via an AVL system. The value must be set to the average time taken in seconds from the detection of the bus on street until the data values are presented to the SCOOT interface. Typically this will be 1 or 2 seconds and will be calculated by STC when the UTC/AVL link is commissioned and proven.

7.4.1(b) BASP Link Level Bus Approach SPeed

This parameter is mandatory for AVL detection and is the average cruise speed in kph of the bus on the link.

7.4.1(c) BERL Node Level Bus Extensions and/or RecalLs

This parameter determines whether extensions and/or recalls will be allowed at a node. The possible values are EXTEND, RECALL, TRUNC, SKIP, CANCDET, EXTEND+RECALL (equivalent to STANDARD) .

7.4.1(d) BJNY Link Level Bus Journey time

This parameter is set up for loop detection as the cruise time from loop to stop-line.

7.4.1(e) BOFF Area Level Bus priority OFF

This parameter switches the bus priority either OFF or ON.

7.4.1(f) BPAN Node Level Bus Priority At Node

This parameter determines whether any priority should be allowed at a node. The possible values are OFF, ON and LIMBO (calculate optimum priority but do not implement). Set this to ON to enable priority.

7.4.1(g) BPFL Link Level Bus Priority FLag

This parameter defines for each link whether priority for buses is to be allowed. The values are INHIBIT, LATE only (used with AVL detection) and ALL.

7.4.1(h) BSEL Node Level Bus mode SELection

This parameter determines which of several modes bus priority will run in. The value should be set to ALL to enable priority to work.

7.4.1(i) DAVL Link Level Discard AVL data

This parameter specifies a value in seconds above which it is considered counter-productive to pass the detection of a bus by an AVL system onto SCOOT. This then allows the system to ignore very long (and hence variable) journey times and also parts of links that can be disruptive to a bus, e.g. due to parking.

7.4.2 Optional Parameters

7.4.2(a) BCTU Link Level Bus Cruise Time Uncertainty

This parameter is principally used with AVL detection but can also be used with loop detection. The value specified makes the system allow for a degree of variability in journey time along the link. If it is thought important to maximise the chances of a bus successfully making use of an extension when the journey time is sometimes greater than the expected value, this value can be set to add a number of seconds to the extension to “guarantee” that the bus gets through.

7.4.2(b) BEXR Node Level Bus EXtension Recovery method

This parameter selects one of the recovery methods for use after an extension has been granted. The possible values are:

DEFAULT	Allow SCOOT to select the appropriate method
NOTHING	Do not attempt any recovery
DEG_SAT	Run short stages subject to not exceeding a defined saturation level
LONG_STG	Run stages as long as possible until offset achieved
MIN_STG	Run stages as short as possible until offset achieved
MORL	Select the most efficient of MIN_STG and LONG_STG

7.4.2(c) BLAT Link Level Bus LATe Threshold

This parameter, used with AVL detection, defines in minutes the value determined as “late” for a bus on this link. It is used in conjunction with BOTT, BSLT and BVLT to determine the priority a bus should have depending on its variation from schedule. The values relative to schedule are between -9 (behind) and +9 (ahead). The value must lie between BSLT and BVLT.

7.4.2(d) BOTT Link Level Bus On Time Threshold

This parameter, used with AVL detection, defines in minutes the value determined as “on time” for a bus on this link. It is used in conjunction with BLAT, BSLT and BVLT to determine the priority a bus should have depending on its variation from schedule. The values relative to schedule are between -9 (behind) and +9 (ahead). The value must lie between +9 and BSLT.

7.4.2(e) BRER Node Level Bus Recall Recovery method

This parameter selects one of the recovery methods listed for BEXR for use after a recall.

7.4.2(f) BRSL Node Level Bus Recovery Saturation Level

If DEG_SAT is chosen as a recovery method, this parameter sets the maximum level of saturation that links can attain during recovery (maximum 200).

7.4.2(g) BSLT Link Level Bus Slightly Late Threshold

This parameter, used with AVL detection, defines in minutes the value determined as "slightly late" for a bus on this link. It is used in conjunction with BOTT, BLAT and BVLT to determine the priority a bus should have depending on its variation from schedule. The values relative to schedule are between -9 (behind) and +9 (ahead). The value must lie between BOTT and BLAT.

7.4.2(h) BVLT Link Level Bus Very Late Threshold

This parameter, used with AVL detection, defines in minutes the value determined as "very late" for a bus on this link. It is used in conjunction with BOTT, BSLT and BLAT to determine the priority a bus should have depending on its variation from schedule. The values relative to schedule are between -9 (behind) and +9 (ahead). The value must lie between BLAT and -9.

7.4.2(i) PMAX Node Level Priority Maximum for Extensions

This parameter specifies the total amount by which a stage can be extended (maximum 30).

7.4.2(j) SATE Node Level SATuration level for Extensions

If extensions are allowed, this parameter will only permit one to occur if the anticipated degree of saturation of the link remains below the level specified (maximum 200). This parameter is only valid in version 4.2 and earlier. In version 4.5 use the BESn parameters.

7.4.2(k) SATR Node Level SATuration level for Recalls

If recalls are allowed, this parameter will only permit one to occur if the anticipated degree of saturation of the link remains below the level specified (maximum 200). This parameter is only valid in version 4.2 and earlier. In version 4.5 use the BRSn parameters.

7.4.2(l) BES0-6 Link Level Bus Extension Saturation

If extensions are allowed, these seven parameters (for the seven levels of bus importance) will only permit one to occur if the anticipated degree of saturation of the link remains below the level specified (maximum 200). This parameter is only valid in version 4.5. In version 4.2 and earlier use the SATE parameter.

7.4.2(m) BRS0-6 Link Level Bus Recall Saturation

If recalls are allowed, these seven parameters (for the seven levels of bus importance) will only permit one to occur if the anticipated degree of saturation of the link remains below the level specified (maximum 200). This parameter is only valid in version 4.5. In version 4.2 and earlier use the SATR parameter.

7.4.2(n) BPER Area Level Bus PERiod

In version 4.5 this parameter sets the frequency of output of summary statistics event messages (maximum 60 minutes).

7.4.2(o) NOBP Node Level Node Offset Bus Pointer

In version 4.5 this parameter can be used to select an alternative set of offset authorities for use after bus priority has been granted. For details of authorities, see section 3.3.2.

7.4.2(p) NSBP Node Level Node Split Bus Pointer

In version 4.5 this parameter can be used to select an alternative set of split authorities for use after bus priority has been granted. For details of authorities, see section 3.3.2.

7.5 Stage Skipping

Stage skipping provides an additional level of complication in configuring bus priority. Before proceeding with any implementation it is advised that users read the SCOOT Traffic Handbook sections 0471 (Operational Guide to Stage Skipping) and 0482 (Functional Description of Stage Skipping).

In addition to configuring basic priority as described in the previous section, the following is required to enable skipping facilities.

7.5.1 Database Set-up

In SCOOT data preparation there is a node based option for stage skipping data. The object is to configure for each stage in the cycle, which other stages it is permissible to skip to. In setting up this data users should bear in mind prohibited stage moves and whether it is desirable to omit certain stages (e.g. pedestrians, main road).

Users will be aware that there are 6 SCOOT translation plans available in the system to allow different combinations of UTC stages to run at different times of day. As a result of this, stage skipping set-up needs to be on a per translation plan basis as some plans may not be suitable. Hence the from/to pairs described in the previous paragraph need to be established for each plan under which skipping is to be allowed.

7.5.2 Mandatory Parameters

7.5.2(a) BERL Node Level Bus Extensions and/or RecalLs

This parameter determines whether extensions and/or recalls will be allowed at a node. Its use has been extended to include stage skipping. The possible values are now EXTEND, RECALL, SKIP, TRUNC, CANCDET or any combination using the + sign, e.g. EXTEND+RECALL+SKIP. For stage skipping the minimum requirement is RECALL+SKIP.

7.5.2(b) SKIP Area Level Allow Stage Skipping

This is a system level parameter which can be used to enable and disable stage skipping. Values are YES and NO.

7.5.2(c) SKRM Node Level Skipping Recovery Method

This parameter determines which recovery method will be used after stage skipping has occurred. Possibilities are:

NONE	None (disables skipping at this node)
DN	Do not attempt any recovery
DS	Run short stages subject to not exceeding a defined saturation level
LS	Run stages as long as possible until offset achieved
MS	Run stages as short as possible until offset achieved
LSMS	Select the most efficient of MIN_STG and LONG_STG
ER	Extension or recall

7.5.2(d) SKIH Node Level Skipping Inhibit Period

This parameter determines the time in seconds which must elapse following completion of a stage skip before the next skip is permitted at the node. Range 0 to 3600. A value of 0 will disable skipping at the node. The parameter is Translation Plan based and so must be set for each plan in which skipping is to be allowed.

7.5.2(e) SKIC Node Level Skipping Inhibit Cycles

This parameter determines the number of cycles which must elapse following completion of a stage skip before the next skip is permitted at the node. Range 0 to 10. A value of 0 will disable skipping at the node. The parameter is Translation Plan based and so must be set for each plan in which skipping is to be allowed.

7.5.2(f) SKIT Stage Level Skipping Inhibit Times

This parameter determines the number of times the skipped stage(s) must be called following completion of a stage skip before the next skip is permitted at the node. Range 0 to 10. A value of 0 will disable skipping at the node. The parameter is Translation Plan based and so must be set for each plan in which skipping is to be allowed.

7.5.2(g) SKIF Node Level Skipping Inhibit Priority Level

This parameter sets the bus importance level below which skipping will not be allowed. For "simple" systems, buses default to importance 3 so set SKIF higher than this.

7.5.3 Optional Parameters

7.5.3(a) SKTS Link Level Skipping Target Saturation

This parameter sets the target percentage saturation for a bus detected on the link. If the degree of saturation on any link whose green is to be skipped is greater than the target saturation, stage skipping will not take place. Range is 0 (skipping inhibited) to 200 (unlimited). The parameter is Bus Importance based and so should be set for each of the importance levels (0-6) for which bus importance variations are expected.

7.5.3(b) SKID Node Level Skipping Priority Difference

This parameter sets the difference in priority level below which stage skipping is not allowed to benefit a bus at the node at the expense of another bus. Range 0 to 6. The parameter is Translation Plan based and so should be set for each plan in which skipping is to be allowed.

7.6 Stage Truncation

In addition to configuring basic priority as described in the previous section, the following is required to enable truncation facilities.

7.6.1 Mandatory Parameters

7.6.1(a) BERL Node Level Bus Extensions and/or RecalLs

This parameter determines whether extensions and/or recalls will be allowed at a node. Its use has been extended to include stage skipping. The possible values are now EXTEND, RECALL, SKIP, TRUNC, CANCDET or any combination using the + sign, e.g. EXTEND+RECALL+SKIP+TRUNC (equivalent to ALL).

7.7 Bus Priority Messages

There are some 49 SCOOT event messages relating to bus priority. Each is listed in the SCOOT Traffic Handbook. Some of these are particularly useful when configuring and observing the behaviour of the facility. Others are of lesser importance and are principally concerned with software diagnosis of operation. As far as most users of the facility are concerned, the list given below should suffice for most situations. A description of each of the messages listed below can be found in Section 9.7 of this document.

- B01 Node Level Bus optimiser over-riding SCOOT control
- B11 Link Level Extension Started (node level in prior to version 4.5)
- B12 Link Level Bus detected on a link
- B13 Link Level Bus leaves link
- B14 Link Level Summary of information for a bus after priority
- B17 Stage Level Stage Lengths during priority over-ride
- B18 Stage Level Stage Lengths before and after priority
- B24 Node Level Possible Extension (link level in version 4.5)
- B25 Node Level Possible Recall (link level in version 4.5)
- B26 Node Level Recovery started
- B27 Node Level Duration of bus optimiser override
- B30 Node Level Recall Started (link level in version 4.5)
- B52-54 Various Bus modelling statistics (version 4.5)
- B55-60 Various Bus optimisation statistics (version 4.5)
- B71 Stage Level Stage Truncation (MC3)

- X01 Node Level One or more stages have been skipped (MC3)
- X07 Link Level Reasons for denying stage skipping (MC3)

Of the above, B17 and B18 are mutually exclusive and provide a good indicator of when priority is active/inactive and the resulting effects on stage lengths.

8. USER PARAMETERS

8.1 Introduction

SCOOT has a significant number of facilities available for configuration by the user. Some of the data for these is input through the data preparation process as described earlier in this handbook. The majority of data is controlled on-line by the settings of user parameters.

This section lists all the available parameters in alphabetical order. With each parameter are a number of pieces of information. First are the commands that are permitted with the parameter. Note that not all commands are allowed with some parameters

The **VALU** command lists the on-line value for any of the parameters that follow. This is not necessarily the value that has been baselined (see below) as it may have been changed with a CHAN command

The **CHAN** command may be used to change the on-line value of a parameter. If this is allowed the letter '**C**' at the end of the line which contains the four letter parameter name.

If the letter '**B**' appears at the end of the line which contains the four letter parameter name this indicates that the parameter may be baselined. There are 4 commands which are associated with baselining and they are shown below:

RUBA - baseline a new value for a parameter. This value will take effect when the system is restarted by a reboot, after REIN or UPDA or after a GUBA command (see below).

LUBA - list the baseline value previously set with RUBA. No value will be listed if RUBA has not previously been executed for the SCN/parameter.

DUBA - list the differences between the baseline values and the on-line data.

GUBA - replace the on-line value with the baseline value.

An example of a command which may only be changed by a CHAN command is:

AELG Area End Lag C

An example of a command which may be changed by a CHAN command and which also may be baselined is:

BPAN (N) Bus Priority at Node CB

The other data presented with each parameter is:

Level - The type of SCN needed in the command. The first letter of the level (Area, Region, Node, Stage, Link, Detector) appears immediately after the mnemonic, e.g. STOC(L) Saturation Occupancy.

Version - The version of SCOOT in which the parameter is available. This will be specified after the mnemonic title, e.g. BPER (A) Bus Period [4.2]. If no version is specified, the parameter is either available in all versions or not directly associated with the SCOOT version.

Description - What the parameter is for.

Values - The allowable values for CHAN and RUBA.

Default - The default value if no CHAN or RUBA is entered.

It should be noted that not all CHAN and VALU parameters are listed here; some apply to UTC facilities and are described in the Operator Handbook (Ref: 1.3.2)

8.2 ADJU (A) Check Detector Counts Adjust Mode C

The Check Detector Counts (CDC) facility is used to identify potential problems with detectors. It can be scheduled in the timetable once a day (the CHDC command) and will run for one hour. At the end of that time a report can be examined (the DCOU command) which identifies where count values are significantly different from the norm.

When the CDC program runs with ADJU set to 'OFF', it uses an established set of base values to compare with current data to assess the detector performance. When ADJU is set to 'ON', the program recalculates its base values for each detector using a formula with a rolling average. The adjustment will take place provided that the newly acquired values lie within twenty percent of the accumulated base values. If ADJU is set to OVERRIDE, the base values are updated regardless of any discrepancy between the new and accumulated data. This setting is useful when first using the facility or if the base values are deemed to be out of date.

Values for CHAN/RUBA are: OFF, ON and OVERRIDE

Default: OFF

8.3 ADZQ - Allow Demand Dependent Zero Queue (A)

If YES then it allows the use of the demand dependent zeroise queue logic. This logic sets the queue on a demand dependent link to zero if it is not called. The default and recommended value is YES.

Values for CHAN are: YES or NO

Default: YES

Only available on systems licensed for SCOOT MMX or later.

8.4 AELG (A) Area End Lag C

This is the area-wide end lag in seconds. This value is added to the link end lag (ELAG) when determining the end delay for an individual link.

Values for CHAN/RUBA are: 0 to 15

Default: 3

8.5 AIEB (A) Allow Improved Exit Blocking CB

This Parameter enables or disables the improved exit blocking algorithm. A running average effective saturation occupancy is calculated through each green by factoring the validated value by the current estimate of exit blocking. This effective saturation occupancy will then be used in the model.

Only available on systems licensed for SCOOT MC3 or later.

Values for CHAN are : YES or NO

Default: NO.

8.6 ALBG - Allow Background SCOOT Mode (N)

Normally, when SCOOT control is turned off at a SCOOT node then SCOOT continues to model traffic flows at the node but doesn't make any adjustment to the SCOOT timings. When this parameter is set to YES then when ALL nodes in a region are off SCOOT control then SCOOT is made to run in a background mode on the selected nodes, whereby it can adjust the SCOOT timings in response to traffic flows even though its timings aren't being implemented on street.

Values for CHAN are:

'YES' Background SCOOT Mode allowed

'NO' Background SCOOT Mode disabled (default)

This has a number of benefits.

a) When SCOOT control becomes active - SCOOT will start out with a better set of timings than would otherwise be the case.

b) The ACCT facility can be used to enable or disable SCOOT in response to cycle time changes. When the cycle time falls to its minimum because the flows are low then SCOOT control can be turned on. When an incident occurs that results in unusually high flows at peak times then SCOOT can be enabled.

It should be noted that is an experimental feature and you should read the following to understand the limitations of this facility before enabling this parameter.

SCOOT is not a box into which you supply detector flows and out pops the ideal controller timings. It operates by continually making small changes which after a period of time results in the optimal timings according to the current situation as it models it. It is usually considered that its decisions are only meaningful if its timings are implemented on street because its decisions affect how the traffic subsequently behaves. However, if we consider that when SCOOT timings are not being implemented on street then effectively we can regard each node as a standalone entity because SCOOT decisions aren't affecting the flows of traffic between linked nodes. In other words, SCOOT should still be able to perform meaningful cycle time and split optimisations. Offset optimisations will not be effective and the lack of good offset will affect the other two values but nevertheless, the split and cycle time values calculated should approximate the optimal values.

In order to make SCOOT run in this mode, it is necessary to tell SCOOT that control is implemented (even though it isn't) and this will be reflected in SCOOT messages such as M35. In UTC applications where the node implemented status is shown, the status will be shown as 'background'. It is also necessary to run SCOOT with stage feedback inhibited. This means that SCOOT will not model links according to the actual controller stages but according to what SCOOT stage is being forced. This behaviour is only true whilst the background mode is active. As soon as SCOOT control returns, normal modelling behaviour is resumed.

By default, this facility is only licensed for use by ESS customers.

8.7 ALMS (A) Allow Area Link Maximum Saturation CB

This Parameter enables or disables LMS calculations for the Area.

Only available with SCOOT 6.1 (MMX SP1 or JTR GOLD).

Values for CHAN are : YES or NO

8.8 APVI - Allow Pedestrian Variable Invitation To Cross (N)

Allows the use of the pedestrian variable invitation to cross logic to run on the node. This logic allows the pedestrian stage green man time to be increased and/or the minimum practical cycle time to be reduced in response to increased pedestrian demand.

Values for CHAN are: YES or NO

Default: No

8.9 ASAL (A) Allow Stage Arrive Late Logic CB

This Parameter enables or disables the stage confirm arriving late logic.

When the SCOOT kernel detects the stage confirm arriving late or not at all, it will disable feedback for the affected stage. When the kernel detects the stage confirm arriving regularly, it will re-enable the feedback for the stage (subject to user allowing feedback).

Only available on systems licensed for SCOOT MC3 or later.

Values for CHAN are : YES or NO.

Default: NO.

8.10 ASLG (A) Area Start Lag C

This is the area-wide start lag in seconds. This value is added to the link start lag (SLAG) and the default intergreen (5 seconds) when determining the start delay for an individual link.

Values for CHAN/RUBA are: 0 to 15

Default: 2

8.11 ASTC (R) Allocate SCOOT Region to ASTRID Cell CB

This parameter allows the user to allocate a SCOOT region to an ASTRID cell. The ASTRID cell is represented by a 2 digit number where the first digit is the TCC number and the second digit the cell number on that TCC.

Values for CHAN/RUBA are: SCOOT region SCN and cell number.

This is a licenced facility.

Default Cell number: 00

8.12 **<u>AVLL</u> (A)** **AVL Lag** **CB**

This parameter must be set if detection for buses is via an Active Vehicle Location (AVL) system. The value must be set to the average time taken in seconds from the detection of the bus on street until the data values are presented to the SCOOT interface. Typically this will be 1 or 2 seconds and will be calculated by STC when the UTC/AVL link is commissioned and proven.

Values for CHAN/RUBA are: 1 to 15

Default: 0

8.13 **<u>BASP</u> (L)** **Bus Approach Speed** **CB**

This parameter is mandatory for bus priority if the detection is by an AVL system. It is the average cruise speed of the bus on the link in kilometres per hour (kph).

Values for CHAN/RUBA are: 1 to 127

Default: 30

8.14 **<u>BCTU</u> (L)** **Bus Cruise Time Uncertainty** **CB**

This parameter is used to allow for a degree of variability in bus journey time along the link. If it is thought important to maximise the chances of a bus successfully making use of an extension when the journey time is sometimes greater than the expected value, then this parameter can be set to add a number of seconds to the extension to “guarantee” that the bus gets through.

Values for CHAN/RUBA are: 0 to 10

Default: 5

8.15 **<u>BDDD</u> (L)** **Bus Detector Demand Delay** **CB**

This parameter determines whether and when a bus detection should impose a forced demand for the bus stage. This would be used where no suitable local detection for buses exists, e.g. on an exit from a bus station or park and ride site. When required, the value is set to the delay in seconds from receipt of a BD reply bit to the setting of DX/Dn control bits for the appropriate stage(s) for the bus. A value of -1 indicates the facility is not active.

Values for CHAN/RUBA are: -1 to 60

Default: -1

8.16 **<u>BDOL</u> (L)** **Bus Distance Optimisation Limit** **CB**

If non-zero, specifies the maximum distance from stopline at which a bus is included in optimisation. This allows the user to apply a fixed limit in addition to the automatic limitation applied by the software. This would normally be left at 0.

The parameter is used in the logic which allows bus journey times longer than the 30 seconds allowed prior to SCOOT 5.1.

Only available on systems licensed for SCOOT MC3 or later.

Values for CHAN are : 0 to 127

Default: 0

8.17 BERL (N) Bus Extensions or Recalls CB

This parameter determines whether extensions and/or recalls will be allowed at a node when bus priority is active.

For those Systems licenced for SCOOT MC3 the BERL parameter has been extended to allow stage skipping and truncation.

The parameter sets the strategies for the Bus Priority system to use. It may be one or more of the following.

EXTEND	(local and central extensions)
RECALL	(stage recall)
TRUNC	(truncate stages)
SKIP	(skip stages)
CANCDET	(allow cancel detection)

A combination of strategies may be specified by separating the modes with a comma (,) or plus (+) with no extra spaces. e.g. EXTEND+RECALL+TRUNC. The following modes are also provided for convenience.

STANDARD	Equivalent to EXTEND+RECALL.
ALL	Equivalent to EXTEND+RECALL+TRUNC+SKIP+CANCDET

The legacy value BOTH is also accepted and has the same meaning as STANDARD.

The TRUNC and SKIP modes are only available for use on systems licensed for SCOOT-MC3. Mode CANCDET is only available on SCOOT-MC3 SP1 (5.1). The SCOOT Traffic Handbook notes on this facility must be read before these modes are used.

Because of the assumptions that SCOOT makes on how the plan is going to be implemented, stage truncation must only be used in the following circumstances:

- It should only be used on SCOOT plans where strict plan compliance is observed. This is because UTC stages must run when they are expected to.
- All plan events should be simple comprising of no more than two events per SCOOT stage and no fixed length stage components.
- Demand windows should not be longer than 2 seconds.

Values for CHAN/RUBA are: EXTEND, RECALL, TRUNC, SKIP, or BOTH

Default: BOTH

8.18 BES0-BES6 (L) Bus Extension Saturation [4.5] CB

In version 4.5, buses can be accepted into SCOOT with one of 7 priority levels, 0-6. For most sources of buses, no priority is available, so a default of 3 is chosen by UTC. The BESn parameters are used to determine the percentage saturation of a link above which an extension will not be granted. It would be expected that the values from BES0 to BES6 would be increasing, i.e. level 6 would give priority at higher levels of saturation than any other levels.

Values for CHAN/RUBA are: 0 to 200

Default 0

8.19 BEXR (N) Bus Extension Recovery CB

This parameter is used to select a recovery method for use after an extension has been granted to give bus priority.

Values for CHAN/RUBA are:

DEFAULT	Allow SCOOT to select the appropriate method
NOTHING	Do not attempt any recovery
DEG_SAT	Run short stages subject to not exceeding a defined saturation level
LONG_STG	Run stages as long as possible until offset achieved
MIN_STG	Run stages as short as possible until offset achieved
MORL	Select the most efficient of MIN_STG and LONG_STG

Default: DEFAULT

8.20 BIAS (L) Offset Biasing CB

As the BIAS is increased for the link, the likelihood of the offset moving towards the default offset (DFOF) is increased. The relationship is non-linear - See SCOOT Traffic Handbook, section 474-12. The value of 127 is to be avoided, as this does not achieve the effect of a “fixed” offset that was intended.

Values for CHAN/RUBA are: 0 to 127 (really 0 to 126)

Default: 0

8.21 BJNY (L) Bus Journey Time CB

This parameter is set up during validation for loop detection of buses and is the free flow cruise time in seconds from the loop to the stop-line.

Values for CHAN/RUBA are: 5 to 127

Default: 127

8.22 BJT2 (L) Bus Journey Time from 2nd Trigger Point CB

When used with the ACIS RTIG gateway interface, this parameter specifies the time the bus is expected to take to reach the stop line from the "Request" trigger point. If BJT2 is set to 0, the Request trigger point is ignored. The BJNY parameter specifies the bus journey time from the "Register" trigger point.

8.23 BLAT (L) Bus Late Threshold CB

This parameter, used with AVL detection, defines in minutes the value determined as "late" for a bus on the link. It is used in conjunction with BOTT, BSLT and BVLT to determine the relative importance of a bus depending on its variation from schedule. The values relative to schedule are in the range +9 (ahead) and -9 (behind) minutes. The value of this parameter must lie between BSLT and BVLT.

Values for CHAN/RUBA are: -9 to 9

Default: -4

8.24 BLCD (L) Bus Link has Cancel Detection CB

If YES, this link has bus cancel detection.

Cancel detection indicates that the bus has left the link, or is just about to do so, and that any bus priority for that bus may be cancelled.

Only available on systems licensed for SCOOT MC3 or later.

Values for CHAN are : YES or NO

Default: NO

8.25 BLNK (L) Bottleneck Link [Up to 4.2] C

This parameter defines whether this link has a bottleneck link to be used when gating is active. This parameter is also configured in data preparation.

Note: BLNK is VALU only in version 4.5

Values for CHAN are: Link SCN, 0

Default: 0

8.26 BLSD (L) Bus Link has Secondary Detection CB

If the parameter is YES, this link has bus secondary detection.

A secondary detection causes SCOOT to update its information about an existing bus and not to generate a new bus.

Only available on systems licensed for SCOOT MC3 or later.

Values for CHAN are : YES or NO

Default: NO

8.27 **<u>BOFF</u> (A)** Bus Priority Off CB

This parameter is used to switch bus priority off for the whole network.

Values for CHAN/RUBA are: YES and NO

Default: NO

8.28 **<u>BOTT</u> (L)** Bus On Time Threshold CB

This parameter, used with AVL detection, defines in minutes the value determined as "on-time" for a bus on the link. It is used in conjunction with BLAT, BSLT and BVLT to determine the relative importance of a bus depending on its variation from schedule. The values relative to schedule are in the range +9 (ahead) and -9 (behind) minutes. The value must lie between +9 and BSLT.

Values for CHAN/RUBA are: -9 to 9

Default: 0

8.29 **<u>BPAN</u> (N)** Bus Priority at Node CB

This parameter determines whether any bus priority should be allowed at a node.

Values for CHAN/RUBA are: OFF, ON and LIMBO (calculate but do not implement)

Default: OFF

8.30 **<u>BPER</u> (A)** Bus Priority Period [4.5] CB

Version 4.5 contains new event messages with bus priority summaries/statistics. The BPER parameter determines the interval (in minutes) at which these messages appear.

Values for CHAN/RUBA are: 0 (defaults to 5), 1-60

Default: 0/5

8.31 **<u>BPFL</u> (L)** Bus Priority Flag CB

This parameter determines for each link whether priority for buses is to be allowed. It also allows only late buses to be given priority (provided detection is through an AVL system and this information is available from it).

Values for CHAN/RUBA are: INHIBIT, LATE and ALL

Default: INHIBIT

8.32 **<u>BRER</u> (N)** Bus Recall Recovery Method CB

This parameter is used to select a recovery method for use after a recall has been granted under bus priority. This parameter works in the same way as BEXR.

Values for CHAN/RUBA are:

DEFAULT Allow SCOOT to select the appropriate method

NOTHING	Do not attempt any recovery
DEG_SAT	Run short stages subject to not exceeding a defined saturation level
LONG_STG	Run stages as long as possible until offset achieved
MIN_STG	Run stages as short as possible until offset achieved
MORL	Select the most efficient of MIN_STG and LONG_STG

Default: DEFAULT

8.33 BRS0-BRS6 (L) Bus Recall Saturation [4.5] CB

In version 4.5, buses can be accepted into SCOOT with one of 7 priority levels, 0-6. For most sources of buses, no priority is available, so a default of 3 is chosen by UTC. The BRSn parameters are used to determine the percentage saturation of a link above which a recall will not be granted. It would be expected that the values from BRS0 to BRS6 would be increasing, i.e. level 6 would give priority at higher levels of saturation than any other levels.

Values for CHAN/RUBA are: 0 to 200

Default 0

8.34 BSEL (N) Bus Mode Selection CB

This parameter determines which of several modes bus priority will run in. Most of these are for test purposes and can be ignored. The value should be set to ALL to enable priority to work effectively.

Values for CHAN/RUBA are one or more of the following :

NONE, MULTI, QUEUE, HOLD,

LONGJ (long jnyt disable),

SRECD (strict recall disable),

RCANC (real cancel detection)

ALL

This Parameter specifies a pattern of selections for bus priority.

To specify a combination of selections separate the modes with a comma (,) or plus (+) with no extra spaces. e.g. MULTI+HOLD (formerly MHOLD) or MULTI+QUEUE (formerly MQUEUE).

Mode ALL is equivalent to:

MULTI+QUEUE+HOLD+LONGJ+SRECD+RCANC

For SCOOT 5.1, three extra selections are available :

Disable long bus journey time

Disable strict recall

These values would normally be not set.

Real cancel detection

With this value set, a cancel detection is taken to indicate that the bus has crossed (or will shortly cross) the stopline regardless of colour of lights.

With this value not set, a cancel detection is taken to indicate that the bus has crossed (or will shortly cross) the stopline provided that the lights are currently modelled as green. If the lights are currently modelled as red, the bus is taken to be positioned at 1 second from the stopline and will be modelled as stopped by the lights.

Default: NONE

8.35 BSLT (L) Bus Slightly Late Threshold CB

This parameter, used with AVL detection, defines in minutes the value determined as “slightly-late” for a bus on the link. It is used in conjunction with BOTT, BLAT and BVLT to determine the priority a bus should have depending on its variation from schedule. The values relative to schedule are between -9 (behind) and +9 (ahead). The value specified must lie between BOTT and BLAT.

Values for CHAN/RUBA are: -9 to 9

Default: -2

8.36 BTSM (L) Bus Traffic Signal Movement CB

When used with the ACIS RTIG gateway interface and in conjunction with the BTSN (Bus Traffic Signal Number), this parameter is used to define a look-up table to convert the traffic signal number and movement provided by the ACIS system to a SCOOT link.

Values for CHAN/RUBA are 0 to 31

Default: 0

8.37 BTSN (L) Bus Traffic Signal Number CB

When used with the ACIS RTIG gateway interface and in conjunction with the BTSM (Bus Traffic Signal Movement), this parameter is used to define a look-up table to convert the traffic signal number and movement provided by the ACIS system to a SCOOT link.

Values for CHAN/RUBA are 0 to 16383

Default: 0

8.38 BVLT (L) Bus Very Late Threshold CB

This parameter, used with AVL detection, defines in minutes the value determined as “very-late” for a bus on the link. It is used in conjunction with BOTT, BSLT and BLAT to determine the relative importance of a bus depending on its variation from schedule. The values relative to schedule are between -9 (behind) and +9 (ahead). The value specified must lie between BLAT and -9.

Values for CHAN/RUBA are: 9 to -9

Default: -8

8.39 CATR - Calculation Trigger (R)

This is one of the SCOOT cycle time independence trigger configuration parameters. This specifies the type of delay calculation(s) to be performed.

Best results can be obtained by using the COMPLEX trigger method. The reasons for choosing SIMPLE over COMPLEX are that SIMPLE has a lower CPU load. BOTH allows the results of SIMPLE and COMPLEX to be compared. Note, the root trigger (ROTR) should be set to a compatible value in order for cycle time independence triggering to occur.

Values for CHAN are: NONE, SIMPLE, COMPLEX, BOTH

The default and recommended setting is **COMPLEX**.

Only available on systems licensed for SCOOT MMX or later.

8.40 CDEF (S) Calculated Default Stage Lengths

Lists the calculated default stage lengths on a node if the automatic calculation of default stage lengths is turned on by CDSL. Values from CDEF may be input to a CAST using the CHAN DEFS command.

8.41 CDSL (A) Calculate Default Stage Lengths C

This starts the automatic calculation of default stage lengths on all nodes in the system. The last 10 readings for the stage length are taken from the M16 message and averaged. The results are ratioed to a 120 second cycle time.

Values for CHAN are: ON and OFF

Default: OFF

8.42 CFBI (N) Cycle Feedback Inhibit Flag CB

This flag determines whether actual stage reply information is taken into account by the Cycle Time optimiser.

Values for CHAN/RUBA are: YES and NO

Default: NO

8.43 CGIF (L) Congestion Importance Factor CB

This factor is applied to each link according to the importance of congestion appearing on the link and how quickly it should be dealt with. The degree of congestion on a link is determined from the number of congested intervals each cycle. A detector has to be continuously occupied for the whole of a SCOOT interval (4 seconds) for one congested interval to be recorded. Using a combination of the number of congested intervals and the value of the congestion importance factor, SCOOT then weights the green split in favour of that link. If the inhibit maximum queue check (INMQ) has not been set then congestion will only be considered if the queue in the model is more than 50% of the maximum queue value. The typical use of values of importance is as follows:

0 insignificant entry links, small side road

1 minor entry links

2 major entry links

3 main road normal links

4 important main road links

5 important links which must be kept clear

6 critical links to avoid exit blocking

7 top priority rarely used

The allocation of values to links is very much in the hands of the traffic engineer, but the above is offered as a guideline. Very short links, where the normal queue at red for the signals is likely to be stationary on the loop should be set to 0 and if necessary a loop sited for congestion further back upstream.

Values for CHAN/RUBA are: 0 to 7

Default: 0

8.44 CGOF (L) Congestion Offset CB

Sets the ideal value that the offset optimiser should move to if congestion occurs on the link. The amount of weighting is applied by the use of CGWT; see section 8.45.

Values for CHAN/RUBA are: -127 to 127

Default: 0

8.45 CGWT (L) Congestion Weighting CB

The congestion weighting for a link. This parameter is used by the offset optimiser to determine how strongly to move towards the congestion offset (CGOF) when a link is congested.

Values for CHAN/RUBA are: 0 to 255

Default: 0

8.46 **CHDI** (L) Cycle Time Historic Data Inhibit CB

If profile data from ASTRID is not to be used by the cycle time optimiser for the link, then this parameter should be used.

Values for CHAN/RUBA are: NO (use profile data) YES (do not use profile data)

Default: YES

8.47 **CLAM** (A) Cycle Time Optimisation Lambda Factor CB

This is the extent to which demand dependent stages are taken into account. A default of 100 means that the cycle time optimiser assumes that all demand dependent stages are always called. A value of 0 means the assumption is that there are never any demands.

This is very much an experimental parameter and should be used with great care.

Values for CHAN/RUBA are: 0 to 100

Default: 100

8.48 **CLAS** (L) Link Class CB

This parameter determines whether a link is to model normal traffic or bicycles.

Values for CHAN/RUBA are: VEHICLE and BICYCLE

Default: VEHICLE

8.49 **CLIF** (L) Congestion Link Importance Factor CB

This is the congestion importance factor allocated to a congestion link. It operates the same way as CGIF see 8.43.

Values for CHAN/RUBA are: 0 to 7

Default: 0

8.50 **CLNK** (L) Congestion Link C

This is a link that provides additional congestion information for another downstream link. If congestion occurs on either or both links the congestion term is included in the split optimiser for the link. For more information on congestion see section 2.5.

Note: this value is also configurable in data preparation.

Values for CHAN are: 0 and Link SCN

Default: 0

8.51 **CLUS** (L) Cluster of Trigger Link [4.5] CB

In Version 4.5, gating is activated by one or more links in a cluster. This parameter determines which cluster the trigger link belongs to. Gated links are assigned to clusters using GCLU.

Values for CHAN/RUBA are: 0 (not used), 1 to 100

Default: 0

8.52 **CLWT** (L) Congestion Link Weighting CB

This is the amount by which congestion is weighted when it occurs on a congestion link. This is similar to congestion weighting for offset but applies to strength of the congestion term in the split optimisation.

Values for CHAN/RUBA are: 0 to 255

Default: 0

8.53 **CMJI** (R) Cycle Time Minimum Jump Inhibit [4.2] CB

In version 4.2, an increase in the value of MINC or a decrease in the value of MAXC will cause the cycle time optimiser to jump to the specified value rather than stepping through the intervening SCOOT cycle times as in previous versions. The CMJI parameter allows the user to retain the step change method if required.

Values for CHAN/RUBA are: NO (allow jumps) and YES (step as before)

Default: NO

8.54 **COMP** (L) Composite Link [4.5] CB

In version 4.5, the supplementary detection facility is available. Links on a node which are to be part of this facility all need to be associated with a composite link. This is achieved using COMP. The composite link must be a link on the same node.

Values for CHAN/RUBA are: Composite Link SCN or 0

Default: 0

8.55 **CONN** (A) Configured Number of Nodes V

The output will show both the current total of configured nodes and the maximum number allowed under the SCOOT licence. For versions of SCOOT earlier than 4, there is no licence limit, and the maximum number permitted in the UTC software build is shown instead.

8.56 **CRTH** - Cycle Time Ratio Threshold (R)

This is one of the SCOOT cycle time independence trigger configuration parameters. This specifies the threshold of cycle time ratio at which calculations take place.

This can be set to a value below 100 to reduce the processing time of the delay calculations. The delay calculations will only be performed if the (would be) independent cycle time of the node or sub-region is less than CRTH% of the current cycle time.

Typically, it has not been found that the delay calculation processing to be significantly high so it is recommended that this parameter be left at it's default.

Values for CHAN are: 0 to 100 %

The default and recommended value is 100%.

Only available on systems licensed for SCOOT MMX or later.

8.57 CTFP (R) Cycle Time Forward Period [4.2] CB

ASTRID data can be used to influence the behaviour of the cycle time optimiser. Profile data for up to 1 hour in the future can be considered. The purpose of this would be to try and better predict the onset of peak periods and causes of other regular unusually large changes in demand. This parameter specifies the number of minutes of profile which are to be considered.

Values for CHAN/RUBA are: 0 to 60

Default: 0

8.58 CTOI (R) Cycle Time Optimiser Interval [4.2] CB

Traditionally, the cycle time optimiser has run every 5 minutes during normal operation (or 2.5 minutes during periods of increase and decrease). The interval in minutes can be varied with CTOI, either to be smaller (to make the optimiser more reactive) or larger (to make the cycle time more stable).

Values for CHAN/RUBA are: 2 to 10

Default: 5

8.59 CYFX (N) Cyclic Fixed Time C

The cyclic fixed time for a node is the total “lost” time to vehicles during the cycle. If set to zero, SCOOT will calculate the value by examining stage replies and intergreens.

Note that this value is also configurable in data preparation.

Values for CHAN are: 0 to 63

Default: 0

8.60 CYOS (R) Cycle Time Optimiser Status C

This is the parameter that enables and disables cycle time optimisation.

Values for CHAN are: OFF, ON and LIMBO (Calculate timings but do not implement)

Default: ON

8.61 DAVL (L) Discard AVL Data CB

This parameter for bus detection by AVL specifies a value in seconds for the journey time for a bus to the stop-line above which it is considered counter-productive to pass the data onto

SCOOT. This then allows the system to ignore very long (and hence variable) journey times and also parts of links that can be disruptive to a bus, e.g. due to parking.

Values for CHAN/RUBA are: 0 to 127

Default: 127

8.62 DCIG (N) Double Cycle Ignore [4.5] CB

This parameter allows the user to inhibit the contribution of a double cycling node from the decision process of the Cycle Time optimiser.

Values for CHAN/RUBA are: YES, NO

Default: NO

8.63 DDFL (S) Demand Dependent Optimisation Flag [4.5] CB

This parameter allows the user to ask SCOOT to optimise the best use of a demand dependent stage if the demand does not occur. Time will be given either to the previous or next stage.

Values for CHAN/RUBA are: YES, NO

Default: NO

8.64 DEFS (S) Default Stage Length C

Values for CHAN are for a single stage and must be between the minimum stage length and maximum stage length. The sum of all the default stage lengths for a node must add up to 120 seconds. The Default Stage Lengths can be used if detectors become faulty (see below). Changing the default stage length of one stage will automatically adjust the values of subsequent stages in the cycle. The default stage length for the stage that is two stages before the named stage is adjusted to correctly maintain the 120-second cycle time. The stage before the named stage cannot be directly changed by the CHAN DEFS command. Removed stages are not included in this calculation.

An example would be if there are 4 SCOOT stages at a node and the named stage is 3, then all stages except stage 2 can have their default stage lengths changed. Stage 2 will be automatically adjusted. The default stage lengths must be changed in order, starting with the named stage.

CHAN DEFS N12131/3 30

CHAN DEFS N12131/4 40

CHAN DEFS N12131/1 24

STAGE 2 will be automatically left with 26 seconds.

This value is normally changed by time-of-day and is used if a detector on a link is set faulty, when the main stage that that link discharges in reverts to its default setting. The value will be factored up or down from the base 120 second cycle time to the actual cycle time being implemented.

When a detector is faulty, the use of the default stage length depends upon the settings of parameters INLD and HDLP, which provide alternatives to the default value.

See section 6.3 for more information on setting up default stage lengths.

Note: Default Stage Lengths are initially calculated during database preparation.

8.65 DETL (D) Detector Lane Coverage CB

This parameter defines the number of lanes covered by a SCOOT detector. This is then used in the calculation of speed and journey time values that then contribute to the evaluation of link travel times.

Note: this parameter is not used by the SCOOT model

Values for CHAN/RUBA are: 1 to 2

Default: 1

8.66 DETU (D) Detector Used CB

This parameter sets the status of SCOOT detectors, either used or not used. The LNKU flag will be reset if no detectors on the link are used. The fault status of the detector will be reset. The link status will be corrected if a change of status is made to the detector. An example of the use of this facility would be in tidal flow systems.

Values for CHAN/RUBA are: YES and NO

Default: YES

8.67 DFOF (L) Default Offset CB

This is the default offset for a link. This parameter cannot be used for filter links. When a link is faulty (i.e. one or more detectors on the link are faulty) or when link bias is being applied, the offset optimiser will attempt to move the link offset towards this value.

This is the ideal offset that the link requires for good progression. It is important to realise that it represents the difference in time of the start of the SCOOT up node through stage for a link, to the start of the SCOOT down node through stage for the same link, less any time to clear a residual queue.

Values for CHAN/RUBA are: -127 to 127

8.68 DFSP (L) Default Speed C

This parameter specifies the speed that should be used for each link when the vehicle count for a link for a five minute is 0 or close to 0

Values for CHAN are 5 to 70 mph

Default: 50 mph

8.69 DLAG - Demand Dependent Lag (A)

Additional user specified lag to the appearance of green on street to allow for the clearance of a queue on the demand dependent link (see ADZQ).

The default and recommended value is 10.

Values for CHAN are: 0 to 10

Only available on systems licensed for SCOOT MMX or later.

8.70 DRSM - Delay Ratio Smoothing Factor (R)

This is one of the SCOOT cycle time independence trigger configuration parameters. This is the smoothing factor applied to the update of the delay ratio for a node or sub-region.

The delay ratio is the ratio of predicted delays when the node/sub-region is running at the region cycle time and at the independent cycle time. Values > 1.0 indicate that independence will yield less delays; when the delay ratio < 1.0 then this indicates non-independence is the better choice.

Values for CHAN are: 0 to 100 %

The default and recommended value is 90%

Only available on systems licensed for SCOOT MMX or later.

8.71 DSTS (D) Detector Status C

SCOOT detectors are marked as 'Suspect ' or 'Faulty' automatically by SCOOT. When a detector reaches the 'Faulty' state this is reported by SCOOT to the UTC system, where a fault message is output to all terminals configured for SCOOT messages. SCOOT uses the default stage lengths as its target for stages showing green to any links with detectors that are not 'OK. Alternatively, historic flow profile data stored in ASTRID may be used instead – see the HDLP (8.96) and CHDI (8.46) parameters.

Once marked as 'Faulty' the state can only be cleared by operator command. When an operator command is input to change the status to 'OK' (i.e. to clear the fault), the detector is marked initially as 'Suspect' and will change to 'OK' after a short time of normal operation, assuming the condition which caused the fault has been removed. When the detector stops being 'Faulty' a 'Fault Cleared' message is output by the UTC sub-system.

Values for CHAN are: OK, SUSPECT and FAULTY

8.72 DUDD (D) Faulty Detectors

Detectors will be named in the output from this command only if they are marked as 'FAULTY'.

8.73 ELAG (L) Link End Lag CB

This parameter alters the end lag for a link. The value when added to the area end lag will give the delay between the change of stage and the cessation of vehicle movement. This is the time between a SCOOT stage terminating and traffic on a link using that stage stopping. A typical value would be 0 seconds which when added to area end lag equates to the amber leaving period. If there are phase delays in operation on the controller then the link may well stay green for several more seconds after the termination of the SCOOT stage. The end lag is then increased by the appropriate amount.

Values for CHAN/RUBA are: -63 to 63

Default: 0

8.74 ETHR (A) Detector Empty Fault Threshold CB

This parameter sets the threshold in minutes above which a SCOOT detector which has shown continuous empty status will be considered faulty by the system.

Values for CHAN/RUBA are: 10 to 1440 (=24*60)

Default: 60

8.75 EXTD (L) Extension Duration CB

This parameter is used with bus priority. If extensions are to be given locally but nevertheless under SCOOT control, this value is the configured duration of the extension.

Values for CHAN/RUBA are: 0 to 63

Default: 0

8.76 FASM - FAC Smoothing Factor (R)

This is one of the SCOOT cycle time independence trigger configuration parameters. This is the smoothing factor applied to the update of FAC for sub-regions and nodes in this region.

FAC is the smoothed minimum delay factor. It is used to factor the average delay calculations to estimate what the actual current delay will be in practise.

Values for CHAN are: 0 to 100 %

The default and recommended value is 90%

Only available on systems licensed for SCOOT MMX or later.

8.77 **FCYT (R)** Forced Cycle Time C

FCYT must be between the minimum and maximum allowable cycle times for the region. FCYT is set to force the cycle time of a region to a particular value. If the optimiser is to be allowed to find its own cycle time again, FCYT must be disabled by setting MAXC and MINC to the desired limits for optimisation.

Values for CHAN are: 32 to 120 (only valid SCOOT cycle times allowed)

8.78 **FDWN (R)** Fast Fall in Cycle Time CB

If the flag is set to ON and the cycle time is falling then the cycle optimisation will operate at half its normal interval.

Values for CHAN/RUBA are: YES and NO

Default: NO

8.79 **FLEN (L)** Full Link Length [4.2] CB

This is the length in metres from upstream stop-line to downstream stop-line and is used in the estimation of emissions. It should not be confused with LLEN, which is the distance from detector to stop-line.

Values for CHAN/RUBA are: 0 to 9999

Default: 0

8.80 **FLST (N)** Filter Lower Target Saturation CB

This parameter specifies the lower target saturation value for filter links on a node. The value must be below FUST.

Values for CHAN/RUBA are: 0 to 200

Default: 40

8.81 **FMUL (L)** Filter Saturation Multiplier [4.5] CB

This parameter specifies for a filter link the degree of weighting to be applied when the saturation is above the threshold specified by FSAT.

Values for CHAN/RUBA are: 0 to 31

Default: 0

8.82 **FORC (N)** Forced Cycling Status for Node C

If FORC is set to 'Release' the Cycle Time Optimiser will single or double cycle the node as it sees fit. If FORC is set to 'Single' the node will only be run in single cycle mode. If FORC is set to 'Double' the node will be double cycled if the region cycle time permits it to do so. The cycle time will not be automatically increased just to accommodate a node that is forced to double cycle.

Note: the cycling and force status are also configured in data preparation.

Values for CHAN are: RELEASE, SINGLE and DOUBLE

Default: RELEASE

8.83 **FSAT** (L) Filter Saturation [4.5] CB

This parameter specifies for a filter link the percentage saturation above which the filter will receive positive weighting in the Split optimiser.

Values for CHAN/RUBA are: 0 to 255

Default: 0

8.84 **FTHR** (A) Detector Full Fault Threshold CB

This parameter sets the threshold in minutes above which a SCOOT detector which has shown continuous occupancy will be considered faulty by the system.

Values for CHAN/RUBA are: 2*SFTH to 120

Default: 30

8.85 **FUST** (N) Filter Upper Target Saturation CB

This parameter specifies the upper target saturation value for filter links on a node. The value must be above FLST.

Values for CHAN/RUBA are: 0 to 200

Default: 80

8.86 **GCAT** (L) Gating Cluster Active Threshold [4.5] CB

In Version 4.5, gating is activated by one or more links in a cluster. This parameter determines the percentage of trigger links in the cluster which must be active before gating begins. Changing GCAT for one link in the cluster will be effective. It is recommended that all such gating parameters for a cluster are changed on the same link for consistency.

Values for CHAN/RUBA are: 0 to 100

Default: 100

8.87 **GCIT** (L) Gating Cluster Inactive Threshold [4.5] CB

In Version 4.5, gating is activated by one or more links in a cluster. This parameter determines the percentage of trigger links which if active will prevent gating from stopping. Changing GCIT for one link in the cluster will be effective. It is recommended that all such gating parameters for a cluster are changed on the same link for consistency.

Values for CHAN/RUBA are: 0 to 100

Default: 0

8.88 **GCLU** (L) Gated Link Cluster [4.5] CB

In Version 4.5, gating is activated by one or more links in a cluster. This parameter determines to which cluster the gated link belongs. Trigger links are assigned to clusters using CLUS.

Values for CHAN/RUBA are: 0 (not used), 1 to 100

Default: 0

8.89 **GCON** (L) Gating Congestion Threshold [4.5] CB

In Version 4.5, gating can be activated based on congestion. This parameter determines the congestion threshold for a trigger link above which the trigger will be active.

Values for CHAN/RUBA are: 0 to 127

Default: 0

8.90 **GGAI** (L) Gate Gain CB

This parameter is used on a gated link. A value of +1 indicates that the green length on this link should decrease when the bottleneck link is over saturated. A value of -1 indicates the green length should increase.

Values for CHAN/RUBA are -1 to 1

Default: 0

8.91 **GLMG** (L) Gating Lower Minimum Green [4.5] CB

When gating is active and the gated link is expected to lose green (GGAI=1), this parameter can limit the extent to which the green time can be reduced. The lower minimum green limit applies when all triggers in a cluster are active.

Note: the value chosen should be the effective green length for the link, not the minimum stage length as in previous versions of gating.

Values for CHAN/RUBA are: 0 to 63

Default: 1

8.92 **GSAT** (L) Gate Saturation CB

The parameter is used to set the percentage degree of saturation for the bottleneck link above which gating should take place (0 indicates no gating should take place).

Values for CHAN/RUBA are: 0 to 255

Default: 0

8.93 **GSMO** (A) Green Smoothing Factor CB

This factor is used to smooth some values in the calculation of link green length when feedback is used. It is largely an experimental parameter and it is recommended that the value is not varied from the default.

Values for CHAN/RUBA are: 0 to 100

Default: 90

8.94 **GSTG - Stage Ghost Demand (S)**

This is for demand dependent stages. If YES then this nominates a stage that can be ghosted if the demand dependent stage is rarely being called; SCOOT omits the stage from the calculation of the cycle time but the stage is still given the opportunity to run.

Ghosting is not permitted (regardless of whether it is nominated)

- for the named stage

- for stages that have variable invitation-to-cross (PINV) enabled

- if the previous or next stage is currently ghosted.

It's use is not recommended on multi-controller nodes.

Values for CHAN are: YES or NO

Default is **NO**

Only available on systems licensed for SCOOT MMX or later

8.95 **GUMG (L) Gating Upper Minimum Green [4.5] CB**

This parameter sets the minimum green to be applied when only one non-faulty trigger link in a cluster is active, and there is at least one non-faulty link which is inactive. This value must be greater than or equal to the gating lower minimum green (GLMG).

Note: the value chosen should be the effective green length for the link, not the minimum stage length as in previous versions of gating.

Values for CHAN/RUBA are: 0 to 63

Default: 1

8.96 **HDLP (L) Historic Default Link Profiles CB**

The parameter is used only in conjunction with a system that includes ASTRID. It determines whether historic link profiles are requested from ASTRID for use on faulty links.

Changes to this parameter are not immediately sent to ASTRID. VALU HDLP will indicate 'YES PENDING' or 'NO PENDING' until the new value is in operation. This will typically take a few minutes.

Should you wish data from historic link profiles to be used but do not wish to see the messages which are output when the historic data is or is not being used then use the QUIET value for the parameter.

Values for CHAN/RUBA are: YES ,NO and QUIET.

Default: NO

8.97 **<u>HIST</u> (L)** Historic (ASTRID) Flow Profiles in Use

The VALU parameter HIST will show if historic link profile data is available from ASTRID and if it is being used. The possible values and their meanings are:

YES	Historic occupancy data exists and is being used on the specified link
AVAILABLE	Historic occupancy data exists and would be used if the link were to become faulty
NO	Historic occupancy data is not being used or not available

8.98 **<u>IACC</u> (D)** Interval Fault Accumulator

This parameter lists the interval fault accumulator for a detector, i.e. the current number of consecutive full or empty intervals. This value is then used by SCOOT along with the thresholds ETHR, FTHR, SETH and SFTH to determine the fault status of each detector.

8.99 **<u>IGFB</u> (N)** Enable Intergreen Feedback [MC3] CB

When Intergreen Feedback is enabled SCOOT will model greens from the actual green replies and will use smoothed values of observed intergreens in its optimisation routines.

Notes:

a) If IGFB is set to YES the start lag values for the links on the node may need to be modified. When IFGB is set to NO the start lag is measured from the end of the previous green and 7 subtracted from the observed value. When IGFB is set to YES the start lag is measured from the start of green and a value of 2 subtracted from the observed value.

b) IGFB should not be set to YES on multi-equipment nodes.

Values for CHAN/RUBA are: YES or NO

Default: NO

8.100 **<u>IGSM</u> (L)** Intergreen Smoothing Factor [MC3] CB

This parameter set the smoothing factor which is used when SCOOT updates its intergreen for a specific stage combination.

Smaller values result in less smoothing. 0 causes no smoothing, i.e. the latest intergreen is always recorded. The default value is 80 (20% of the new and 80% of the old). The M80 message can be used to show the update of smoothed intergreens.

Values for CHAN/RUBA are: 0 to 100%

Default: 80

8.101 **IMPL** (N) Implementation Status

This command shows the status of the NODE RLY IMPL and SCOOT NODE IMPL flags. These flags are set if stage replies are being received from a node and if the node is under the control of SCOOT respectively.

8.102 **INAL** (A) INGRID Alpha – Sensitivity of Current Method CB

This parameter changes the INGRID Alpha method sensitivity using the current method. Smaller values will make incident detection more likely

The current method looks for significant changes in traffic activity over a short time period.

This parameter is only available on Systems configured for INGRID V1.6 or later.

Values for CHAN/RUBA are: 0 to 10000

Default: 200

8.103 **INBE** (A) INGRID Beta – Sensitivity of Reference Method CB

This parameter changes the INGRID Beta method sensitivity using the historic method. Smaller values will make incident detection more likely

The historic method looks for significant differences between the current network activity and the typical network activity for the day and time as retrieved from the ASTRID profile data.

This parameter is only available on Systems configured for INGRID V1.6 or later.

Values for CHAN/RUBA are: 0 to 10000

Default: 200

8.104 **INCO** (A) INGRID Confidence Filter CB

The INGRID confidence value is derived from the length of time that an incident has been present. The INGRID confidence filter sets the confidence level, above which, an incident is reported.

This parameter is only available on Systems configured for INGRID V1.6 or later.

Values for CHAN/RUBA are: 1 to 5

Default: 200

8.105 **INCY** (L) Inhibit Cycle Time Optimisation CB

This allows a link to be removed from cycle time optimisation. Over saturated side roads where the decision has been taken to ignore congestion might have this flag set to ON. Similarly it is quite common to take pelican links out of the cycle time optimisation. If a region contains a number of pelicans their requirement to double cycle may well lead to many junctions running a higher cycle than necessary. One way of handling this would be to remove them from contributing to the cycle time optimiser.

Any links that have SSAT or INSP applied to them will automatically be removed from contributing to cycle time optimisation.

Values for CHAN/RUBA are: ON and OFF

Default: OFF

8.106 **INDF** (D) INGRID Detector Fault Status

This command shows whether a detector has been flagged as faulty by INGRID. The parameter also shows if a detector has been configured for use by INGRID and if INGRID has detected an incident at this detector.

This parameter is only available on systems configured for INGRID V1.6 or later.

8.107 **INFE** (A) INGRID Faulty Empty Limit CB

This is the time (in minutes) after which INGRID will flag a detector as faulty when the detector output contains all zeros.

This parameter is only available on systems configured for INGRID V1.6 or later.

Values for CHAN/RUBA are: 5 to 100.

Default is 10.

8.108 **INFF** (A) INGRID Faulty Full Limit CB

This is the time (in minutes) after which INGRID will flag a detector as faulty when the detector output is all ones.

This parameter is only available on systems configured for INGRID V1.6 or later.

Values for CHAN/RUBA are: 5 to 100.

Default: 10.

8.109 **INFG** (A) INGRID Detector Faulty Good Limit CB

This is the time (in minutes) after which INGRID will clear a detector fault when the detector output is neither all zeros or all ones.

This parameter is only available on systems configured for INGRID V1.6 or later.

Values for CHAN/RUBA are: 5 to 100.

Default: 10

8.110 **INFR**(A) INGRID Reporting Frequency CB

Normally INGRID will re-report an incident every minute whilst it is present. This behaviour may be modified with this parameter. This is the time (in minutes) after which INGRID will re-report an incident if it is still present. (0 has the same meaning as 1).

Note, if the incident status changes (e.g. the confidence level changes) then the incident will always be re-reported.

This parameter is only available on systems configured for INGRID V1.6 or later.

Values for CHAN/RUBA are: 0 to 99.

Default is 0.

8.111 <u>INKE</u> (A) INGRID Keep Flag C

This is the INGRID keep flag. This parameter should be left at 1.

This parameter is only available on systems configured for INGRID V1.6 or later.

Values for CHAN are: 0 to 1.

Default: 1.

8.112 <u>INLD</u> (L) Inhibit Link Defaults CB

This parameter allows inhibition of the Link Defaults, perhaps if the link is unimportant. Setting to YES will instruct the split optimiser not use the default for this link if it goes faulty.

Values for CHAN/RUBA are: NO and YES

Default: NO

8.113 <u>INMQ</u> (L) Maximum Queue Check Inhibit CB

In normal operation, when a detector is occupied for a four-second interval, there is a check to see if the queue in the SCOOT model is sufficiently far back along the link for congestion to be considered to exist. This is to avoid congestion occurring in the model due to, for example, temporary parking. However, when 'ON', this flag causes the link to be considered congested when the detector is occupied for a complete four second interval, even though the SCOOT model has a queue which is very much less than the maximum for that link. It should only be used on main roads and where parking over the loops is unlikely.

Values for CHAN/RUBA are: ON and OFF

Default: OFF

8.114 <u>INOF</u> (L) Inhibit Offset Optimisation CB

When set to "ON" this will prevent the link from contributing to the offset optimiser. This may be used when the engineer is trying to get good progression in the opposing direction, in which case BIAS would be in use for the opposing link.

Values for CHAN/RUBA are: ON and OFF

Default: OFF

8.115 INS0-INS3 (A) INGRID Severity Ranges CB

Severity Ranges. The severity of an incident is determined from the number of detectors affected by the incident. These parameters set the ranges to convert the number of detectors to a severity.

This parameter is only available on Systems configured for INGRID V1.6 or later.

Values for CHAN/RUBA are: 1 to 20

Default: 1, 3, 6, 9

8.116 INSE (A) INGRID Severity Filter CB

An incident will not be reported unless the severity is greater than or equal to this value. The severity is determined by the number of upstream and downstream detectors that are affected by the incident

This parameter is only available on Systems configured for INGRID V1.6 or later.

Values for CHAN/RUBA are: 1 to 5

Default: 1

8.117 INSP (L) Inhibit Split Optimisation CB

When set to "ON" the link will be prevented from contributing to the cycle time and split optimisers. If this is the only link associated with a stage then that stage will run down to the minimum stage length. If a detector on the link is faulty then setting INSP to "ON" will take the node off defaults and the split optimiser will be fully operative on that stage again.

Values for CHAN/RUBA are: ON and OFF

Default: OFF

8.118 INTH - Independence Threshold (R)

This is one of the SCOOT cycle time independence trigger configuration parameters. This parameter is the delay ratio threshold for specifying when a node or sub-region that is running non-independently should switch to running independently.

The delay ratio is the ratio of predicted delays when a node/sub-region is running at the region cycle time and at the independent cycle time. Values > 1.0 indicate that independence will yield less delays; when the delay ratio < 1.0 then this indicates non-independence is the better choice. With the default of 115%, SCOOT will switch a node or sub-region to independent when the delay ratio is greater than 1.15.

The default and recommended value is 115%.

Values for CHAN are: 101 to 999 %

Only available on systems licensed for SCOOT MMX or later.

8.119 **<u>IRCT</u> (R)** **Initial Region Cycle Time** **C**

IRCT is the initial value used for the cycle time of the region when the UTC system re-starts or after an UPDA or REIN. The value is also configurable in data preparation.

Values for CHAN are: 32 to 120

8.120 **<u>ISAT</u> (N)** **Ideal Node Saturation** **CB**

This parameter specifies the Ideal Target Saturation for the node. This value is used by the cycle time optimiser in deciding whether a node merits a change in cycle time.

Values for CHAN/RUBA are: TSAT to 200

Default: 90

8.121 **<u>ISGN</u> (N)** **Ignore Stage Green** **CB**

This enhancement to the Siemens implementation of SCOOT for handling multicontroller SCOOT nodes where SCOOT does not correctly model/optimise the splits because the link's UTC stage green information is not interpreted correctly.

When this parameter is set to YES, the SCOOT knitting software ignores the database entered stage greens and calculates new stage green information using the start/end stages entered on the SCOOT link/stage form. The net effect is to force the split optimiser to make its decisions using the link start/end stage data only.

The typical scenario where this might be needed is where the node has links where the effective green depends on the UTC stage of more than one controller/stream.

IMPORTANT: By ignoring the database entered stage green information, it is necessary to also turn off model and split feedback (MFBI = YES, SFBI = YES). This is not currently enforced as there may be rare occasions where feedback may still be valid.

This parameter should only be used by advanced and experienced SCOOT engineers.

Values for CHAN/RUBA are: NO and YES

Default: NO

8.122 **<u>JNYO</u> (L)** **Journey Time Offset** **CB**

The journey time offset in seconds is the measured journey time for a link excluding the part of the link between the detector and the stop-line, i.e. the time from upstream stop-line to the detector. This value is used when the UTC system is calculating link travel times.

Note: This value is not used by the SCOOT model**.**

Values for CHAN/RUBA are: -127 to 1000

Default: 0

8.123 JNYT (L) Journey Time CB

This is the journey time for a free flowing vehicle in a platoon from the detector to the stop line. The SCOOT model uses the journey time to translate the detector data to the flow arriving at the stop line. The longer the journey time then the more platoon dispersion will take effect. See section 5.2.3 for validation of this parameter.

Values for CHAN are: 0 to 127

Default: 97-99 (to show a link is not validated)

8.124 LFAL (L) Link Flare Approach Lanes [4.2] CB

This parameter identifies the number of lanes the link has before it flares.

Values for CHAN/RUBA are: 0 to 3

Default: 0

8.125 LFEL (L) Link Flare Extra Lanes [4.2] CB

This parameter identifies the number of additional lanes that make up the flare, i.e. lanes at the stop-line less LFAL above.

Values for CHAN/RUBA are: 0 to 7

Default: 0

8.126 LFLA (L) Link Flare [4.2] CB

This flag identifies whether a link has a flared stop-line.

Values for CHAN/RUBA are: NO and YES

Default: NO

8.127 LFMQ (L) Link Flare Maximum Queue [4.2] CB

This parameter must be set to the clear time in seconds for a queue completely filling the flared portion of a link.

Values for CHAN/RUBA are: 0 to 63

Default: 63

8.128 LLEN (L) Link Length CB

This is the length of a link in metres from the loop to the stop-line. This value is used in the calculation of speed and link travel times.

Note: This value is not used by the SCOOT model.

Values for CHAN/RUBA are: 0 to 9999

Default: 0

8.129 LMSM (L) Link Maximum Saturation Multiplier CB

This value is used in conjunction with LMSV to provide a LMS term used for the derivation of split merit values during split optimisation. This value determines the strength to which the LMS term is to be weighted. Recommended value 100.

Only available with SCOOT 6.1 (MMX SP1 or JTR GOLD).

Values for CHAN are : 0 to 100%

Default: 100

8.130 LMSO (N) Link Maximum Saturation Override CB

The following SCOOT facilities will be overridden if the node contains a LMS link and LMSO flag is set in conjunction with ALMS, RMLS, NLMS, LMSV and LMSM:

Bus priority

Gating

LRT priority

Ghost Stages

Pedestrian node

Pedestrian extra invitation to cross period (PINV)

Split weighting and Split Congestion term

Only available with SCOOT 6.1 (MMX SP1 or JTR GOLD).

Values for CHAN are : YES or NO

8.131 LMSS (L) Link Maximum Saturation Stay CB

This value is used in conjunction with LMSV to define a range within which the degree of saturation is to be maintained. If the degree of saturation of the LMS link is in the range of LMSV ± LMSS then a ‘stay’ decision is enforced upon the split optimiser. Recommended value 3.

Only available with SCOOT 6.1 (MMX SP1 or JTR GOLD).

Values for CHAN are : 0 to 10%

Default: 3

8.132 LMSV (L) Link Maximum Saturation Value CB

This is the target maximum saturation value for the link for LMS calculations.

Only available with SCOOT 6.1 (MMX SP1 or JTR GOLD).

Values for CHAN are : 0 to 150%

8.133 **LNKU** (L) Link Used

Links are marked as used or not used. Turning all detectors off (DETU) for a link will set the link to not used.

8.134 **LPUV** (L) LPUs per Vehicle Factor [4.5] CB

In version 4.5, the supplementary detection facility is available. Links which are to be part of this facility may have an LPUs per vehicle factor defined if traffic behaviour over its detector is different from the main link. This is achieved using LPUV.

Values for CHAN/RUBA are: 0 (not used), 1-31

Default: 0

8.135 **LRT1** (N) LRT Recovery Saturation Level 1 [4.2] CB

This parameter is set to the lower percentage saturation level required for the recovery algorithms from absolute priority.

Values for CHAN/RUBA are: 0 to 255

Default: 0

8.136 **LRT2** (N) LRT Recovery Saturation Level 2 [4.2] CB

This parameter is set to the middle percentage saturation level required for the recovery algorithms from absolute priority. It must be greater than LRT1 and less than LRT3.

Values for CHAN/RUBA are: 0 to 255

Default: 0

8.137 **LRT3** (N) LRT Recovery Saturation Level 3 [4.2] CB

This parameter is set to the higher percentage saturation level required for the recovery algorithms from absolute priority. It must be greater than LRT2.

Values for CHAN/RUBA are: 0 to 255

Default: 0

8.138 **LRTS** (S) LRT Recovery Stage Permitted [4.2] CB

This parameter indicates whether it is permissible to move from the UTC stage that gives LRT priority to this SCOOT stage.

Values for CHAN/RUBA are: NO and YES

Default: NO

8.139 **LRTU** (N) LRT UTC Stage Pattern [4.2] CB

This parameter is used to identify which UTC stages are LRT stages. To add UTC stage n, type n. To remove a UTC stage n, type -n.

Values for CHAN/RUBA are: A to H, -A to -H, 0 (no stages)

Default: 0 (no stages)

8.140 **<u>LSTS</u> (L)** **Link Status**

Links are marked as faulty if any of the detectors on them are not 'OK'.

8.141 **<u>LTGC</u> - Lower Trigger Ghost Cycles (N)**

Values for CHAN are: 0 to 2.

The SCOOT ghosting logic monitors stages for which ghosting is allowed and records for the last 15 (NGAC) cycles whether the demand dependent stage was called. If the demand dependent stage appears no more than the lower limit then ghosting will be started. The default and recommended value is 0.

Only available on systems licensed for SCOOT MMX or later.

8.142 **<u>LTTF</u> (L)** **Link Travel Time Factor** **CB**

This value is used in the calculation of link travel times based on speed. For links with two detectors, this factor determines the proportion of speed for each detector to be used in the formula. A value of 100 takes the upstream detector only. A value of 0 takes the downstream detector only.

Note: this value is not used by the SCOOT model.

Values for CHAN/RUBA are: 0 to 100

Default: 50

8.143 **<u>LTTM</u> (L)** **Link Travel Time**

This parameter displays the current travel time calculated by the system for the link.

Note: The Link Travel Times facility is Licenceable feature.

8.144 **<u>LTTT</u> (L)** **Link Travel Time Type** **CB**

This value is used to determine the method used to calculate link travel times.

Note: this value is not used by the SCOOT model.

Values for CHAN/RUBA are: DELAY (as generated by SCOOT), SPEED1 (use the speed algorithm for a single detector) and SPEED2 (use the speed algorithm for a pair of detectors)

Default: DELAY

8.145 MAXC (R) Maximum Cycle Time CB

This is the highest cycle time the user wishes the region to run at. MAXC must be greater than or equal to MINC. For values between 32 and 64 MAXC must be a multiple of 4; above 64 and below 120 MAXC must be a multiple of 8; above 128 MAXC must be a multiple of 16.

Values for CHAN/RUBA are: 32 to 240

8.146 MAXS (S) Maximum Stage Length C

The maximum stage length must be within range and greater than or equal to MINS. The sum of all MAXS on the node must be greater than or equal to the maximum possible region cycle time.

Values for CHAN are: 8 to 240 changeable only by a licensed option

8.147 MCLL (A) Max Clear Late Stage CB

For the stage confirm arriving late logic (see ASAL), this sets the number of concurrent stage confirms required to re-enable stage feedback.

Values for CHAN are : 0 to 10

Default: 5

8.148 MDSL (L) Main Downstream Link C

Main Downstream Link is the link receiving most of the traffic from the specified link. It is used in the determination of exit blocking. The main downstream link may be in a different region.

Note: this value is also configurable in data preparation.

Values for CHAN are: Link SCN or 0 (none)

Default: 0

8.149 MFBI (N) Model Feedback Inhibit Flag CB

The modelling of red/green on a link is by junction replies (feedback) if MFBI=NO or by SCOOT stage times if MFBI=YES.

Values for CHAN/RUBA are: YES and NO

Default: NO

8.150 MINC (R) Minimum Cycle Time CB

This value is the lowest cycle time the user wishes a region to drop to. An example of use might be at the beginning of the morning peak where the flow increases dramatically and the cycle time optimiser even with the trend flag on cannot move upwards fast enough. In this case the MINC could be placed in the timetable to a particular value before the morning peak starts and then reset at a later time.

MINC must be less than or equal to MAXC. The same constraints on possible values for MAXC apply to MINC.

Values for CHAN/RUBA are: 32 to 240

8.151 MINH (A) MONACO Inhibit [MC3] CB

This parameter is used to turn MONACO on or off. To enable MONACO, MINH should be set to NO.

Values for CHAN/RUBA are: YES or NO

This parameter is for the SCOOT congestion supervisor (MONACO) and is only available on systems licensed for SCOOT MC3 or later.

8.152 <u>MINS</u> (S) Minimum Stage Length C

The minimum stage length must be within range and less than or equal to MAXS. The sum of all MINS on the node must be at least 28 and less than or equal to the initial region cycle time - 4 seconds.

Values for CHAN are: 8 to 63 changeable only by a licensed option

8.153 MMWQ (A) MONACO Minimum Wasted Queue [MC3] CB

This parameter sets the lower limit of wasted capacity required to determine critical links.

Values for CHAN are: 0 to 50 (lpus)

This parameter is for the SCOOT congestion supervisor (MONACO) and is only available on systems licensed for SCOOT MC3 or later.

8.154 <u>MPCY</u> (N) Minimum Practical Cycle Time V

MPCY is calculated by the cycle time optimiser and is the lowest cycle time at which a node could be run to achieve the target saturation level on the most critical link on the node.

8.155 <u>MPFB</u> (N) Multi-Pelican Node Feedback Mode CB

This parameter is only used for multi-pelican nodes. i.e. multi-controller nodes that do not include a junction. The parameter specifies whether the new method of modelling pelicans should be used. The old method models links on the node only using the first pelican on the node. i.e. all links on the node are modelled red or green according to the GX state of one pelican. When this parameter is set to YES, then each link on the node is modelled according to the GX state of the pedestrian controller associated with that link.

Users with existing multi-pelican nodes may wish to set this value to NO to ensure the new modelling mode doesn't affect the behaviour of nodes validated under the old method. Type

VALU MPFB N* to see what nodes would be affected by this change. It is not expected that many customers would be affected at all.

Values for CHAN are: YES and NO.

Default : YES

8.156 **MPFR** (N) Maximum Pedestrian Frequency [4.6] CB

This parameter is used for the pedestrian priority control enhancements added in SCOOT V4.6. The parameter specifies the number of consecutive cycles that the pedestrian stage can be called early. If this maximum is reached, no priority is given to the pedestrian stage.

Values for CHAN are: 0 to 15. If set to 0 (not recommended!) a pedestrian stage can be called early in every cycle.

Default : 5

8.157 **MPWT** (N) Maximum Pedestrian Wating Time [4.6] CB

This parameter is used for the pedestrian priority control enhancements added in SCOOT V4.6. Waiting time is only considered when the pedestrian priority level (PPRI) is 2 or 3. The actual waiting time as a proportion of this maximum is used during the calculation of when the pedestrian stage can occur.

It should be noted that pedestrian waiting time can only be provided to SCOOT if the controller is equipped with a either a wait confirm (WC) bit or a demand reply (DR) bit.

Values for CHAN are: 0 to 240.

8.158 MRNI (A) MONACO Run Interval [MC3] CB

This parameter sets the MONACO run interval.

Values for CHAN/RUBA are: 20 to 3600 (s)

This parameter is for the SCOOT congestion supervisor (MONACO) and is only available on systems licensed for SCOOT MC3 or later.

8.159 MTWQ (A) MONACO Threshold Wasted Queue [MC3] CB

This parameter sets the lower limit of accumulated wasted capacity along a congestion chain required to determine a critical link.

Values for CHAN are: 5 to 200 (lpus)

This parameter is for the SCOOT congestion supervisor (MONACO) and is only available on systems licensed for SCOOT MC3 or later.

8.160 MUJT (A) MONACO Upper Journey Time [MC3] CB

This parameter sets the upper limit of journey time required to determine critical short links.

Values for CHAN are: 5 to 127 (seconds)

This parameter is for the SCOOT congestion supervisor (MONACO) and is only available on systems licensed for SCOOT MC3 or later.

8.161 NGAC - Number of Ghost Assessment Cycles (N)

This parameter specifies the number of cycles over which SCOOT monitors for the appearance of demand dependent stage for which ghosting is allowed. It is used in conjunction with UTGC and LTGC to determine when ghosting can be started and stopped.

The default and recommended value is 15.

Values for CHAN are: 10 to 15.

Only available on systems licensed for SCOOT MMX or later.

8.162 NCYT (N) Node Cycle Time V

The current cycle time of the node and its forced status are displayed.

8.163 NDCG (N) Node Double Cycling Group [4.2] CB

This parameter allows the configuration of a group of nodes whose cycling status must be the same; i.e. the cycle time optimiser must always ensure that all nodes in the group are single or double cycling.

Values for CHAN/RUBA are: 0 to 100

Default: 0

8.164 NIGM (N) New Intergreen Modelling Method CB

This parameter, which only applies to multi-controller nodes, determines which intergreen modelling method is used. If the parameter value is NO when any controller, which forms part of the node, goes into intergreen, SCOOT is told that the whole node is in intergreen. If the parameter value is YES intergreens are handled on a per link basis so that when the queue for each link is updated SCOOT is informed if the controller which gives green to that link is in intergreen.

For existing multi-node configurations, which have MFBI set to NO, NIGM should probably be set to NO.

Values for CHAN/RUBA are: YES or NO

Default: NO

8.165 NITH - Non-Independence Threshold (R)

This is one of the SCOOT cycle time independence trigger configuration parameters. This parameter is the delay ratio threshold for specifying when a node or sub-region that is running independently should switch back to running non-independently.

The delay ratio is the ratio of predicted delays when a node/sub-region is running at the region cycle time and at the independent cycle time. Values > 1.0 indicate that independence will yield less delays; when the delay ratio < 1.0 then this indicates non-independence is the better choice.

For the default setting of 95%, if the delay ratio goes below 0.95 then the node will switch back from independent to non-independent.

Values for CHAN are: 0 to 100 %

The default and recommended value is 95%.

Only available on systems licensed for SCOOT MMX or later.

8.166 NLMS (N) Allow Node Link Maximum Saturation CB

This Parameter enables or disables LMS calculations for a Node.

Only available with SCOOT 6.1 (MMX SP1 or JTR GOLD).

Values for CHAN are : YES or NO

8.167 NMIN (N) Node Minimum Cycle Time V

This parameter lists the minimum cycle time that a node could run, which is a sum of all the SCOOT minimum stage lengths for the node rounded up to the nearest SCOOT cycle time.

8.168 NOAP (N) Node Offset Authority Pointer CB

This parameter specifies which set of Offset Authority values are to be used. For details of optimiser authorities, see section 3.3.2.

Values for CHAN/RUBA are: 0 to 10

Default: 0

8.169 NOBP (N) Node Offset Bus Authority Pointer [4.5] CB

This parameter specifies which set of Offset Authority values are to be used following bus priority. For details of optimiser authorities, see section 3.3.2.

Values for CHAN/RUBA are: 0 to 10

Default: 0 (use the normal offset authorities)

8.170 NSAP (N) Node Split Authority Pointer CB

This parameter specifies which set of Split Authority values are to be used. For details of optimiser authorities, see section 3.3.2.

Values for CHAN/RUBA are: 0 to 10

Default: 0

8.171 NSBP (N) Node Split Bus Authority Pointer [4.5] CB

This parameter specifies which set of Split Authority values are to be used following bus priority. For details of optimiser authorities, see section 3.3.2.

Values for CHAN/RUBA are: 0 to 10

Default: 0 (use the normal split authorities)

8.172 NSST (N) Named Stage Start Time CV

This parameter allows you to specify or view the initial start time of the named stage in the cycle. This value is only used on system restart or after UPDA or REIN.

Values for CHAN are: 0 to IRCT

Default: 0

8.173 NSTG (N) Named Stage V

The Named Stage is the stage in which Offset Optimisation occurs for the node.

8.174 NTST (N) Node Transferred Status V

This parameter lists the previous and current regions of a node if it has been transferred by a NODT command.

8.175 OFST (N) Offset Optimiser Status CV

The Offset Optimiser operates according to the value of OFST, on links for which the type is normal. If OFST is set to 'ON', the Optimiser will calculate offsets to minimise delays. If OFST is set to 'MESS', the Optimiser will calculate offsets to maximise delays (this feature should only be used with great care).

Values for CHAN are: OFF, LIMBO (Calculate timings but do not implement), ON and MESS (De-optimise)

Default: ON

8.176 OFWT (L) Offset Weighting CB

The amount of weighting that the offset optimiser gives to a link. For no offset weighting the initial value should be set to 10. Values above 10 give positive weighting; values below 10 give negative weighting. The higher the OFWT the more the offset optimiser will attempt to reach the ideal offset for that link. This should not be confused with LINK BIAS where the offset is being biased towards the value held in DFOF. The relationship of values is non-linear. See SCOOT Traffic Handbook, Reference 1.3, for more details.

Values for CHAN/RUBA are: 0 to 127

Default: 10

8.177 OPNI - Operator Node Independence Selection (N)

This parameter controls whether the node is permitted to run at a cycle time independent of the region. If the value is YES, then the node will run at its minimum practical cycle time. If the value is NO or NEVER, then the node will run at the region (or sub-region cycle time, possibly double-cycling). If the value is AUTO, then the node will be permitted to run independently based on the SCOOT cycle time independence triggers. NO and NEVER differ in that NEVER disables the cycle time independence trigger calculations, where NO allows the trigger calculations to continue in the background. This can improve the performance of the triggers if OPNI is subsequently set to AUTO.

A node will only become independent if it's minimum practical cycle time is lower than the region cycle time.

Values for CHAN are: YES, NO, NEVER, AUTO

The default value is NEVER.

This parameter is not valid for nodes in sub-regions.

Only available on systems licensed for SCOOT MMX or later.

8.178 OPSI - Operator Sub-Region Independence Selection

This is a Sub-region level parameter.

This parameter controls whether the nodes in the sub-region are permitted to run at a cycle time independent of the region. If the value is YES, then the nodes will run at the sub-region cycle time (which is calculated in the same way as for regions but for the subset of nodes), possibly double cycling. If the value is NO or NEVER, then the sub-region nodes will run at the region cycle time as normal. If the value is AUTO, then the sub-region will be permitted to run independently based on the SCOOT cycletime independence triggers. NO and NEVER differ in that NEVER disables the cycle time independence trigger calculations, where NO allows the trigger calculations to continue in the background. This can improve the performance of the triggers if OPSI is subsequently set to AUTO.

A node or sub-region can never run at a cycle time higher than the region cycle time.

Values for CHAN are: YES, NO, NEVER, AUTO

The default value is AUTO.

Only available on systems licensed for SCOOT MMX or later.

8.179 OOEW (N) Offset Optimiser Emissions Weight CV

This parameter determines the weighting which the offset optimiser gives to emissions as compared with stops and delays. A value of 100 would mean that stops and delays are ignored whereas a value of 0 would mean that emissions are ignored.

Values for CHAN/RUBA are: 0 to 100 (%)

Default: 0

8.180 OVEP (N) Over-ride Extension Permission CB

This parameter is used with bus priority. If local extensions are allowed, SCOOT sends out an Extension Permission (EP) bit when it considers conditions are favourable for a local extension to be granted. This parameter allows the user to force local extensions to be always or never allowed.

Values for CHAN/RUBA are: NO (allow SCOOT to decide), SET (always allow extensions) and RESET (never allow extensions)

Default: NO

8.181 PDCI (N) Pedestrian Priority Double Cycling Inhibit [4.6] CB

If a pedestrian stage is called early, this parameter specifies whether the pedestrian stage can be called at the normal time in the cycle as well. If the flag is set to YES the pedestrian stage will only be called (and run) once per cycle.

This parameter only affects pedestrian nodes where pedestrian priority has been enabled with the PPRI parameter.

Values for CHAN are: NO or YES

Default: NO

8.182 PEDS (N) Pedestrian Stage [4.6] CB

This parameter specifies which stage is the pedestrian stage in a pedestrian controller. This parameter only needs to be set up for a pedestrian node if the pedestrian priority enhancements in SCOOT V4.6 are to be used. For nodes where pedestrian priority is not required this parameter can be left as 0.

Values for CHAN are: 0, 1 or 2

Default: 0

8.183 PLAN (N) Plan Timings V

The current cycle time and stage change times for the node are output. The stage change times are shown in stage order and are relative to the start time of the named stage of the first node in the region. The first node in the region is chosen arbitrarily by the UTC system and may change if nodes are transferred into and out of the region.

8.184 **PLST** (N) Pedestrian Lower Saturation Threshold [4.6] CB

This parameter is used for the pedestrian priority enhancements in SCOOT V4.6 If the node saturation is less than the pedestrian lower saturation threshold the pedestrian stage may be called as soon as the minimum green timer has expired on the vehicle stage. If greater than this threshold, the current stage may run longer than the minimum green before the pedestrian stage is called.

Values for CHAN are: 0 to 100 (%)

Default: 10

8.185 **PMAX** (N) Priority Maximum for Extensions CB

This parameter specifies the total time in seconds by which a SCOOT stage can be extended under bus priority.

Values for CHAN/RUBA are: 0 to 30

Default: 30

8.186 **PPRI** (N) Pedestrian Priority Level [4.6] CB

This parameter controls the level of priority given to a particular crossing. The parameter can only be set for nodes that are pedestrian crossing for which the PEDS parameter has been set.

Values for CHAN are: 0 (no additional priority) to 4 (maximum priority).

Default: 0

8.187 **PUBR** (N) Pick-up Using Bus Recovery CB

_When this parameter is set to YES then when a junction controller comes on to SCOOT control from another mode of control (e.g. local or fixed time plan), then the UTC system will use the SCOOT bus priority recovery mechanism to bring the controller into synchronization with the current SCOOT plan, rather than the normal minimum green catch-up algorithm. The system makes SCOOT believe that a bus priority recall has just finished. SCOOT will then use its normal recovery algorithm as determined by the BRER parameter. When this feature is enabled then DIPM and other messages may indicate the bus priority is active when a controller is initially put onto SCOOT control.

To use this feature, the controller should have Smooth Plan Change enabled (on the junction data entry form) and bus priority should be enabled (BPAN). If BPAN is not enabled (but Smooth Plan Changes are enabled) then enabling this parameter will have only the following effect. When SCOOT control is started, minimum green catch-up will be used to synchronize the controller to the SCOOT plan but rather than using the upper minimum UTC stage green time, the system will use the minimum SCOOT stage lengths.

This facility will not operate on multi-controller nodes.

Values for CHAN are: 0 = `NO' or 1 = `YES'

Default: 0

8.188 PUST (N) Pedestrian Upper Saturation Threshold [4.6] CB

This parameter is used for the pedestrian priority enhancements in SCOOT V4.6 If the node saturation is greater than this threshold the pedestrian stage can only be called at the optimum time in the cycle for vehicles. If less than this threshold, the vehicle stage may be shortened to allow the pedestrian stage to be called early.

Values for CHAN are: 0 to 100 (%)

Default: 90

8.189 PVIL - Pedestrian Variable Invitation To Cross Link (L)

Values for CHAN are: YES or NO

This parameter specifies whether the link should be modelled as a pedestrian link. This should only be set to YES for links that have been created for this purpose. Such a link should be configured as an entry link with no detectors.

This is a configuration parameter for the pedestrian variable invitation to cross SCOOT logic. This logic allows the pedestrian stage green man time to be increased in response to increased pedestrian demand.

Only available on systems licensed for SCOOT MMX or later.

8.190 PVIS - Pedestrian Variable Invitation To Cross Stage (S)

This parameter specifies whether a SCOOT stage controls a pedestrian stage for which pedestrian demand is to be assessed. This is a configuration parameter for the pedestrian variable invitation to cross SCOOT logic. This logic allows the pedestrian stage green man time to be increased in response to increased pedestrian demand.

Values for CHAN are: YES or NO

Only available on systems licensed for SCOOT MMX or later.

8.191 PVLD - Pedestrian Button Lower Demand Call Time Threshold (N)

The pedestrian button call time is the number of seconds between the end of a pedestrian stage and the pedestrian push button being pressed. It is used by the pedestrian invitation to cross logic as an indicator of pedestrian demand. This parameter issued with PVUD (Upper Demand call time threshold) to convert the smoothed call time to a pedestrian priority 0-4. The Lower Demand threshold specifies the time above which the pedestrian priority is 0 (i.e. no priority). PVUD specifies the time below which the pedestrian priority is it's highest. The threshold for the intermediate priorities are proportional between the upper and lower call times. Note, the lower demand call time should be higher than the upper demand call time (because higher call times indicate lower pedestrian demand).

This is a configuration parameter for the pedestrian variable invitation to cross SCOOT logic. This logic allows the pedestrian stage green man time to be increased in response to increased pedestrian demand.

Values for CHAN are: 0 to 255 seconds.

The default value is 30.

Only available on systems licensed for SCOOT MMX or later.

8.192 PVLP - Pedestrian Link Priority (L)

This parameter determines the pedestrian priority for links being used with the variable invitation to cross logic. If the priority is set to AUTO then the priority is worked out automatically from how quickly the pedestrian push button is pressed after the pedestrian stage has finished (see PVLD, PVUD and PVUS for the parameters that control this). Otherwise, the pedestrian priority is the value specified.

This is a configuration parameter for the pedestrian variable invitation to cross SCOOT logic. This logic allows the pedestrian stage green man time to be increased in response to increased pedestrian demand.

Values for CHAN are: AUTO, 1 to 4

Default: AUTO

Only available on systems licensed for SCOOT MMX or later.

8.193 PVSM - Ped Button Call Time Smoothing Factor (A)

The pedestrian button call time is the number of seconds between the end of a pedestrian stage and the pedestrian push button being pressed. It is used by the pedestrian invitation to cross logic as an indicator of pedestrian demand and priority. This parameter specifies the smoothing factor applied when SCOOT updates the smoothed call time.

This is a configuration parameter for the pedestrian variable invitation to cross SCOOT logic. This logic allows the pedestrian stage green man time to be increased in response to increased pedestrian demand.

Values for CHAN are: 0 to 100 %.

The default and recommended value is 90%

Only available on systems licensed for SCOOT MMX or later.

8.194 PVUD - Pedestrian Button Upper Demand Call Time Threshold (N)

The pedestrian button call time is the number of seconds between the end of a pedestrian stage and the pedestrian push button being pressed. It is used by the pedestrian invitation to cross logic as an indicator of pedestrian demand. This parameter is used with PVLD (Lower Demand call time threshold) to convert the smoothed call time to a pedestrian priority 0-4.

This parameter specifies the time below which the pedestrian priority is it's highest. PVLD specifies the time above which the pedestrian priority is 0 (i.e. no priority). The threshold for the intermediate priorities are proportional between the upper and lower call times. Note, the lower demand call time should be higher than the upper demand call time (because higher call times indicate lower pedestrian demand).

Values for CHAN are: 0 to 255 seconds.

The default value is 5.

This is a configuration parameter for the pedestrian variable invitation to cross SCOOT logic. This logic allows the pedestrian stage green man time to be increased in response to increased pedestrian demand.

Only available on systems licensed for SCOOT MMX or later.

8.195 PVUE - Pedestrian Stage Upper Extension (N)

This parameter specifies the maximum amount of time to extend the invitation to cross for pedestrians - i.e. this is the maximum extension to the SCOOT stage servicing the pedestrian stage when the associated pedestrian link has the highest pedestrian priority (4). Values for other priorities are worked out proportionally from 0 - i.e. if the priority is 2 then the extension will be half this value. The actual extension applied is subject to cycle time constraints. The default value is 8 seconds.

The way the extension is applied is somewhat unusual. The pedestrian SCOOT stage should continue to be defined as a fixed length SCOOT stage (i.e. the minimum and maximum SCOOT stage length are set to the same - the default invitation to cross time). When an extension is applied, SCOOT will internally increase the minimum & maximum length for the pedestrian SCOOT stage, in effect, forcing it to the required length. This is a configuration parameter for the pedestrian variable invitation to cross SCOOT logic. This logic allows the pedestrian stage green man time to be increased in response to increased pedestrian demand.

Values for CHAN are: 0 to 20 seconds.

Only available on systems licensed for SCOOT MMX or later.

8.196 PVUS - Pedestrian Priority Upper Saturation (N)

This parameter specifies the invitation-to-cross degree of saturation to use for the node when a pedestrian link on a the node has the highest priority. For other pedestrian priorities there is a linear interpolation between the lower limit and this upper limit. The lower limit is the normal target degree of saturation that would apply when there is no pedestrian priority - i.e. ISAT or TSAT. The default value is 110%. If this value is set lower than the lower limit then the lower limit is used.

The invitation-to-cross degree of saturation is only used to restrict the pedestrian extension such that the overall node saturation will not exceed this value. It is not used in the calculation of the minimum practical cycle time.

Values for CHAN are: 0 to 150 %.

Only available on systems licensed for SCOOT MMX or later.

8.197 QCMQ (L) Clear Time for Maximum Queue CB

This is the length of time in seconds for a vehicle stationary over the detector at start of green to clear the stop-line. For long links that rarely fill to capacity, an estimate will be sufficient. QCMQ does not apply to filter links.

Values for CHAN/RUBA are: 1 to 255

Default: 255

8.198 RCYT (R) Current Region Cycle Time V

The current cycle time of a region.

8.199 RDFF (L) Reduced Detection Flow Factor [4.2] CB

Where reduced detection algorithms are to be applied, this parameter specifies the percentage by which the RDPF is to be factored for this link.

Values for CHAN/RUBA are: 0 to 255

Default: 0

8.200 RDFR (L) Reduced Detection Flow Ratio [4.2] CB

Where reduced detection algorithms are to be applied, this parameter specifies as a percentage the flow during green to flow during the whole cycle.

Values for CHAN/RUBA are: 0 to 255

Default: 0

8.201 RDPF (L) Reduced Detection Proxy Flow [4.2] CB

Where reduced detection algorithms are to be applied, this parameter specifies the proxy flow in vehicles per hour.

Values for CHAN/RUBA are: 0 to 3600

Default: 0

8.202 RDPL (L) Reduced Detection Proxy Link [4.2] CV

Where reduced detection algorithms are to be applied, this parameter specifies the proxy link from which information on this link is to be derived.

Values for CHAN/RUBA are: 0 or valid link SCN

Default: 0

8.203 RLMS (R) Allow Region Link Maximum Saturation CB

This Parameter enables or disables LMS calculations for a Region.

Only available with SCOOT 6.1 (MMX SP1 or JTR GOLD).

Values for CHAN are : YES or NO

8.204 ROTR (R) - Root Trigger

This is one of the SCOOT cycle time independence trigger configuration parameters. This specifies the type of delay calculation to be used to influence the trigger. The Root Trigger should be one of the methods selected by Calculation Trigger (CATR) - that is, Root Trigger should be either be the same as Calculation Trigger or, if Calculation Trigger is set to BOTH, then Root Trigger should be either SIMPLE or COMPLEX. If there is not a match then no triggering will occur.

Values for CHAN are: NONE, SIMPLE, COMPLEX

The default and recommended value is COMPLEX.

Only available on systems licensed for SCOOT MMX or later.

8.205 RSCT (R) Resume SCOOT Timings CB

If this parameter is set to YES the System will save the SCOOT timings of cycle time, stage lengths and offsets for the region and attempt to re-instate them if the System is re-started after a short time (less than 5 minutes).

This facility is an optional, licenceable, one.

Values for CHAN/RUBA are: YES or NO

Default: YES

8.206 SATE (N) Saturation for Extensions [4.2 and earlier] CB

If bus priority is enabled for extensions on a node, this parameter will only permit one to occur if the anticipated degree of saturation remains below the specified percentage.

Values for CHAN/RUBA are: 0 to 200

Default: 200

8.207 SATR (N) Saturation for Recalls [4.2 and earlier] CB

If bus priority is enabled for recalls on a node, this parameter will only permit one to occur if the anticipated degree of saturation remains below the specified percentage.

Values for CHAN/RUBA are: 0 to 200

Default: 200

8.208 SETH (A) Detector Suspect Empty Threshold CB

This parameter sets the time in minutes after which a SCOOT detector which has shown continuous empty intervals will be considered suspect by the system. The value must be less than ETHR.

Values for CHAN/RUBA are: 3 to 60, <=0.5*ETHR

Default: 6

8.209 SFBI (N) Split Feedback Inhibit Flag CB

If SFBI is set to NO, the split optimiser will adjust its decisions based on the actual stage replies if they differ from its assumptions during the previous optimisation.

Values for CHAN/RUBA are: YES and NO

Default: NO

8.210 SFTH (A) Detector Suspect Full Threshold CB

This parameter sets the time in minutes after which a SCOOT detector which has shown continuous full intervals will be considered suspect by the system. The value must be less than FTHR.

Values for CHAN/RUBA are: 3 to 60, <=0.5*FTHR

Default: 3

8.211 SIDF (R) Simple Delay Factor

This is one of the SCOOT cycle time independence trigger configuration parameters. This specifies a factor influencing reduction in simple delay when coordinated.

This setting is used when the SIMPLE delay calculation method is selected (with CATR/ROTR). By default, delay calculations use the COMPLEX method so normally this parameter will not be used.

Values for CHAN are: 0 to 100 %

The default and recommended value is 75%.

Only available on systems licensed for SCOOT MMX or later.

8.212 SJNY (D) SOFT Journey Time CB

The SOFT journey time is the time in seconds for a vehicle to travel from the stop line to the downstream detector.

Values for CHAN/RUBA are: 1 to 63

Default: 63

8.213 SKIC (N) Skipping Inhibit Cycles [mc3] C

This parameter sets the number of cycles which must elapse at the node between the end of one stage-skipping sequence and the start of another stage-skipping sequence. A stage-skipping sequence consists of all those stages skipped within one cycle for the benefit of one bus.

The SCOOT translation plan number X (1 to 6) should be specified with the parameter suffix [X]. E.g. SKIC[1]

Values for CHAN are: 0 to 10 (cycles)

If the SKIC value is set to 0, skipping will not be allowed.

Default: 0

8.214 SKID (N) Skipping Priority Level Difference [mc3] C

This parameter sets the difference in priority level below which stage skipping is not allowed to benefit a bus at the node at the expense of another bus.

The SCOOT translation plan number X (1 to 6) should be specified with the parameter suffix [X]. E.g. SKID[1]

Values for CHAN are: 0 to 6

Default: 0

8.215 SKIF (N) Skipping Priority Level [mc3] CB

This parameter sets the priority level of buses below which stage skipping is not allowed.

Values for CHAN are: 0 to 6

If set to 0 then skipping will not be permitted at this node.

Default: 0

8.216 **SKIH** (N) Skipping Inhibit Period [mc3] C

This parameter sets the length of time which must elapse at the node between the end of a stage-skipping sequence and the start of another stage-skipping sequence. A stage-skipping sequence consists of all those stages skipped within one cycle for the benefit of one bus.

The SCOOT translation plan number X (1 to 6) should be specified with the parameter suffix [X]. E.g. SKIH[1]

Values for CHAN are: 0 to 3600

8.217 **SKIP** (A) Allow Skipping CB

This parameters selects whether or not stage skipping is allowed.

Values for CHAN are: YES or NO

Default: NO.

8.218 **SKIT** (S) Skipping Inhibit Times [mc3] C

This parameter sets the number of times the stage must be called by SCOOT after the stage has been skipped before it can be skipped again.

The SCOOT translation plan number X (1 to 6) should be specified with the parameter suffix [X]. E.g. SKIT[1]

Values for CHAN are: 0 to 10

Default: 1;

If 0 then skipping will not be permitted for this stage.

8.219 **SKRM** (N) Bus Skipping Recovery Method [mc3] CB

This parameter sets the recovery method to use after skipping. If set to NONE then skipping will not be permitted.

Values for CHAN are:

NONE	None
DN	Do Nothing
DS	Degree of Saturation
LS	Long Stage
MS	Minimum Stage
LSMS	Long Stage or Minimum Stage

ER Extension or Recall

Default: DN

8.220 **SKTS** (L) Skipping Target Saturation [mc3] C

This parameter sets the target saturation for a bus detected on the link with the given priority level. If the degree of saturation on any link whose green is to be skipped is greater than the target saturation then stage skipping will not take place.

The bus priority level X (1 to 6) should be specified with the parameter suffix [X]. E.g. SKTS[1]

Note that level 3 is the bus priority level used for buses detected by bus detector loops).

Values for CHAN are: 0 to 200 (%) where 0 = skipping not allowed, and 200 = unlimited.

Defaults:

SKTS[1] 0, SKTS[2] 50, SKTS[3] 90, SKTS[4] 110, SKTS[5] 110, SKTS[6] 200

8.221 **SLAG** (L) Link Start Lag CB

This is the time from a SCOOT stage change to the associated link going green on the street. It is normally the time from the amber appearing to the stage losing right of way to the first vehicle, on the stage gaining right of way, crossing the stop line.

The assumed constant part of every start lag for links at junctions is AREA START LAG (ASLG) + Default Intergreen (5). The SLAG should then be set up to vary 7 to the correct value for the street conditions.

For pelicans, the constant part is equal to AREA START LAG + MIN STG LENGTH (of pedestrian stage). The LINK START LAG should then be set up to vary this for the street conditions. Pelican links are unlikely to have a negative start lag.

Values for CHAN/RUBA are: -63 to 63

Default: 0

8.222 **SLAM** (A) Split Optimisation Lambda Factor CB

This is the extent to which demand dependent stages are taken into account in the optimisation of splits. A value of less than 100 will start to optimise splits assuming some non-maturing of demands.

This is very much an experimental parameter and should be used with great care.

Values for CHAN are: 0 to 100

Default: 100

8.223 **SLBI** (L) Stop-line Link Bias [4.2] CB

This is equivalent to BIAS but for a stop-line link, i.e. it encourages the offset optimiser to move the offset towards the default. The larger the SLBI, the more effect it will have.

Values for CHAN/RUBA are: 0 to 1023

Default: 0

8.224 **SLUL** (L) Stop-line Link Upstream Link [4.2] V

For a link controlled by a stop-line detector, this value is the upstream link, which will be used to manufacture a profile for the stop-line link for offset optimisation.

8.225 **SMAN** (D) SOFT Detector Mandatory CB

A SOFT detector may be set to mandatory (ON). If so, then a fault on the detector will cause SOFT to stop operating on the link.

Values for CHAN/RUBA are: OFF and ON

Default: OFF

8.226 **SMAX** (L) SOFT Maximum Saturation Occupancy CB

This is the upper limit for the variability of the saturation occupancy for a SOFT link. The value must be greater than SMIN.

Values for CHAN/RUBA are: 1 to 63

Default: 63

8.227 **SMIN** (L) SOFT Minimum Saturation Occupancy CB

This is the lower limit for the variability of the saturation occupancy for a SOFT link. The value must be less than SMAX.

Values for CHAN/RUBA are: 1 to 63

Default: 1

8.228 **SMOI** (N) Split Minimum Optimisation Inhibit CB

If this parameter is YES, it inhibits the extra split optimisation for stages on minimum.

Normally this should not be necessary, and this variable should be left at NO. When a stage is on its minimum, the following stage only has split optimisation. With four (or more) stages it is difficult to move green time from stage 3 to stage 1 if stage 4 is on its minimum and there is a large demand for stage 2.

Only available on systems licensed for SCOOT MC3 or later.

Values for CHAN/RUBA are : YES or NO

Default: YES

8.229 **SMUL** (L) Split Weighting Multiplier CB

This weights the amount by which the link will tend towards the chosen degree of saturation (SSAT). The value is normally set to 0 if no split weighting is wanted. It is used in conjunction with Split Weighting Saturation SSAT to weight against a link in the Split Optimisation. This value determines the strength to which a link is to be adversely weighted. Typical values might be in the range 2 to 5 with 0 being no weighting and 31 being very strong weighting. If a link is weighted it does not contribute to the Cycle Time Optimisation for the region.

Values for CHAN/RUBA are: 0 to 31

Default: 0

8.230 SNSI (A) Gas Sensor Collection Interval CB

This parameter specifies the frequency with which the smoothed gas sensor data is updated.
.

Values for CHAN/RUBA are: 1 to 15

Default: 5 (minutes)

8.231 SOFT (L) Implementation Status for SOFT C

This parameter allows the user to implement the SOFT algorithm.

Values for CHAN are: OFF, LIMBO (calculate but do not implement) and ON

Default: OFF

8.232 SPEN (A) Stop Penalty CB

The value in seconds equivalent to one stop. For users familiar with TRANSYT this has the same function. The Stop Penalty is the relative weighting for vehicle stops, against delays, used in the calculation of the Performance Index (similar to TRANSYT). The higher the stop penalty then the more emphasis is put on stops in the optimisation processes.

The value currently recommended by TRL is 20.

Values for CHAN/RUBA are: 0 to 20000

Default: 20

8.233 SPLT N) Split Optimiser Status C

The Split Optimiser will make alterations to the stage change times for a node if SPLT is set to either Temp or Perm. Any stage change times may be moved by the temporary authority seconds in either direction. If SPLT is set to 'Temp', the stage change time will be scheduled for the same time in the next cycle, and the Optimiser will have the option of setting the change time within the same window of the temporary authority seconds from the scheduled time. If SPLT is set to Perm, the scheduled stage change time is moved by the permanent authority.

Values for CHAN are:

OFF,

LIMBO (calculate timings but do not implement), TEMP (make no permanent changes)

PERM (temporary and permanent changes)

Default: PERM

8.234 SRST (S) Stage removable status V

List the stage removable status. Shows whether removable stages are currently being used or not.

8.235 SSAT (L) Split Weighting Saturation CB

Target percentage saturation value for split weighting. See section 6.2 and SMUL.

This value is normally 0 if no split weighting is wanted. It is used in conjunction with Split Weighting Multiplier SMUL for weighting against a link in the Split Optimisation. This value determines the maximum degree of saturation up to which a link is adversely weighted. Above this degree of saturation for a link, the link weighting term is not effective. When no split weighting is required this value should be set to 0. A value of 90 to 95 would be typical if weighting is required.

Values for CHAN/RUBA are: 0 to 255

Default: 0

8.236 STOC (L) Saturation Occupancy CB

The discharge rate from the stop line in LINK PROFILE UNITS (LPUs) per second. This is perhaps the most critical parameter in the system and is determined during validation, see section 5.2.7 for further information.

Values for CHAN are: 1 to 63

Default: 63

8.237 SUPT (L) Supplementary Link Type [4.5] CB

In version 4.5, the supplementary detection facility is available. Links on a node which are to be part of this facility all need to have a supplementary link type. This is achieved using SUPT.

Values for CHAN/RUBA are: NONE, MAIN, ADDITIVE, SUBTRACTIVE, FILTER

Default: NONE

8.238 TACC (R) Test ACCT C

The CHAN TACC command is used to put the ACCT command for a SCOOT region into test mode. A value of YES will turn test mode on and a value of NO will turn it off. When in test mode, changes in region cycle time, which would normally cause a CAST to be actioned, will cause a message to be output instead..

Values for CHAN are YES or NO.

Default: NO

8.239 TPLN (N) Stage Translation Plan C

This parameter alters the translation plan used between the SCOOT and UTC stages within the system. Six plans are available for each node.

Values for CHAN are: 1 to 6

Default: 1

8.240 TRAF (D) Traffic Period Flag CB

This flag enables or disables the Empty Detector Fault Check. It is set to ON to enable checking (normally during the day), and OFF to disable checking (normally during the night hours, when there is little or no traffic about).

Values for CHAN/RUBA are: OFF and ON

Default: OFF

8.241 TREN (R) Cycle Time Trend Status CB

When this flag is set the target saturation level used by the Cycle Time Optimiser is TSAT instead of ISAT. This has the effect of encouraging the Cycle Time Optimiser to react more quickly at a time of rising flows. The flag should typically be set by timetable command at the onset of each peak period.

Values for CHAN/RUBA are: OFF and ON

Default: OFF

8.242 TSAT (N) Trend Node Saturation CB

This parameter specifies the Trend target saturation for the node (see TREN above). TSAT must be less than ISAT.

Values for CHAN/RUBA are: 0 to ISAT

Default: 80

8.243 UNTS (L) Up Node Through Stage CV

This parameter specifies the stage at the upstream node of a normal link that first feed traffic onto this link.

Note: this value is also configured in data preparation.

Values for CHAN are: Stage SCN

8.244 UTGC (N) - Upper Trigger Ghost Cycles

The SCOOT ghosting logic monitors stages for which ghosting is allowed and records for the last 15 (NGAC) cycles whether the demand dependent stage was called. If ghosting is currently enabled then the upper trigger specifies the maximum number of times the demand dependent stage can be called before ghosting is stopped.

Values for CHAN are: 4 to 10.

The default and recommended value is 4

Only available on systems licensed for SCOOT MMX or later.

9. SCOOT EVENT DRIVEN MESSAGES

There are many messages that can be obtained from SCOOT. Those deemed to be useful to the user are described in this section. Many others exist for diagnostic purposes. All messages are described in the SCOOT Traffic Handbook, reference 1.3.1, section 0479.

Output of messages takes place as the result of an operator or timetable **MESS** command. Output of requested messages is made to the requesting terminal when the associated event takes place. Cycle time messages will be output at every optimisation of the cycle time optimiser. Split messages will be output at every split optimisation, i.e. every stage change. Offset messages will be output once per cycle when offset optimisation of the named stage takes place.

SCOOT equipment SCNs in the messages are denoted by **<eqp>** where 'eqp' may be REG, NODE, LINK, DET, STG. The forms of these SCNs are:

<REG>	Rxy(z)	where xyz is the 2 or 3 letter region identity.
<NODE>	Niiiii(i)	where iiiiii is a 5 or 6 digit node SCN.
<LINK>	<node>x	where x is the link letter.
<DET>	<link>n	where n is the SCOOT detector number.
<STG>	<node>/n	where n is the SCOOT stage number.

9.1 Message Categories

“M” messages are associated with model information

“C” messages are associated with cycle time optimisation

“S” messages are associated with split optimisation

“O” messages are associated with offset optimisation

“W” messages are associated with detectors and warnings

“B” messages are associated with bus priority

“X” messages are associated with bus priority stage skipping

“P” messages are associated with pollution (emissions) modelling

“G” messages are associated with gating

“J” messages are associated with the congestion supervisor

“E” messages are error messages

9.2 Model messages (M Class)

9.2.1 M02 Link <LINK> PERIOD aaaa STP bbbbbb DLY*10 ccccccc FLO dddddd CONG eeeeee RAW ffffff FLTS gggggg

9.2.2 M03 Node <NODE> PERIOD aaaa STP bbbbbb DLY*10 ccccccc FLO dddddd CONG eeeeee RAW ffffff FLTS gggggg

9.2.3 M04 Region <REG> PERIOD aaaa STP/10 bbbbbb DLY cccccc FLO/10 dddddd CONG/10 eeeeee RAW/10 ffffff FLTS gggggg

These three messages allow you to assess the situation of the traffic network. The data is valid provided feedback is enabled, i.e. it does not require SCOOT to be implemented, enabling before and after measurements to be taken.

PERIOD is the time in seconds over which the figures were collected

STP is the approximate number of vehicle stops per hour

DLY is the approximate delay in vehicle hours per hour

FLO is the approximate flow in vehicles per hour

CONG is SCOOT congestion in intervals/hour

RAW is congestion at the detector in intervals/hour

FLTS is number of faulty links in period

9.2.4 M05 Stage <STG> OFFSET DUE a STAGE FIXED b

This informs you of the start time of a stage and if the selected stage is that chosen for offset optimisation, i.e. the named stage.

OFFSET DUE offset due (1=yes)

STAGE FIXED (1=yes) indicates whether or not there is a fixed offset on the stage. This would normally be zero.

9.2.5 M08 Link <LINK> %SAT aaa %CONG bbb MAXQ c EXITB d OSQ eeeee NSQ fffff

This message will appear at the start of effective red.

%SAT percentage saturation or -1 if faulty

%CONG percentage congestion or -1 if faulty

MAXQ indicates whether maximum queue was reached during green (0=no or 1=yes)

EXITB indicates whether exit was blocked during green (0=no or 1=yes)

OSQ queue at start of previous red-green period in LPUs

NSQ queue at start of current red-green period in LPUs

9.2.6 M10 Link QUEUE AT START OF GREEN ON LINK <LINK> : aaaaa LPU

This message appears at the start of effective green for a non-faulty link.

9.2.7 M11 Link QUEUE CLEAR TIME ON LINK <LINK> : aa SEC

This message is output once per green period for a non-faulty link.

Note that the link and queue in the SCOOT model do not extend beyond the detector. Therefore the queue and the queue clear time is limited by the maximum queue clear time set for the link. A value of -1 indicates that the queue has not cleared by the end of green.

9.2.8 M14 Link <LINK> IVL aaaa OCC bbbb LQ ccccc BQ dddd EB eeeee LIT <REP> f

This message is generated every four seconds for a non-faulty link.

IVL	is current interval within the profile
OCC	is the occupancy value arriving at stop-line (LPU/interval)
LQ	is the length of queue currently modelled (LPU)
BQ	is the position of back of queue (LPU)
EB	exit blocked flag (0=no, 1=yes)
LIT	is four bits giving the effective state of signals in previous four seconds (1= green, 0=red)

9.2.9 M15 Area <AREA> PD aaa SPLTS-DONE: bbb MISSED ccc OFSTS-DONE: ddd MISSED eee SOFTS-DONE: fff MISSED ggg

This message provides information regarding the number of optimisations carried out in each period. If any optimisations are missed, contact STC.

PD	the interval at which the message appears (typically 5 minutes)
SPLITS-DONE	the number of split optimisations done
MISSED	the number of split optimisations missed
OFFSETS-DONE	the number of offset optimisations done
MISSED	the number of offset optimisations missed
SOFTS-DONE	the number of SOFT optimisations done
MISSED	the number of SOFT optimisations missed

9.2.10 M16 Node <NODE> TNOW aaaaaa NCYT bbbbbb REV STG TIMES <REP> cccccc

This message contains stage length data and is output every cycle.

TNOW	is the current second in the region's cycle

NCYT is the node cycle time

REV STG TIMES stage start times.

9.2.11 M17 Stage <STG> ACTUAL STAGE LENGTH aaaaaa SECS

SECS the stage length in seconds for the most recent occurrence of the stage.

9.2.12 M18 Link <LINK> ACTUAL OFFSET aaaaaa SEC (FROM <STG> TO <STG>)

This message shows the offset between upstream and downstream stages. It can be used to calculate the default offset for a link.

9.2.13 M19 Detector <DET> abcd

This message shows the second by second occupancy over a detector.

a represents first bit of data (0 or 1)

b represents second bit of data (0 or 1)

c represents third bit of data (0 or 1)

d represents fourth bit of data (0 or 1)

9.2.14 M20 Link <LINK> SAT aaa% LMSV bbb% SQ ccc FLOW ddd GN eee STOC fff

Calculation of saturation.

SAT the Saturation percentage.

LMSV the Link Maximum Saturation value(%) [MMX SP1 only]

SQ the standing queue (LPU).

FLOW the Inflow (LPU).

GN the Green Length (s).

STOC the Saturation Occupancy (LPU/S).

9.2.15 M21 Link <LINK> TC aaa T2 bbb T4 ccc TG ddd TM eee T fff

This message provides information regarding the on street queue clear time that is being measured by SOFT. The T2 and T4 relate to the time until a 2 and then a 4-second gap occurs in the traffic passing over the loop. This can be used to validate the accuracy of the SOFT measurements.

TC the time for the SCOOT queue to clear in seconds

T2 the time for the 2 second gap in seconds

T4 the time for the 4 second gap in seconds

TG the length of green in seconds

TM the maximum queue clear time in seconds

T the length of saturated outflow in seconds

9.2.16 M22 Link <LINK> SOFT FACTORS - REASON aa K% bbb KS% ccc L% ddd LS% eee D fff DS ggg S hhh

This message is output every cycle by SOFT and shows the main parameters calculated by SOFT, including the current estimate of STOC.

REASON a code showing whether or not this is a calibration cycle.

0	Calibrate OK, the cycle is a calibration cycle with all conditions satisfied.
1	No gap in outflow of at least 4 seconds.
2	The first gap of at least 2 seconds was less than 4 seconds long.
3	Although a gap of 4 seconds was found it was after a long time.
4	Faulty link.
5	SCOOT queue was too small.
6	SCOOT model showing maximum queue during green time.
7	The change in smoothed calibration factor was too large.
10	No SCOOT data was ready by the time of SOFT calibration.
11	SCOOT not implemented.
12	Downstream detector faulty.
13	Exit blocking.
14	No traffic seen on downstream detector.
15	Out flow during the period of saturation flow did not exceed a threshold.
16	One vehicle

K% is the percentage K value.

KS% is the percentage K smoothed.

L% is the percentage upstream factor.

LS% is the percentage L smoothed.

D is the saturation flow in LPU/sec/100.

DS is D smoothed in LPU/sec/100.

S is the saturation occupancy in LPU/100.

9.2.17 M26 Link <LINK> SOFT CHANGE OF SAT OCC aaaaa -> bbbbb

SAT OCC indicates the soft change in the saturation occupancy, e.g. 6->7 indicates that SAT OCC was 6, but has changed to 7.

9.2.18 M30 Link <LINK> UTCSTG aaa -> bbb

This message is output when there is a change in UTC stage reply.

UTCSTG indicates the change in the UTC stage, e.g. 1 -> 2

9.2.19 M31 Link <LINK> COLOUR a CTRL b

This message is output when SCOOT models a change of colour for a link.

COLOUR the new colour (0=red, 1=green)

CTRL feedback enabled? (0=yes, 1=no)

9.2.20 M32 Link <LINK> SUSP MODEL a SUSP TIME b

This message is output when the SCOOT model suspends or continues after suspension. These events are usually associated with awaiting the new UTC stage reply when feedback is enabled.

SUSP MODEL model suspended? (0=no, 1=yes)

SUSP TIME area time now when suspension occurred

9.2.21 M33 Link <LINK> SUSP OPT a

This message is output when the SCOOT optimisers suspend or continue after suspension. These events are usually associated unplanned events such as green waves and hurry calls.

SUSP OPT optimisers suspended? (0=no, 1=yes)

9.2.22 M35 Node <NODE> HC a GW b UTCREQ cc CNF dd CHC eee ND IMPL f RY IMPL g

This message allows you to identify the UTC confirm bit and can be helpful when dealing with problems relating to short stage lengths and model accuracy under feedback.

HC the hurry call indicator (0=no, 1=yes)

GW the green wave indicator (0=no, 1=yes)

UTCREQ the UTC stage requested (1 to 15)

CNF the UTC stage confirmed (bit pattern)

CHC the UTC stage choice (bit pattern)

ND IMPL the SCOOT implemented indicator (0=no, 1=yes)

RY IMPL the UTC stage replies valid indicator (0=no, 1=yes)

9.2.23 M37 Node <NODE> UTC a IG b GN cc LENGTH ddd

The UTC stage lengths as measured from the stage replies.

UTC The UTC stage

IG The preceding intergreen

GN Green length(s)

Length Total length = IG + green length(s)

9.2.24 M39 Stage <STG> INFRING aaa SMOO bbb

This message indicates the amount by which the model calculates that it may infringe the minimum stage length. This may occur when a change of SCOOT stage does not result in a change of link greens.

INFRING the infringement in seconds

SMOO smoothed infringement in seconds.

9.2.25 M44 Stage <STG> PrevStgReplyState psr PrevReqStage <STG> ReqStage <STG> LateArrFbInhib inh DecayCount dc UppCnt up

Stage confirm arrives late. Allowed if parameter ASAL = YES.

PrevStgReplyState Previous stage reply state, possible states are:

0 new stage requested

1 a previous stage confirmed

2 intergreen

3 new stage confirmed

4 invalid - replies not valid

5 invalid - not on SCOOT control

PrevReqStage previous stage

ReqStage requested stage

LateArrFbInhib late stage feedback inhibit flag for the previous stage

DecayCount decay count of concurrent stage confirms while inhibited

UppCnt largest decay count - the value of MCLL parameter

Only available with SCOOT 5.1 (MC3 SP1).

9.2.26 M47 Link <LINK> CF a C bb GF ccc G dd GSF eee RSF fff GS g SR hh H iii

This message shows the historic data from ASTRID placed into the profiles for a faulty link.

CF Normalised historic flow in the cycle in LPU

C Historic cycle length in seconds

GF Normalised historic flow in green in LPU

G Historic green length in seconds

GSF One second of normalised green flow in profile in LPU

RSF One second of normalised red flow in profile in LPU

GS Number of seconds of green in the interval in seconds

SR Time since last time link was red at detector

H Four seconds of normalised historic profile in LPU, i.e. what is actually going to be used!

9.2.27 M56 <LINK> SAT a SQ b FLOW c GN d FQCT e FSTOC f STOC g

This message provides key data items for a flared link.

SAT Percentage saturation

SQ Standing queue in LPUs

FLOW Inflow in LPUs

GN Green length in seconds

FQCT Flare queue clear time in seconds

FSTOC Flare saturation occupancy in LPU/second

STOC Saturation occupancy in LPU/second

9.2.28 M63 <DET> PERIOD a FLOW b OCC c

This message provides accurate count and occupancy data for links with detection over one lane.

PERIOD The interval between messages (typically 5 minutes)

FLOW The vehicle count in the period

OCC The raw occupancy in the period (count of full ¼ seconds)

9.2.29 M65 <STG> UTC a REASON b

This message indicates that SCOOT is requesting a change in UTC stage

UTC UTC stage (bit pattern)

REASON 0 - Normal

1 - Bus priority active

2 - LRT stage running

3 - LRT recovery active

9.2.30 M66 <STG> REQ STG LEN a REASON b

This message indicates the length of the stage that SCOOT is requesting.

REQ STG LEN Length of requested stage in seconds

REASON 0 - Normal

1 - Bus priority active

2 - LRT stage running

3 - LRT recovery active

9.2.31 M75 <LINK> SAT OCC a b c d e f g

This message indicates the range of STOC values being considered when concurrent modelling is active.

SAT OCC The seven values of STOC being modelled

9.2.32 M76 <LINK> Q AT GREEN a b c d e f g

This message indicates the queue at start of green for each of the range of STOC values being considered when concurrent modelling is active.

Q AT GREEN The seven values calculated

9.2.33 M77 <LINK> Q CLEAR TIME a b c d e f g

This message indicates the queue clear time for each of the range of STOC values being considered when concurrent modelling is active.

Q CLEAR TIME The seven values calculated

9.2.34 M78 <LINK> SATURATION a b c d e f g

This message indicates the percentage saturation for each of the range of STOC values being considered when concurrent modelling is active.

SATURATION The seven values calculated

9.2.35 M79 <LINK> Q AT RED a b c d e f g

This message indicates the queue at start of red for each of the range of STOC values being considered when concurrent modelling is active.

Q AT RED The seven values calculated

9.2.36 M80 <NODE> IG FROM a TO b : MEASURED c SMOOTHED d

This message shows the measured and smoothed intergreen values

9.2.37 M81 <LINK> Total processing lag is negative so cannot time from start of green

This message is output when the overall lag is negative and consequently intergreen feedback cannot be used

9.2.38 M82 <LINK>Timing from start of green

This message is output when the overall lag is negative and consequently intergreen feedback cannot be used

9.2.39 M83 <NODE> SAT SSSS% determined by link LINK

This message shows the saturation of the node which is determined by the link with the highest saturation and which is not faulty and has the cycle and split optimisers running and is of type normal, entry or filter.

SSS Node saturation

LINK The link which has the highest saturation

This message is only output for pedestrian nodes where the PEDS parameter has been set to a non zero value by CHAN or RUBA. It is output every second whilst the vehicle stage is running.

9.2.40 M84 <NODE> Pri=P ls=LLL hs=HHH dos=DDD% MaxPri=PPP% min=MIN cur=CUR opt=OPT

This message shows the calculation of the optimum time to run the pedestrian stage.

P Pedestrian priority level

LLL Low saturation threshold

HHH High saturation level

DDD Degree of saturation

PPP Maximum priority allowed

MIN Minimum stage length

OPT Optimum time in current stage for early pedestrian window.

This message is only output for pedestrian nodes where the PEDS parameter has been set to a non zero value by CHAN or RUBA. It is output every second whilst the vehicle stage is running.

9.2.41 M85 <NODE>Ped window open. Ped cnt=CCC wait time=WWW sec

SCOOT has requested the pedestrian stage to start early and to open the pedestrian window.

CCC Number of pedestrians waiting (normally 0, but set to 1 when there is a pedestrian demand)

WWW Length of time pedestrians have been waiting

This message is only output for pedestrian nodes where the PEDS parameter has been set to a non zero value by CHAN or RUBA. It is output on the first second of an early pedestrian window request.

9.2.42 M92 Link <LINK> MQChk mqc MQIhb mqi Grn g C4 c C4AND c4 C8OR c8 MEB me MHEB mh OEB o HEB h FEB f

Exit blocking.

Only available with SCOOT 5.1 (MC3 SP1).

9.2.43 M93 Link <LINK> MQCT mqct SmtEffectiveGrn seg LinkLength ll QClearLenTime qclt QClearLen qcl MaxCycTime mct

Calculated MQCT on long links.

Only available with SCOOT 5.1 (MC3 SP1).

9.2.44 M94 LINK GrnSeenTmr iii GrnSeen i DDNotSeen i DemDepLag ii Reqd ss EndGrnStg i PrevGrnSeen i PrevDDZeroQ i

Zeroise queue on a demand-dependent link if no demand

GrnSeenTmr Green seen timer (s)

GrnSeen Green seen by link (0=no, 1=yes)

DDNotSeen Demand-dependent green not seen by link

(0=no, 1=yes)

DemDepLag Demand-dependent lag as specified by

the user (s)

Reqd Current requested stage

EndGrnStg End green stage (0=no, 1=yes)

PrevGrnSeen Previous double green seen by link

(0=no, 1=yes)

PrevDDZeroQ Queue has been cleared in

previous double green (0=no, 1=yes)

This message is only available on systems licensed for SCOOT MMX or later.

9.3 Cycle Time Messages (C Class)

Note that all the 'C' class messages are output when enabled only if the Cycle Time optimiser is enabled for the appropriate region.

9.3.1 C01 Region <REG> REG CYT aaaa -> bbbb STATUS ccc -> ddd

This message indicates the decision of the Cycle Time optimiser.

REG CYT indicates the change in the region time

(e.g. 64->72 indicates that RCYT was 64, but has moved to 72)

STATUS indicates the overall movement. (-1 means a decrease, 0 means stay, +1 means an increase)

(e.g. 0->+1 means RCYT was steady, but has now gone up)

9.3.2 C02 Region <REG> LO aaaa HI bbbb REC cccc

This message indicates the cycle times considered in the optimisation.

LO the lowest cycle time considered

HI the highest cycle time considered

REC the recommended cycle time

9.3.3 C03 Region <REG> TRCY aaaa DLY bbbbbb

This message shows the vehicle delays associated with each cycle time considered.

TRCY the trial cycle time

DLY the delay associated with it (vehicle hours/hour)

9.3.4 C04 Region <REG> R CY aaaa DLY bbbbbb REC CY cccc MDLY dddddd

This message is output if the recommended cycle time considered is to be ignored because it produces less than 2% reduction in delays.

R CY the current region cycle time

DLY the current vehicle delay

REC CY the "recommended" cycle time

MDLY the delay associated with REC CY

9.3.5 C05 Region <REG> HELD BY <NODE> - MPCY aaaa

This message indicates the node constraining the region cycle time.

MPCY the Minimum Practical Cycle Time for that node.

9.3.6 C06 Region <REG> LOWER a UPPER b REG CYT c -> d

This message displays data associated with a fast cycle time move.

LOWER The lower limit in seconds.

UPPER The upper limit in seconds.

REG CYT The old and new region cycle times.

9.3.7 C08 Region <REG> GROUP a FORCE b MIN CYT c

This message displays data associated with a group of similarly cycling nodes, i.e. where they must all single or all double cycle together.

GROUP The group number.

FORCE Group forced to single cycle (0=no, 1=yes).

MIN CYT The minimum allowed cycle time for the group.

9.3.8 C10 Node <NODE> SNF aaa MAX% bbbb IDNCY cccccc TSAT% ddd NCYT eee LOST fff

This message could be used to monitor the change in demand of nodes through the network, by sending a record to the printer of the days changes can be made.

SNF Sum of nodal flow

MAX% Maximum degree of saturation

IDNCY Ideal node cycle time

TSAT% Target degree of saturation

NCYT Current node cycle time

LOST Cyclic fixed time. If the value in the database is set to 0 then the value calculated by SCOOT is shown here.

9.3.9 C15 Node <NODE> MPCY aaaa -> bbbb MPST ccc -> ddd MPTR eee -> fff

This message gives information for MPCY, supplementing that in message C01.

MPTR a flag indicating the permitted movement of MPCY, i.e. MPCY is not allowed to move down until the optimisation after MPTR has been set to -1.

9.3.10 C16 Node <NODE> N CY aaaa -> bbbb DB CY ccc -> ddd FORCE ee -> ff

This message is output when the single/double cycle status of a node changes. It shows the cycle times, the single/double flag and the force flag.

9.3.11 C20 Node <NODE> NEW N CYT aaaa STG LENGTH <REP> bbbb

The C20 message indicates the new node cycle time and stage lengths.

9.3.12 C24 Node <NODE> MPCY aaaa FORCED DOUBLE CYCLING INAPPROPRIATE

This message is output when SCOOT (if given the choice) would not double cycle a node whose cycling status is forced. (The MPCY for the node is more than half the value of the region cycle time.)

9.3.13 C26 Link <LINK> Snf ss Max mmm% Idncy iii Tar ttt% Ncyt nnn Lost lll

During cycle optimisation.

Calculation of ideal node cycle time.

Snf Sum of nodal flows (lpu)

Max Degree of saturation of the link (%)

Idncy Ideal node cycle time (s)

Tar Link target saturation (%)

Ncyt Node cycle time (s)

Lost Cyclic lost time (s)

Only available on SCOOT MMX SP1.

9.3.14 C27 Link <LINK> Target sat ttt Max sat mmm Ncyt nnn Lost lll

During cycle optimisation.

Overflow in calculation of ideal node cycle time.

Target sat Link target saturation (%)

Max sat Degree of saturation of the link (%)

Ncyt Node cycle time (s)

Lost Cyclic lost time (s)

Only available on SCOOT MMX SP1.

9.3.15 C30 Link <LINK> SCF aaaaa CYCAP bbbbbb %SAT cccc

The output from this message allows details of critical junctions to be displayed, also this could provide evidence for the necessity junction improvements at over capacity intersections.

SCF flow arriving at stop line in cycle

CYCAP cyclic flow capacity of link

%SAT percentage flow saturation of link (SCF/CYCAP)

9.3.16 C35 Link <LINK> RCYT a CFLOW b HFLOW c FLOW d

The output from this message contains values for cycle times considered by the optimiser. The values compare profile information with historic data from ASTRID.

RCYT The region cycle time.

CFLOW Flow from the current long term profile.

HFLOW The historic flow extracted from ASTRID.

FLOW The flow actually used by the optimiser.

9.3.17 C36 Link <LINK> RCYT aaa FORCE bbbbb

Flow for one region cycle time

Rcyt Region cycle time

Flow Flow as used by optimiser (lpu)

9.3.18 C40 Link <LINK> CODE aa SHIFT bbb PROFILE ccc ...

Adjustment to link profile.

This message includes 15 elements of the profile within it. If a C40 message is switched on for a link then several lines of messages will be output whenever a change in cycle time causes the profile to be recalculated.

CODE is the profile code.

SHIFT is the shift in seconds.

PROFILE is the nth element of the profile (LPU).

Profile Code : 10 = old profile.

20 = condensed profile.

30 = transformed profile.

40 = expanded profile.

50 = new profile.

9.3.19 C41 Link <LINK> CYCAP aaaaa EFFGRN1 bbb EFFGRN2 ccc AVGFLRQCLT ddd EFFGRN eee

Flare cycle capacity for double greens

Cycap Cycle capacity (lpu)

Effgrn1 Effective green on first stage (s)

Effgrn2 Effective green on second stage (s)

Avgflrqclt Average flare queue clear time (s)

Effgrn Total effective green (s

9.3.20 C42 REGION Node NODE Independence i -> i

Node has changed its independence. Frequency: Once per node change when complex or simple delay calculations occur.

Node Node

Independence Old independence (0=no, 1=yes)

New independence (0=no, 1=yes)

This message is only available on systems licensed for SCOOT MMX or later.

9.3.21 C43 REGION Sub-region REGION Independence i -> i

Sub-region has changed its independence. Frequency: Once per sub-region change when complex or simple delay calculations occur

Sub-region Sub-region

Independence Old independence (0=no, 1=yes)

New independence (0=no, 1=yes)

This message is only available on systems licensed for SCOOT MMX or later.

9.3.22 C44 LINK Rcyt iii -> iii Dbcy ii -> ii

Adjustment to link profile. Frequency: When complex or simple delay calculations occur

Rcyt Old region cycle time (s)

New region cycle time (s)

Dbcy Old double/single cycling status (0=single, 1=double)

New double/single cycling status (0=single, 1=double

This message is only available on systems licensed for SCOOT MMX or later.

9.3.23 C45 LINK Code ii Cycle time iii Shift iii Profile :iii ...

Adjustment to link profile in seconds. Frequency: When there is a cycle time change in complex delay calculations

Code Code

10 Old profile

20 Condensed profile

30 Transformed profile

40 Expanded profile

50 New profile

Cycle time New region cycle time (s)

Shift Shift (s)

Profile Profile (lpu)

etc...

This message is only available on systems licensed for SCOOT MMX or later.

9.3.24 C46 LINK Offset iii Colour :iii ...

Colour of link. Frequency: Once per offset when complex delay calculations occur. 5 sets of messages are printed to show pattern.

Offset Offset

Colour Code

1 Green

0 Red

etc...

This message is only available on systems licensed for SCOOT MMX or later.

9.3.25 C47 LINK Coord i Delay fff.fff Ave delay fff Min delay fff.fff Calc indep i

Complex delay Frequency: When complex delay calculations occur

Coord Coordination flag (0=not coordinated, 1=coordinated)

Delay Current delay (s)

Ave delay Average delay (s)

Min delay Minimum delay (s)

Calc indep Calculate independence (0=no, 1=yes)

This message is only available on systems licensed for SCOOT MMX or later.

9.3.26 C48 LINK Coord i Delay fff.fff Mmod fff.fff Ave flow fff.fff Gn iii Calc indep i

Simple delay Frequency: When simple delay calculations occur

Coord Coordination flag (0=not coordinated, 1=coordinated)

Delay Delay (s)

Mmod Mean modulus (lpu/s)

Ave flow Average flow (lpu/s)

Gn Green (s)

Calc indep Calculate independence (0=no, 1=yes)

9.3.27 C49 NODE Req node indep iii Region REGION Non-indep rcyt iii Indep rcyt iii

Node independence trigger. Frequency: When complex or simple delay calculations occur

Req node indep Request node independence

0 none

1 non-independent

2 independent

Region Region

Non-indep rcyt Non-independent region cycle time (s)

Indep rcyt Independent region cycle time (s)

9.3.28 C50 SUB-REGION Req sub-region indep iii Region REGION Non-indep rcyt iii Indep rcyt iii

Sub-region independence trigger. Frequency: When complex or simple delay calculations occur

Req sub-region indep Request sub-region independence

0 none

1 non-independent

2 independent

Region Region

Non-indep rcyt Non-independent region cycle time (s)

Indep rcyt Independent region cycle time (s)

9.3.29 C51 LINK Non-indep rcyt iii Indep rcyt iii Dbcy non-indep I Dbcy indep i Link cat i

Non-independent and independent region cycle time. Frequency: When complex or simple delay calculations occur

Non-indep rcyt Non-independent region cycle time (s)

Indep rcyt Independent region cycle time (s)

Dbcy non-indep Non-independent double cycle status

(0=single, 1=double)

Dbcy indep Independent double cycle status

(0=single, 1=double)

Link cat Link category

0 Cat entry

1 Cat upstream

2 Cat downstream

3 Cat internal

4 Cat ignored

9.3.30 C52 NODE Cspdd fff.fff Cpdr fff.fff Non-indep thresh fff.fff Indep thresh fff.fff

Node proportional delay ratio, complex calculation. Frequency: When complex delay calculations occur.

Cspdd Complex smoothed proportional delay ratio

Cpdr Proportional delay ratio

Non-indep thresh Non-independent threshold

Indep thresh Independent threshold

9.3.31 C53 SUB-REGION Cspdd fff.fff Cpdr fff.ff Non-indep thresh fff.ff Indep thresh fff.fff

Sub-region proportional delay ratio, complex calculation. Frequency: When complex delay calculations occur

Cspdd Smoothed proportional delay ratio

Cpdr Complex proportional delay ratio

Non-indep thresh Non-independent threshold

Indep thresh Independent threshold

9.3.32 C54 NODE Indep i Region REGION Non-indep delay fff.fff Indep delay fff.fff

Non-independent and independent delays

Frequency: When complex or simple delay calculations occur

Indep Independent status (0=no, 1=yes)

Region Region

Non-indep delay Non-independent delay (s)

Indep delay Independent delay (s)

9.3.33 C55 Link <LINK> FLRTYPE a DBCY bb -> cc OLGN ccc NEWGN ddd AVGFLRQCLT eee MAXFLRQCLT fff

Avgflrqclt adjusted due to change in double/single cycling status

Type Flare type (0=no, 1=yes)

Dbcy Old double/single cycling status

(0=single, 1=double)

-> New double/single cycling status

(0=single, 1=double)

Gn Old green length (secs)

Gn New green length (secs)

FlrQClt Average flare queue clear time (secs)

FlrQClt Maximum flare queue clear time (secs)

9.3.34 C56 SUB-REGION Indep i Region REGION Non-indep delay fff.fff Indep delay fff.fff

Non-independent and independent delays. Frequency: When complex or simple delay calculations occur

Indep Independent status (0=no, 1=yes)

Region Region

Non-indep delay Non-independent delay (s)

Indep delay Independent delay (s)

9.3.35 C57 NODE Sspdd fff.fff Spdr fff.fff Non-indep thresh fff.fff Indep thresh fff.fff

Node proportional delay ratio, simple calculation. Frequency:

When simple delay calculations occur

Sspdd Simple smoothed proportional delay ratio

Spdr Simple proportional delay ratio

Non-indep thresh Non-independent threshold

Indep thresh Independent threshold

9.3.36 C58 SUB-REGION Sspdd fff.fff Spdr fff.fff Non-indep thresh fff.fff Indep thresh fff.fff

Sub-region proportional delay ratio, simple calculation

Frequency: When simple delay calculations occur

Sspdd Smoothed proportional delay ratio

Spdr Simple proportional delay ratio

Non-indep thresh Non-independent threshold

Indep thresh Independent threshold

9.3.37 C59 LINK Jnyt iii Txlg iii Upnode time now iii Downnode time now iii Stage times :iii ...

Stage times in frame of upnode Frequency: Once per complex delay calculation

Jnyt Link journey time (s)

Txlg TX lag (s)

Upnode time now Up node time now (s)

Downnode time now Down node time node (s)

Stage times New stage change time

etc....

9.3.38 C60 LINK Offset iii Start green iii End green iii

Green period. Frequency: Once per offset when complex delay calculations occur, once (offset=0) when simple delay

Offset Offset

Start green Start green (s)

End green End green (s)

9.3.39 C61 NODE Link LINK Non-indep delay fff.fff Indep delay fff.fff

Link delays. Frequency: When complex or simple delay calculations occur

Link Link

Non-indep delay Non-independent delay

Indep delay Independent delay

9.3.40 C62 SUB-REGION Link LINK Non-indep delay fff.fff Indep delay fff.fff

Link delays. Frequency: When complex or simple delay calculations occur

Link Link

Non-indep delay Non-independent delay

Indep delay Independent delay

9.3.41 C63 LINK Est curr delay fff.fff Fac non-indep fff.fff Fac indep fff.fff

Estimated current delay. Frequency: When link is coordinated and change occurs in complex delay calculations

Est curr delay Estimated current delay

Fac non-indep Non-independent factor

Fac indep Independent factor

9.3.42 C64 LINK Offset iii Delay fff.fff

Delay for each offset. Frequency: Once per offset, when complex delay calculations occur

Offset Offset

Delay Delay

9.3.43 C65 NODE Fac non indep fac fff.fff Fac fff.fff Fsmfac fff.fff Sum delay fff.fff Sum ave fff.fff Sum min fff.fff

Calculation of smoothed factor non-independent. Frequency: When not independent for complex delay calculations

Fac non indep fac Smoothed factor non-independent

Fac Factor non-independent

Fsmfac Factor smoothing factor

Sum delay Sum current delay

Sum ave Sum average delay

Sum min Sum minimum delay

9.3.44 C66 LINK Region cycle time iii Dbcy i Calc indep i

Non-independent and independent region cycle time. Frequency: When complex delay calculations occur

Region cycle time Independent region cycle time (s)

Dbcy Double cycle status (0=single, 1=double)

Calc indep Calculate independent (0=no, 1=yes)

9.3.45 C67 SUB-REGION Fac non indep fac fff.fff Fac fff.fff Fsmfac fff.fff Sum delay fff.fff Sum ave fff.fff Sum min fff.fff

Calculation of smoothed factor non-independent. Frequency: When not independent for complex delay calculations

Fac non indep fac Smoothed factor non-independent

Fac Factor non-independent

Fsmfac Factor smoothing factor

Sum delay Sum current delay

Sum ave Sum average delay

Sum min Sum minimum delay

9.3.46 C68 SUB-REGION Fac indep fac fff.fff Fac fff.fff Fsmfac fff.fff Sum delay fff.fff Sum ave fff.fff Sum min fff.fff

Calculation of smoothed factor independent. Frequency: When independent for complex delay calculations

Fac indep fac Smoothed factor independent

Fac Factor independent

Fsmfac Factor smoothing factor

Sum delay Sum current delay

Sum ave Sum average delay

Sum min Sum minimum delay

9.4 Split Optimiser Messages (S Class)

Note that all the 'S' class messages are output when enabled only if the Split optimiser is enabled for the appropriate node.

9.4.1 S01 Stage <STG> STG MVD aa TEMP bbb PERM ccc SUM PERM dddd

This message shows the optimiser decision.

STGMVD number of stages affected

TEMP the temporary change in timings (+ve = retarded)

PERM the permanent change in timings (+ve = retarded)

SUM PERM the sum of all the permanent changes since system start-up

9.4.2 S02 Stage <STG> CHANGE TIME aaaa LENGTH bbbb

This message shows information on the new stage data.

CHANGE TIME the stage change time (in terms of TIME NOW)

LENGTH the current expected stage length after optimisation has taken place. i.e. the length predicted for it to run.

9.4.3 S03 Link <LINK> MVAaaaaaa MVS bbbbbb MVR cccccc FULL IVL ddd

This message illustrates the decision of the Split optimiser in terms of the merit values of the three possible decisions, based on degrees of saturation. It is produced approximately five seconds before each stage change time (dependent on the use of variable authorities) for each link for which it is enabled.

MVA the merit value of an advance decision

MVS the merit value of a stay decision

MVR the merit value of a retard decision

FULL IVL the number of intervals in the last cycle for which the detector(s) on the link was fully occupied. For a filter link, the value output is the OCC seen at the filter detector in the last filter green

For the link whose green is about to finish, the square root of ten times the MVS value gives an approximate degree of saturation. (This value may range up to 200 percent, as a congestion term is used in the calculation).

9.4.4 S04 Stage <STG>REASON aaaa TEMP bbb REVCT ccc REVMD ddd

This message gives the reason for the decision made by split.

REASON 0=normal, -1=forced, -2=faulty, -3=gated, -4=fixed offset, -5=stage already running, -6=cycle time optimiser active, -7=reversions outstanding, -8=partly forced

TEMP the temporary authority in seconds

REVCT the reversion count in seconds

REVMD the reversion modifier in seconds (permanent authority - temporary authority)

9.4.5 S05 Stage <STG> STGNOW <STG> TFLS a TTNS b EXPLEN c

This message contains stage length and timing information.

STGNOW The current SCOOT stage

TFLS Time from last stage in seconds

TTNS Time to next stage in seconds

EXPLEN Expected stage length in seconds

9.4.6 S07 Stage <STG> TEMP AUTH aa bb cc etc.

This message outputs the values for each possible temporary authority.

9.4.7 S08 Stage <STG> PERM AUTH aa bb cc etc.

This message outputs the values for each possible permanent authority.

9.4.8 S25 Stage <STG> Move : ssss ...

Split optimisation when stages on minimum.

Number of stages moved for each authority.

Only available with SCOOT 5.1 (MC3 SP1).

9.4.9 S26 Link <LINK> TEMP a SAT bbb CONG ccc WT ddd LMS eee MV ff

This message describes the composition of a merit value.

TEMP The size of the temporary change in seconds

SAT The saturation term %

CONG The congestion term %

WT The weighting term %

LMS Link Maximum Saturation term(%) [MMX SP1 only]

MV The merit value (divided by 1000)

9.4.10 S32 Link <LINK> GATE SAT aaa SAT bbb GATE TERM c GATE INT TERM d

This message shows data regarding the state of the gating algorithm if operating through the Split optimiser

GATE SAT Gate Saturation %

SAT Actual Saturation %

GATE TERM Gate term (0 to 3)

GATE INT TERM Gate Integral Term (0 to 3)

9.4.11 S35 Link <LINK> TEMP a SAT bbb CONG ccc WT ddd LMS eee MV ff

This message is similar to S26 but describes the composition of the merit value for the implemented decision only.

TEMP The size of the temporary change in seconds

SAT The saturation term %

CONG The congestion term %

WT The weighting term %

LMS Link Maximum Saturation term(%) [MMX SP1 only]

MV The merit value (divided by 1000)

9.4.12 S39 <LINK> SAT LIMIT a MULT b MEASURED SAT c ADJ SAT d

This message indicates the values and thresholds for the operation of filter weighting.

SAT LIMIT The value of FSAT

MULT The value of FMUL

MEASURED SAT The current saturation

ADJ SAT The adjusted saturation (including the weighting factor)

9.4.13 S44 <LINK> DEM DEP CODE a

This message indicates the recommendation of the demand dependent stage optimisation process.

DEM DEP CODE 0 = No recommendation

1 = No recommendation – previous stage at maximum

2 = No recommendation – next stage at maximum

3 = Recommend previous stage

4 = Recommend next stage

9.4.14 S45 Stage <STG> SOSOM : Move m Temp t Perm

Split optimisation when stages on minimum.

Original decision (move, temp, perm)

Only available with SCOOT 5.1 (MC3 SP1).

9.4.15 S46 Stage <STG> SOSOM : Consec min m

Split optimisation when stages on minimum.

Shows number of consecutive stages on minimum.

Only available with SCOOT 5.1 (MC3 SP1).

9.4.16 S47 Stage <STG> SOSOM : Make decision d

Split optimisation when stages on minimum.

Number of stages being modified for this alternative decision.

Only available with SCOOT 5.1 (MC3 SP1).

9.4.17 S48 Stage <STG> SOSOM : Temp auth : aaa ...

Split optimisation when stages on minimum.

Temporary authority for each original and alternative decision.

Only available with SCOOT 5.1 (MC3 SP1).

9.4.18 S49 Stage <STG> SOSOM : Move : aaa ...

Split optimisation when stages on minimum.

Move for each original and alternative decision.

Only available with SCOOT 5.1 (MC3 SP1).

9.4.19 S50 Link <LINK> SOSOM : Merit value : aaa ...

Split optimisation when stages on minimum.

Merit values for each original and alternative decision.

Only available with SCOOT 5.1 (MC3 SP1).

9.4.20 S51 Stage <STG> SOSOM : Move m Temp t Perm p

Split optimisation when stages on minimum.

Alternative decision overriding original decision (move, temp, perm).

Only available with SCOOT 5.1 (MC3 SP1).

9.4.21 S52 Link <LINK> LMS term : fff.fff ...

During split optimisation. LMS term for each decision.

LMS term LMS term (%)

Only available on SCOOT MMX SP1.

9.4.22 S53 Link <LINK> LMSV lll% Mult mmm Sat sss% LMS term fff.fff%

During split optimisation. Calculation of LMS term.

LMSV Link maximum saturation value

Mult LMS multiplier

Sat Link saturation (%)

LMS term LMS term (%)

Only available on SCOOT MMX SP1.

9.4.23 S54 Link <LINK> Temp ttt Sat fff.fff% Cong fff.fff% Weight fff.fff% LMS fff.fff% Mv fff.fff

During split optimisation. Composition of merit value in floating point.

Temp Temporary change (%)

Sat Saturation term (%)

Cong Congestion term (%)

Weight Weighting term (%)

LMS LMS term (%)

Mv Merit value (1/1000)

Only available on SCOOT MMX SP1.

9.5 Offset Messages (O Class)

Note that all the 'O' class messages are output when enabled only if the Offset optimiser is enabled for the appropriate node.

9.5.1 O01 Node <NODE> CHANGE aaa SUM CHANGE bbbb OFST STATUS cc

This message indicates the decision of the Offset optimiser.

CHANGE the change in the offset.

SUM CHANGE the total change in the offset since system start-up.

OFST STATUS optimiser status (1=ON).

9.5.2 O02 Node <NODE> aa bb cc...

This message shows the authorities for the node being optimised.

9.5.3 O03 Node <NODE> TOTAL aaa FLTY bbbbb BIAS ccccc CONG ddddd

This message shows the authorities for the node being optimised.

TOTAL the total number of links

FLTY the number of faulty links

BIAS the number of fixed/biased links

CONG the number of congested links with congestion weighting

9.5.4 O04 Link <LINK> L <LINK> CGIF aaaa LIMP bbbbb %CONG ccc %TERM dddd

This message shows congestion information. It requires O01 to be set.

L the link providing congestion information

CGIF the congestion importance factor

LIMP the link importance factor

%CONG the percentage congestion

%TERM the percentage congestion term

9.5.5 O05 Link <LINK> CNGIVL aaa %CONG bbb PIS ccc ddd eee

This message shows congestion information. It requires O01 to be set.

CNG IVL the number of congested intervals (-1 if link faulty).

%CONG the percentage congestion.

PIS the performance index values for each authority.

9.5.6 O07 Node <NODE> PIS aaa bbb ccc ddd

This message is output once per cycle and is the summation of the PI data for all normal links on the node.

PIS the performance index values for each authority.

9.6 Warning Messages (W Class)

9.6.1 W01 Link LINK CONGESTION CLEARED <LINK>

This message is output when congestion clears.

9.6.2 W02 Detector FAULT ON DETECTOR <DET> FULL/EMPTY IVLS aaaaaa

A detector is marked as Faulty Full when the full intervals count reaches that set by FTHR. It is marked as Faulty Empty when the empty intervals count reaches that set by ETHR. For each Full or Empty interval, the respective count is incremented by one. For each non-full interval, the full intervals count is decremented by 4 (down to zero). For each non-empty interval, the empty intervals count is decremented by 8.

9.6.3 W03 Detector SUSPECT FAULT ON DETECTOR <DET> FULL/EMPTY IVLS aaaaaa

A detector is marked as Suspect Full when the full intervals count reaches that set by SFTH. It is marked as Suspect Empty when the empty intervals count reaches that set by SETH. (See above for details of how the counts are accumulated).

9.6.4 W04 Detector SUSPECT FAULT CLEARED ON DETECTOR <DET>

A detector marked as OK (i.e. Suspect Fault Cleared), when the full intervals count is decremented to 25, or when the empty intervals count is decremented to 45.

9.6.5 W05 Link FAULT ON LINK <LINK>

A link is marked as Faulty if any of the detectors on that link are either Suspect or Faulty.

9.6.6 W06 Link FAULT CLEARED ON LINK <LINK>

This message is output when a link reverts to normal.

9.6.7 W07 Link LINK CONGESTED <LINK>

This message is output when a link becomes congested

9.6.8 W08 Link EXIT CLEAR ON LINK <LINK> DOWN LINK <LINK>

This message is output when an exit blocking clears.

9.6.9 W09 Link EXIT BLOCK ON LINK <LINK> DOWN LINK <LINK>

This message is output if the link's downstream node becomes blocked by a queue on the main downstream link.

9.6.10 W10 Link LINK <LINK> : aaaa CONG IVALS, REG CYT bbbb, % CONG IVALS cccc

This message is output if there are any congested intervals in the demand profile for the link, and SCOOT is modelling at least a half-full queue for the link.

CONG IVALS	the longest period of congestion in the previous cycle in intervals.
% CONG IVALS	the same period expressed as a percentage of the region cycle time.

9.7 Bus Priority Messages (B Class)

9.7.1 B01 Node <NODE> BUS PRIORITY OVERRIDING SCOOT (1=YES) aa BIT PATTERN (0=EXTN >0=RECALL) bb

This message is output when bus priority is active at a node.

OVERRIDE Override (0-no, 1=yes)

CHOICE UTC stages (bit pattern: 0=extension, >0=recall)

9.7.2 B11 Link <LINK> EXTENSION STARTED

An actual extension has started at this link. For SCOOT versions prior to 4.5 this is a node level message.

9.7.3 B12 Link BUS aa IMP bb JT cc VQ dd VY ee RX ff OK (0=IGNORE, 1=OK) gg

Bus detected on a link.

BUS Bus identity

IMP Bus importance factor (0 to 7)

JT Bus journey (cruise) time

VQ Vehicle queue clear max queue(s)

VY Bus vary(s)

RX Bus RX lag(s)

OK Bus ok (0=ignored, 1=ok)

9.7.4 B14 Link BUS aa STOPS bb DELAY cc TIME dd XTIME ee OPT ff DELTA gg

Summary of information for a bus leaves a link.

BUS Bus identity

STOPS Number of stops

DELAY Delay(s)

TIME Time(s)

XTIME External time

OPT Bus optimisation

0 None

1 Central extension

2 Recall

3 Stay

4 Nop

DELTA Bus time difference (s)

9.7.5 B17 Stage STAGE LEN aa -> <STG> DELTA cc BRT dd WHY ee

Stage lengths during priority over-ride.

STAGE LEN Stage length(s)

-> New SCOOT stage

DELTA Difference from SCOOT stage length(s)

BRT Bus recovery type

0 None

1 DN – Do Nothing

2 DS - Degree of Saturation

3 LS – Long Stage

4 MS – Minimum Stage

5 LS/MS - Long Stage or Minimum Stage

WHY Reason for stage change

1 Minimum stage length expired (MS recovery)

2 Minimum stage length expired (DN recovery)

3 Target saturation satisfied (DS recovery)

4 Maximum stage length expired

5 Stage not green to bus (recall)

9.7.6 B18 Stage STAGE LEN aa -> <STG> ACTIVE (1=YES) bb

Stage lengths before and after priority

STAGE LEN Stage length(s)

-> New SCOOT stage

ACTIVE Bus active (0=no, 1=yes)

9.7.7 B20 Node <NODE> LOCAL EXTENSION STARTED

A local on-street extension has started at this node.

9.7.8 B22 Node <NODE> LOCAL EXTENSION ENDED TIME aa

A local on-street extension has ended at this node.

TIME Time local extension was active(s)

9.7.9 B24 Node POSSIBLE EXTENSION BUS aa STAGE <STG> CHOICE bb

An Extension may start depending on the stage reply from street.

BUS Bus identity

CHOICE UTC stages (bit pattern)

9.7.10 B25 Node POSSIBLE RECALL BUS aa STAGE <STG> CHOICE bb

A recall may start depending on the stage reply from street.

BUS Bus identity

CHOICE UTC stages (bit pattern)

9.7.11 B26 Node RECOVERY EXT aa BEHIND bb TYPE cc

Recovery from bus over-ride.

EXT Extension (0=recall, 1=extension)

BEHIND Behind (0=ahead, 1 =behind)

TYPE Recovery type

1 Do nothing

2 Degree saturation

3 Long stages

4 Min stages

9.7.12 B27 Node * BUS CONTROL ENDED * OVERRIDDEN FOR aa EXT bb REC cc

This message is output when priority finishes.

OVERRIDDEN Length of time SCOOT was overridden (s)

Ext Extension (0=no, 1=yes)

Rec Recall (0=no, 1=yes)

9.7.13 B30 Link <LINK> RECALL STARTED

A recall has actually started at this link. For SCOOT versions prior to 4.5 this is a node level message.

9.7.14 B38 Link <LINK> BUS a LIT b RED c QUE d CLR e EXTLEN f

This message details the calculation of the length of an extension.

BUS Bus ID

LIT Colour of Lights (0=red, 1=green)

RED Time to bus seeing red

QUE Bus queuing time

CLR Time to bus clearing stop-line

EXTLEN Length of extension

9.7.15 B45 Node <NODE> TTNS aa CYT bbb USED cc SPARE dd EP e

This message details the calculation of the EP bit.

TTNS	Time to next stage in seconds.
CYT	Node cycle time in seconds.
USED	Green time used in seconds.
SPARE	Spare green time in seconds.
EP	New value of EP bit.

9.7.16 B46 Node <NODE> EP REQD a EP BIT b

This message details the change in EP status.

EP REQD	Is there a change of state? (1=yes)
EP BIT	The new EP state.

9.7.17 B47 Node <NODE> REASON a

This message identifies the reason for changing stage (or not).

REASON The reason, with values:

-1	Minimum stage length not expired
-2	Local extension in operation
-3	Recall saturation not satisfied
1	Minimum stage length expired (MS recovery)
2	Minimum stage length expired (DN recovery)
3	Target saturation satisfied (DS recovery)
4	Maximum stage length expired
5	Stage not green to bus (recall)

9.7.18 B48 Stage <STG> FB a STG b TIMER c CHOICE d CNFN e CNFP f

This message provides feedback information.

FB	Feedback inhibited (0=no, 1=yes)
STG	UTC Stage number
TIMER	Time from stage change
CHOICE	Choice of UTC stages (bit pattern)
CNFN	Confirmed UTC stage number
CNFP	Confirmed UTC stages (bit pattern)

9.7.19 B52 Link PD a FL b ST c DY d DT e

9.7.20 B53 Node PD a FL b ST c DY d DT e

9.7.21 B54 Region PD a FL b ST c DY d DT e

These messages contains data about the modelling of buses.

PD Period (seconds)

FL Outflow (buses/hour)

ST Stops (%)

DY Average delay per bus (0.1 s/bus)

DT Average bus delta (0.1 s/bus)

9.7.22 B55 Link PD a BUSES b GN c CEX d LEX e REC f

9.7.23 B56 Node PD a BUSES b GN c CEX d LEX e REC f

9.7.24 B57 Region PD a BUSES b GN c CEX d LEX e REC f

These messages contains data about the optimisation of buses.

PD Period (seconds)

BUSES Outflow

GN Outflow of buses arriving in green

CEX Number of Central Extensions

LEX Number of Local Extensions

REC Number of Recalls

9.7.25 B58 Link PD a OPTS c CEX d LEX e REC f

9.7.26 B59 Link PD a OPTS c CEX d LEX e REC f

9.7.27 B60 Link PD a OPTS c CEX d LEX e REC f

These messages contains data about the optimisation of buses.

PD Period (seconds)

OPTS Number of Optimisations

CEX Number of Central Extensions

LEX Number of Local Extensions

REC Number of Recalls

9.7.28 B74 Link <LINK> Bus <BUS> GR g R rr T tt Bc bb Ext e Spare s

Optimisation for a bus.

BUS is the bus identifier.

GR is the green to red time (0 to 3).

R is the time to bus seeing red (s).

T is the bus queueing time (s).

BC is the time to bus clearing link (s).

EXT is the change in green required (s).

SPARE is the spare green available for extension (s).

Only available with SCOOT 5.1 (MC3 SP1).

9.7.29 B75 Link <LINK> Bus <BUS> At opt limit oo

Optimisation for a bus.

BUS is the bus identifier.

If the bus optimisation limit is set, and the bus has reached this limit.

Only available with SCOOT 5.1 (MC3 SP1).

9.7.30 B76 Link <LINK> Bus <BUS> At aa Beyond opt limit oo

Optimisation for a bus.

BUS is the bus identifier.

If bus optimisation limit is set and bus is beyond bus optimisation limit.

Only available with SCOOT 5.1 (MC3 SP1).

9.7.31 B77 Link <LINK> Bus <BUS> Bc bb Cnt cc Now <STG> Eras eee ...

Optimisation for a bus.

BUS is the bus identifier.

BC is the time to bus clearing link (s).

Show the era for each stage until bus is expected to clear the stopline, starting with the bus stage now.

Only available with SCOOT 5.1 (MC3 SP1).

9.7.32 B78 Link <LINK> Colour c Rcnt r Gcnt g Stg <STG> Timer t Min m

Optimisation for a bus.

Colour of lights for bus queueing time calculation.

Output message at start of calculation.

Output message in loop of count down of bus to stopline.

Only available with SCOOT 5.1 (MC3 SP1).

9.7.33 B79 Link <LINK> Bus <BUS> At ppp Too far Why aa bbbb

Optimisation for a bus.

Bus too far from stopline, show reason. Reasons :

BCR_BUS_ALMOST_GONE	3061
BCR_BUS_NOT_GONE	3062
BCR_LINK_NOT_GREEN	3063
BCR_EXIT_BLOCKED	3064
BCR_NOT_EXIT_BLOCKED	3065
BCR_BUS_DETECTED	3066
BCR_BUS_CANCELLED	3067
BCR_BUS_MOVED	3068

Only available with SCOOT 5.1 (MC3 SP1).

9.7.34 B80 Link <LINK> Bus <BUS> At pp No longer too far

Optimisation for a bus.

Bus no longer too far from stopline.

Only available with SCOOT 5.1 (MC3 SP1).

9.7.35 B81 Link <LINK> Bus <BUS> Optimise oo

Optimisation for a bus.

BUS is the bus identifier.

For bus priority secondary detection and cancel detection.

Reason for optimisation.

Only available with SCOOT 5.1 (MC3 SP1).

9.7.36 B82 Link <LINK> Bus <BUS> *Extension ended* eeee

Optimisation for a bus.

BUS is the bus identifier.

For bus priority secondary detection and cancel detection. Output B82 message at end of extension. Append reason (see B79).

Only available with SCOOT 5.1 (MC3 SP1).

9.7.37 B83 Link <LINK> Bus <BUS> *Recall ended* eeee

Optimisation for a bus.

BUS is the bus identifier.

For bus priority secondary detection and cancel detection. Output B83 message at end of recall. Append reason (see B79).

Only available with SCOOT 5.1 (MC3 SP1).

9.8 Stage Skipping and Bus Detection Messages (X class)

These messages provide information on bus priority stage skipping

Messages X61 to X77 are concerned with bus detection and are only available with SCOOT 5.1 (MC3 SP1).

9.8.1 X01 Node SKIP a -> b OMIT c,d,e……

These messages contains data about stages skipped at a node

SKIP a=from stage, b=to stage

OMIT c,d,e = list of all skipped stages

9.8.2 X02 Stage PERIOD a SKIPS b

These messages contains summary data about stage skipping

PERIOD number of seconds for this summary period

SKIPS number of skips in the period

9.8.3 X03 Node PERIOD a STG SKIPS b NODE SKIPS c

These messages contains summary data about stage skipping

PERIOD number of seconds for this summary period

STG SKIPS number of stage skips in the period

NODE SKIPS number of times one or more stages have been skipped

9.8.4 X04 Region PERIOD a STG SKIPS b NODE SKIPS c

These messages contains summary data about stage skipping

PERIOD number of seconds for this summary period

STG SKIPS number of stage skips in the period

NODE SKIPS number of times one or more stages have been skipped

9.8.5 X05 Area PERIOD a STG SKIPS b NODE SKIPS c

These messages contains summary data about stage skipping

PERIOD number of seconds for this summary period

STG SKIPS number of stage skips in the period

NODE SKIPS number of times one or more stages have been skipped

9.8.6 X06 Stage

These message indicates that a stage has been skipped.

9.8.7 X07 Link BUS a REASON b

These messages contains information on the decision as to whether skipping is allowed

BUS bus identifier

REASON reason for not skipping. See SCOOT Traffic Handbook for list of reasons.

9.8.8 X12 Link BUS a IMP b EXT c REC d SKIP e

These messages contains summary data about stage skipping

BUS bus identifier

IMP bus importance factor (0 to 6)

EXT target % saturation for extensions

REC target % saturation for recalls

SKIP target % saturation for skipping

9.8.9 X13 Link BUS a LINK b SAT c TARGET d

These messages contains summary data about stage skipping

BUS bus identifier

LINK critical link

SAT % saturation

TARGET target % saturation

9.8.10 X19 Node

Skipping inhibit period expired

9.8.11 X20 Stage

Skipping inhibit “number of times” expired

9.8.12 X21 Node CALLED a ALL b COUNTER c

Skipping inhibit cycles data

CALLED Pattern of called stages

ALL Pattern of all stages

COUNTER skipping inhibit cycles counter

9.8.13 X22 Node

Skipping inhibit cycles expired

9.8.14 X61 Link <LINK> Bus <BUS> Jnyt jjj primary detection

For bus priority secondary and cancel detection.

This is for bus primary detection.

9.8.15 X62 Link <LINK> Bus <BUS> Tfsl tt -> tt secondary detection

For bus priority secondary and cancel detection.

This is output on bus secondary detection.

Tfsl time from stopline

9.8.16 X63 Link <LINK> Bus <BUS> Jnyt jjj unmatched secondary detection

For bus priority secondary and cancel detection.

No match has been found for a primary detection, this detection is treated as a primary detection.

9.8.17 X64 Link <LINK> Bus <BUS> Jnyt jjj cancel detection

For bus priority secondary and cancel detection.

A cancel detection for this bus ident has been detected.

9.8.18 X65 Link <LINK> Bus <BUS> Jnyt jjj unmatched cancel detection

For bus priority secondary and cancel detection.

A cancel detection has been found which does not match a previous primary or secondary detection.

9.8.19 X66 Link <LINK> Bus <BUS> Tfsl ttt gone from SCOOT

For bus priority secondary and cancel detection.

SCOOT has already modelled the bus as leaving the link.

9.8.20 X67 Link <LINK> Bus <BUS> Tfsl ttt timed out

For bus priority secondary and cancel detection.

A bus entry times out and is removed from the internal list if this is the second end of green at which the entry was in the list with time from stopline of 0. This stops entries staying in the list where the bus should have left the link.

9.8.21 X68 Link <LINK> Bus <BUS> Jnyt jjj added to D list

For bus priority secondary and cancel detection.

A bus ident has been added to the internal list (the D list).

9.8.22 X69 Link <LINK> Bus <BUS> Tfsl jjj removed from D list

For bus priority secondary and cancel detection.

A bus ident has been removed from the internal list (the D list).

9.8.23 X70 Link <LINK> Cancel detector gone OK

For bus priority secondary and cancel detection.

A formerly faulty bus cancel detector is now making successful detections.

9.8.24 X71 Link <LINK> Cancel detector gone faulty

For bus priority secondary and cancel detection.

There have been 5 successive bus time-outs on a cancel detector.

9.8.25 X72 Link <LINK> Bus <BUS> Jnyt jjj error - D list full

For bus priority secondary and cancel detection.

There is no room in the internal list (the D list) for a new bus ident.

9.8.26 X73 Link <LINK> Bus <BUS> error - not in D list

For bus priority secondary and cancel detection.

SCOOT was trying to remove a bus ident from the internal list (the D list), but could not find it in the list.

9.8.27 X74 Link <LINK> D list : <BUS> ttt ...

For bus priority secondary and cancel detection.

If the D list is not empty, output an X74 message showing the bus identifier and time from stopline of up to 10 entries in the D list.

9.8.28 X75 Link <LINK> Bus <BUS> Tfsl ttt cccc

For bus priority secondary and cancel detection.

Internal information message consisting of bus ident, time from stopline and an internal message code, in the range 3051-3057.

9.8.29 X76 Link <LINK> Control colour old -> new

For bus priority secondary and cancel detection.

If the link has cancel detection output the control colour change.

9.8.30 X77 Link <LINK> Cancel detection Fault count c Fault f

For bus priority secondary and cancel detection.

For a cancel detector, output the fault count and status.

1 = faulty, 0 = OK (see X70 and X71).

9.9 Emissions Modelling Messages (P Class)

These messages provide information on the emissions model.

9.9.1 P02 Link <LINK> PER a FLT b CO2 c CO d NOX e VOC f PM g

9.9.2 P03 Node <NODE> PER a FLT b CO2 c CO d NOX e VOC f PM g

9.9.3 P04 Region <REG> PER a FLT b CO2 c CO d NOX e VOC f PM g

9.9.4 P05 Area PER a FLT b CO2 c CO d NOX e VOC f PM g

The above messages have the same parameters as follows:

PER	Period of data collection
FLT	Count of faulty links
CO2	Carbon Dioxide estimate in Kilograms per hour
CO	Carbon Monoxide estimate in grams per hour
NOX	Nitrogen Oxides estimate in grams per hour
VOC	Volatile Organic Compounds estimate in grams per hour
PM	Particulate Matter estimate in grams per hour

9.10 Gating and Ghost Messages (G Class)

The following messages provide information on gating.

9.10.1 G01 Link GAT a GATSAT b CNG c GATCNG d STA e

This message gives information about a trigger link.

GAT	Current saturation (-1 if faulty)
GATSAT	Value of GSAT
CNG	Current congestion level (-1 if faulty)
GATCNG	Value of GCON
STA	State of link (-1 if faulty, 0 if inactive, 1 if active)

9.10.2 G02 Area CLUSTER a STATE b -> c

This message gives the state of each cluster.

CLUSTER	Cluster number
STATE	Old -> New (0 if inactive, 1 if partial, 2 if full)

9.10.3 G07 Area CLUSTER a VT b MX VT c MGF d THRESH e f

This message gives values of parameters for each cluster.

CLUSTER	Cluster number
VT	Current votes in the cluster
MX VT	Current maximum votes in the cluster

MGF Cluster minimum green factor

THRESH Lower and Upper thresholds for the cluster

The following messages provide information on ghosting.

9.10.4 G20 STAGE StgConfHist %16b PotGhostStg i GhostStg i

Accumulation of stage confirms

StgConfHist Stage confirm history

PotGhostStg Potential ghost stage (0=no, 1=yes)

GhostStg Ghost stage (0=no, 1=yes)

9.10.5 G21 STAGE LoGhostTrig ii UpGhostTrig ii GhostCycLen ii StgConfHist %16b PotGhostStg i

Derivation of possible ghost stage

LoGhostTrig The lower limit of the occurrence of a stage where it can be modelled as a potential ghost stage

UpGhostTrig The upper limit of the occurrence of a stage where it can not be modelled as a potential ghost stage

GhostCycLen The number node cycles from which the stage will be assessed whether it can be modelled as a potential ghost stage

StgConfHist Stage confirm history

PotGhostStg Potential ghost stage (0=no, 1=yes)

9.10.6 G22 STAGE GhostStg i TimeNowFreeze i

Ghost stage status during a new stage confirm

GhostStg Ghost stage (0=no, 1=yes)

TimeNowFreeze Time now is frozen (0=no, 1=yes)

9.10.7 G23 NODE TimeNow iii TimeNowFreeze i

Time now is frozen due to ghost stage confirm

TimeNow Time now (s)

TimeNowFreeze Time now is frozen (0=no, 1=yes)

9.10.8 G24 STAGE RegGhost i NodeGhost i StgGhost i NamedStg STAGE PotStgGhost i CycGhostStg i GhostStg i NodeGhostStsChg i RegGhostStsChg i

Derivation of the cycle ghost stage flag which indicates that the cycle optimiser can model the stage as a ghost stage

RegGhost Region permit ghost stage (0=no, 1=yes)

NodeGhost Node permit ghost stage (0=no, 1=yes)

StgGhost Stage permit ghost stage (0=no, 1=yes)

NamedStg Named stage of the node (0=no, 1=yes)

PotStgGhost Potential ghost stage (0=no, 1=yes)

CycGhostStg Cycle ghost stage (0=no, 1=yes)

GhostStg Ghost stage (0=no, 1=yes)

NodeGhostStsChg Node ghost stage status change (0=no, 1=yes)

RegGhostStsChg Region ghost stage status change (0=no, 1=yes)

9.10.9 G25 NODE GhostGrnLen iii RawGhostMinCyc iii NewGhostMin iii OldMin iii LowHardRegCyt iii NodeGhostStsChg i

Calculation of the reduced minimum cycle time due to ghost stage

GhostGrnLen Accumulated demand dependant minimum stage time (s)

RawGhostMinCyc New raw minimum cycle time (s)

NewGhostMin New minimum node cycle time (s)

OldMin Old minimum node cycle time (s)

LowHardRegCyt Low hard region cycle time (s)

NodeGhostStsChg Node ghost stage status change (0=no, 1=yes)

9.10.10 G26 LINK GhostLink i

Setting of ghost links

GhostLink Ghost link (0=no, 1=yes)

9.11 Congestion Supervisor Messages (J Class)

These messages provide information on the conclusions of the congestion supervisor.

9.11.1 J06 Link DECISION a

This message gives information about the decision of the supervisor.

DECISION 1 – default split wrong

2 – higher congestion importance factor required

3 – alternative strategy required

4 – default offset wrong

5 – congestion offset wrong

6 – congestion offset required

7 – possible validation problem

8 – imbalance in congestion importance factors

9 – incorrect saturation occupancy

9.11.2 J17 Link CURR OFST a REC OFST b

This message gives information about congestion offset recommendations.

CURR OFST current congestion offset

REC OFST recommended congestion offset

9.11.3 J18 Link CURR WT a REC WT b

This message gives information about congestion weighting recommendations.

CURR WT current congestion weighting

REC WT recommended congestion weighting

9.11.4 J19 Link WASTED CAP a

This message indicates a possible junction overload.

WASTED CAP total wasted capacity at the node

9.11.5 J23 Link REC OFST a

This message gives information about default offset recommendations..

REC OFST recommended default offset

9.11.6 J25 Link LMSO l Maxs m Mins m MerVal m MaxCyt m SpltWC s LFlt l EB e Gate g Bus b LRT l CyoLag c CyInhib c SpltInhib s PedNode p Ghost g Pinv p

During the start of red.

Possible reasons for LMS link exceeding LMSV.

LMSO LMS override

Maxs LMS stage at maximum

Mins Non-LMS stages at minimum

Merval LMS merit value term not sufficient

MaxCyt Maximum cycle time reached

SpltWC Split weighting or congestion term factor in use

LFlt LMS link is faulty

EB A link is exit blocked within the node

Gate Gating active

Bus Bus active

LRT LRT active

CyoLag The required LMS cycle time has not been reached

CyInhib Link is inhibited from cycle optimiser or cycle optimiser is turned off

SpltInhib Link is inhibited from split optimiser or split optimiser is turned off

PedNode Pedestrian node

Ghost Ghost stages running on node

PINV PINV node

Only available on SCOOT MMX SP1.

9.11.7 J26 Node CytMax ccc Cyt ccc MPCY mmm LMSCyt lll

During cycle optimisation.

Calculation to derive the required LMS validated node cycle time.

CytMax Node maximum cycle time

Cyt Current node cycle time

MPCY Current node MCPY

LMSCyt Required validated LMS cycle time

Only available on SCOOT MMX SP1.

9.12 Error Messages (E Class)

These messages are output when the SCOOT kernel detects an error.

9.12.1 E05 Node ERROR 1205 STAGE a UTC b

The message will only be produced when the stage confirm bit does not arrive in time.

ERROR 1202 Stage confirm did not arrive in time.

STAGE SCOOT stage

UTC UTC stage

9.13 Special Debugging Messages (P Class)

9.13.1 P16 LINK Pd iiii Flt iii i ...

Link-level emissions estimate.

Pd Summing period (s)

Flt Link faulty (0=no, 1=yes)

CO2 Carbon dioxide estimate (kg/h)

CO Carbon monoxide estimate (g/h)

NOx Nitrogen oxides estimate (g/h)

HC Hydrocarbons estimate (g/h)

PM Particulate matter estimate (g/h)

C Carbon estimate (g/h)

FC Fuel consumption estimate (L/h)

etc...

9.13.2 P18 LINK Dpv fff.fff s Tt fff.fff s Avsp fff.fff km/h Sp fff.fff km/h Dist fff.fff veh km

Link-level debugging message

Dpv Delay per vehicle (s)

Tt Current average link traversal time (s)

Avsp Current average link speed (km/h)

Sp Current average link speed adjusted for polynomial (km/h)

Dist Total distance travelled within summing period (veh-km)

9.13.3 P25 LINK PedStg STAGE ButtonSts i PedStgEnd i PedButtonTmr iii PedStgSmt iii PedLinkPrio iii

Derivation of pedestrian priority according to pedestrian button press

PedStg Pedestrian stage

ButtonSts Pedestrian button press state (1=pressed; 0=not pressed)

PedStgEnd Pedestrian stage ended (0=no, 1=yes)

PedButtonTmr Pedestrian button timer (s)

PedStgSmt Pedestrian button smoothed timer (s)

PedLinkPrio Pedestrian link priority

9.13.4 P26 STAGE MPCY iii Validate iii TargetSat iii PedUsat iii MaxPedPrio i ExtraGrn iii TotSpareGrn iii TotReqGrn iii

Calculating the increase to invitation to cross period

Rcyt Region cycle time (s)

Validate Validated cycle time (s)

TargetSat Node target degree of saturation

PedUsat Pedestrian upper target degree of saturation

MaxPedPrio Maximum pedestrian priority on the node

ExtraGrn Extra green given to the pedestrian stage to increase the invitation to cross period (s)

TotSpareGrn Total spare green available on node (s)

TotReqGrn Total extra green requested according to pedestrian priority (s)

9.13.5 P27 LINK SumOcc iii TMPCY iii TargetSat iii Excess iii

Calculation to derive validated cycle time

SumOcc Sum of occupancy

TMPCY Trial MPCY

TargetSat Node target degree of saturation

Excess Excess

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