Department for Transport

Traffic Advisory Leaflet 8/00
December 2000

Bus priority in SCOOT®

SPLIT **C**YCLE and **O**FFSET **O**PTIMISATION **T**ECHNIQUE

Introduction

This leaflet should be read in conjunction with TAL 7/99. It expands some of the information provided in the general guidance on the SCOOT® Urban Traffic Control System. More information on SCOOT® is available at www.scoot-utc.com .

Priority features

The SCOOT®UTC system has a number of facilities that can be used to provide priority to buses or other public transport vehicles. Passive priority can be given using the split and offset weighting parameters that can be applied to give priority to links or routes. Passive priority does not differentiate between vehicles. As all vehicles on the weighted link receive a similar benefit, the level of priority that can be given is generally quite low. SCOOT® Version 3.1 and subsequent versions incorporate a facility to provide active priority. For active priority to operate buses need to be separately detected and priority is then given to the individual bus. The method of doing this is described overleaf.

Bus detection

The SCOOT® kernel software allows for buses to be detected either by selective vehicle detectors (SVD),i.e. using bus loops and bus-borne transponders, or by an automatic vehicle location (AVL) system. Bus loops, or AVL systems where bus detection points can be specified, have an advantage as they can be placed in optimum positions. The best location for detection will usually be a compromise between the need for detection as far upstream as possible and the need for accurate journey time prediction. Also, bus detectors need to be located downstream of any bus stop, as SCOOT® does not attempt to model the time spent at bus stops. Depending on site conditions, a location giving a bus journey time of 10 to 15 seconds to the stop line is recommended.

Modelling

Buses are modelled by SCOOT® as queuing with other vehicles. This allows buses to be given priority even though other vehicles may delay them. The effect of bus lanes can also be modelled, including those, which end before the stop line.

Optimisation

The signal timings are optimised to benefit the buses, either by extending a current green signal (an extension) or causing succeeding stages to occur early (a recall). Extensions can be awarded centrally, or the signal controller can be programmed to implement extensions locally on street (a local extension).

For example, for the three stage junction illustrated in Figure 1, if a bus is detected towards the end of Stage 1 (which is a green period on Link A) it will receive an extension (i.e. Stage 1 is extended) as shown in Figure 2.

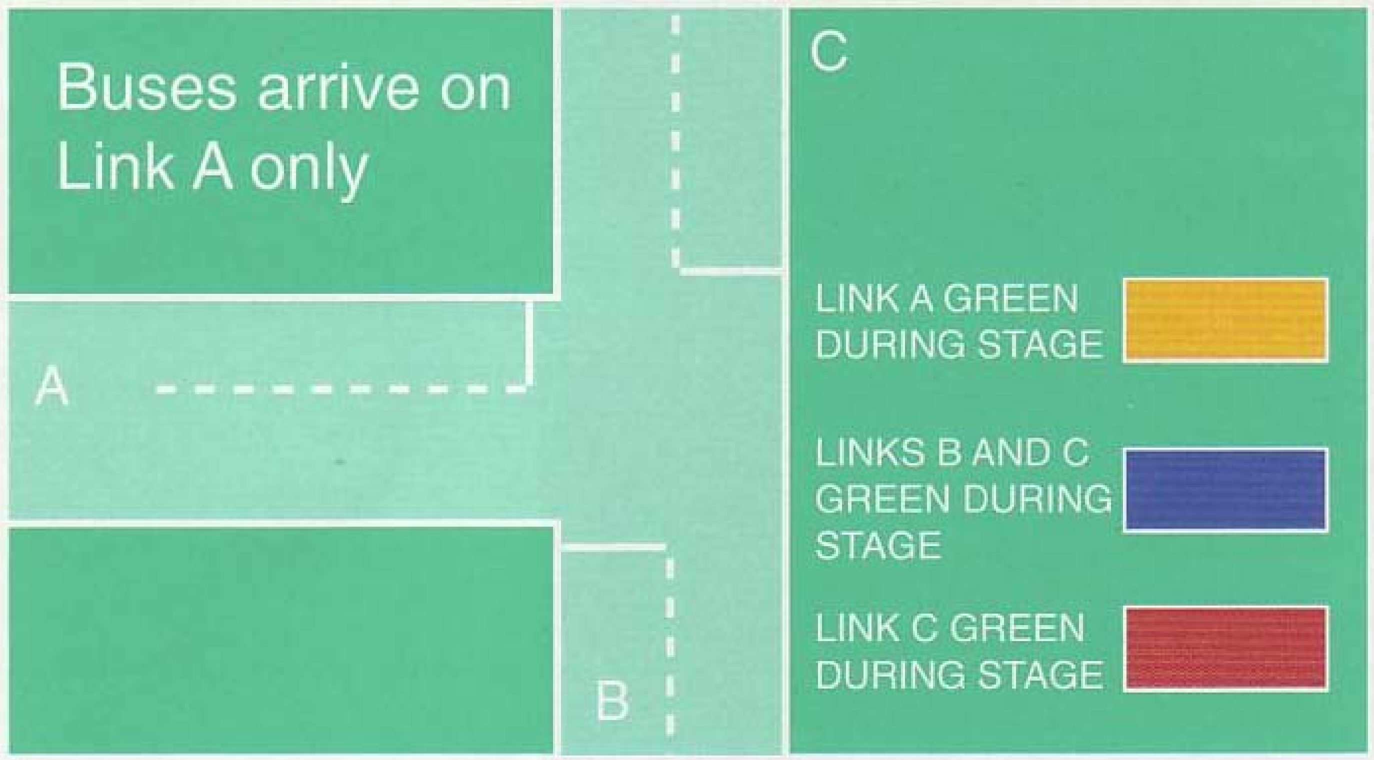

Figure 1

If the bus is detected during a red period e.g. Stage 2,it will receive a recall (i.e. Stage 2 and Stage 3 are shortened so that Stage 1 starts earlier), as shown in Figure 3.

Figure 2

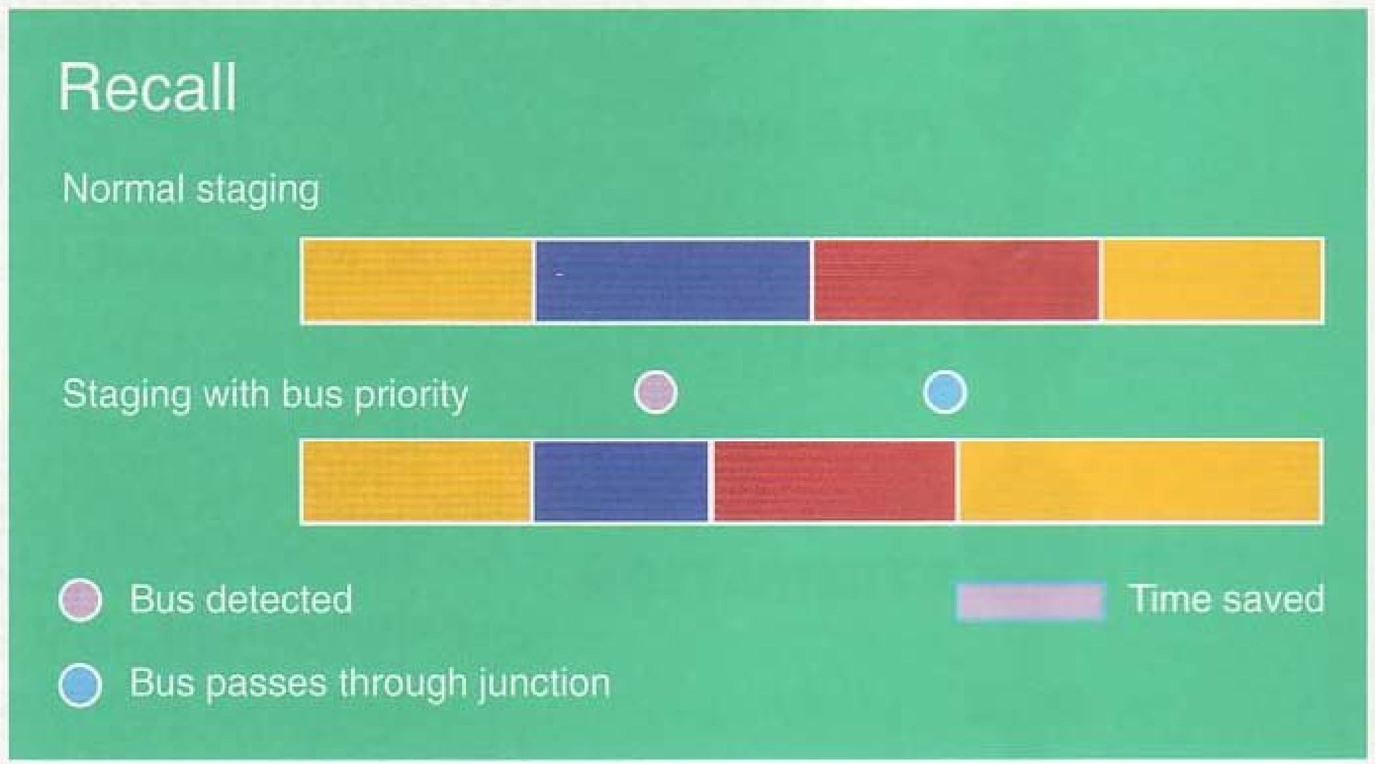

Figure 3

Local extension

Extensions awarded in the controller can be advantageous, as they eliminate 3 to 4 seconds transmission delay between outstation and instation. That allows the system to grant extensions to buses that arrive in the last few seconds of green. The feature is especially important where link lengths are short, or where bus stops are located near to the stop line. SCOOT® is still in control as it sends a bit each second to permit local extensions only when the saturation of the junction is sufficiently low. Techniques for programming the signal controller have been developed and implemented in London.

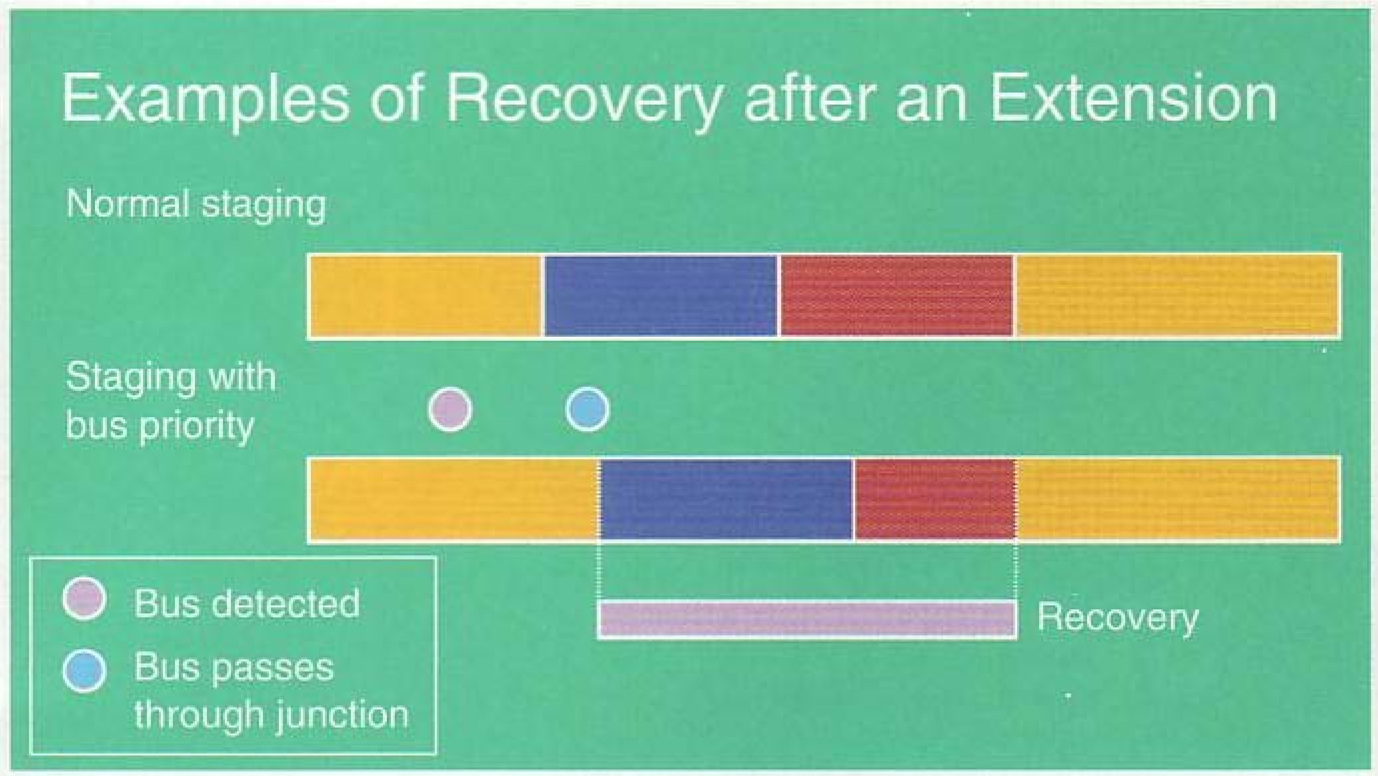

Figure 4

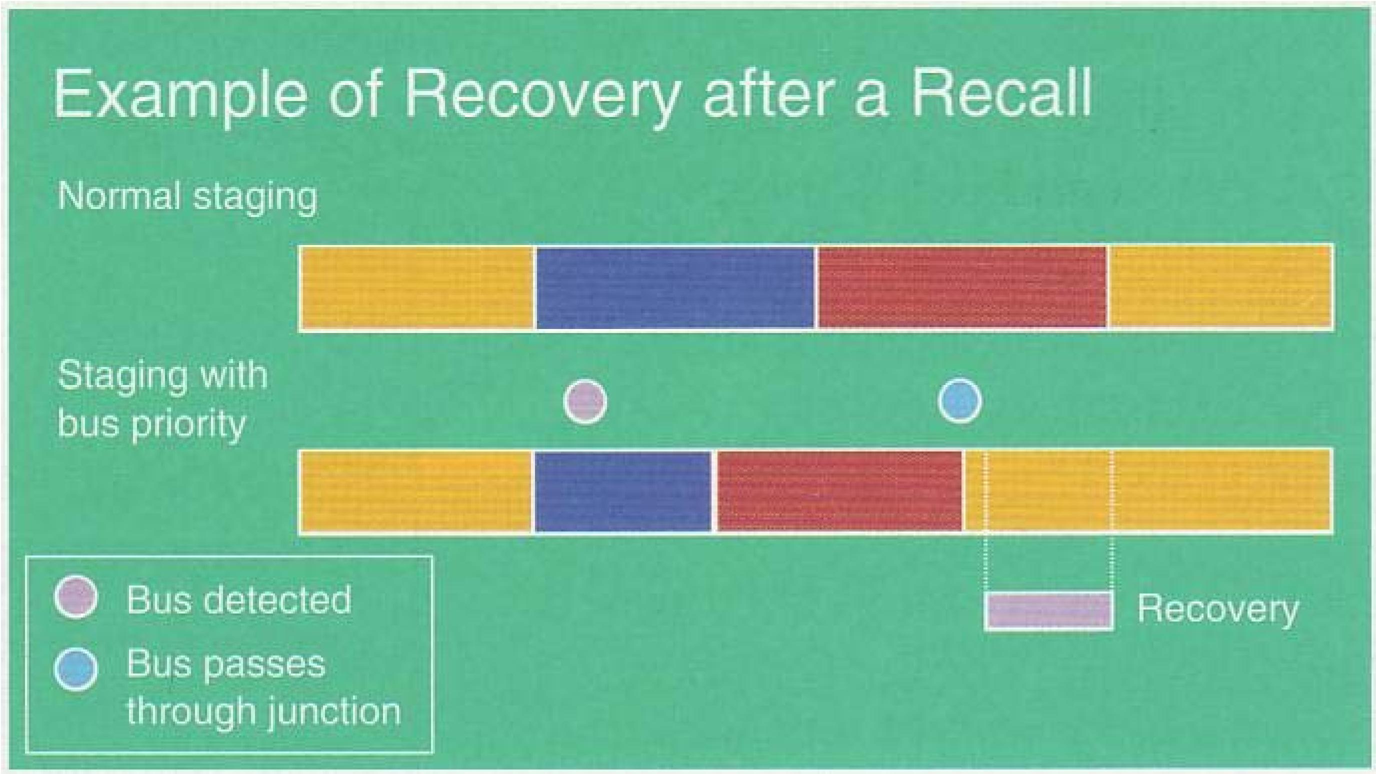

Figure 5

Recovery

Once the bus has passed through the signals, a period of recovery occurs to bring the timings back into line with the normal SCOOT® optimisation. Several different methods are available for use. Figure 4 offers examples of how recovery might work after an extension and figure 5 after a recall.

Restrictions on priority

One of the main advantages of providing priority through SCOOT® is that the extent of priority given to buses can be controlled. Priority can be restricted depending on the saturation of the junction as modelled by SCOOT®. This is managed by specifying target degrees of saturation for extensions and recalls. Non-priority stages can be run to these target saturation values, in the case of a priority extension or recall respectively. Normally the target saturation limits are set so that the junction is not allowed to become over saturated, although some degree of over-saturation may be allowed to service an extension. This means that bus priority will be most effective at junctions that have spare capacity.

Likely benefits of bus priority

The benefit to buses gained through providing active SCOOT® priority varies considerably, and is dependent on the scope for increasing or decreasing the lengths of signal stages. At junctions where the non-priority stages are already at or close to their minimum length, there is little scope for providing priority through recalls. Assuming that stages are not running close to their minimum length, the benefits of priority are then very dependent on the traffic conditions. Reductions in delay as high as 50% are achieved when the degree of saturation is low, whereas at high degrees of saturation the reduction in delay is of the order of 5 - 10%. The increase in delay to general traffic is similarly dependent on the degree of saturation. At low degrees of saturation the increase in delay to other traffic is small and insignificant, whereas at high degrees of saturation the increase in delay to general traffic can be large. The disruptive effect of providing priority by recalls is much greater than by extensions. Giving recalls to buses on a side road can be particularly detrimental as it reduces the green time as well as disrupting the co-ordination along the main road.

The number of buses being given priority is also an important factor, particularly at higher degrees of saturation. Benefit per bus decreases as bus flow increases, due to competing/conflicting priority calls, but total passenger benefit remains substantial at bus flows as high as 120 buses/hr/junction.

Providing priority also offers a small but significant improvement in the regularity of buses. Providing priority only to those buses that are behind schedule can increase the improvement to regularity. Providing priority to late buses only, and therefore to fewer buses, will also tend to increase the level of benefit to those late buses. However, considering all buses, the total benefit is likely to be reduced.

Very high priority

If it is desired to provide higher levels of priority than by using the active priority facility described above then it is possible to do this by overriding SCOOT®. This can be done by using the controller hurry call facility or by other means. It is recommended that this is only used for emergency vehicles and other important but infrequent services, such as Light Rail Transit. Frequent uncontrolled overriding of SCOOT® is likely to be very disruptive and can be counter-productive, particularly at high levels of saturation. New recovery logic in SCOOT® version 4.2 enables SCOOT® to recover efficiently from such a request.

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