Department for Transport

TRAFFIC ADVISORY LEAFLET 1/06

Part 4 of 4

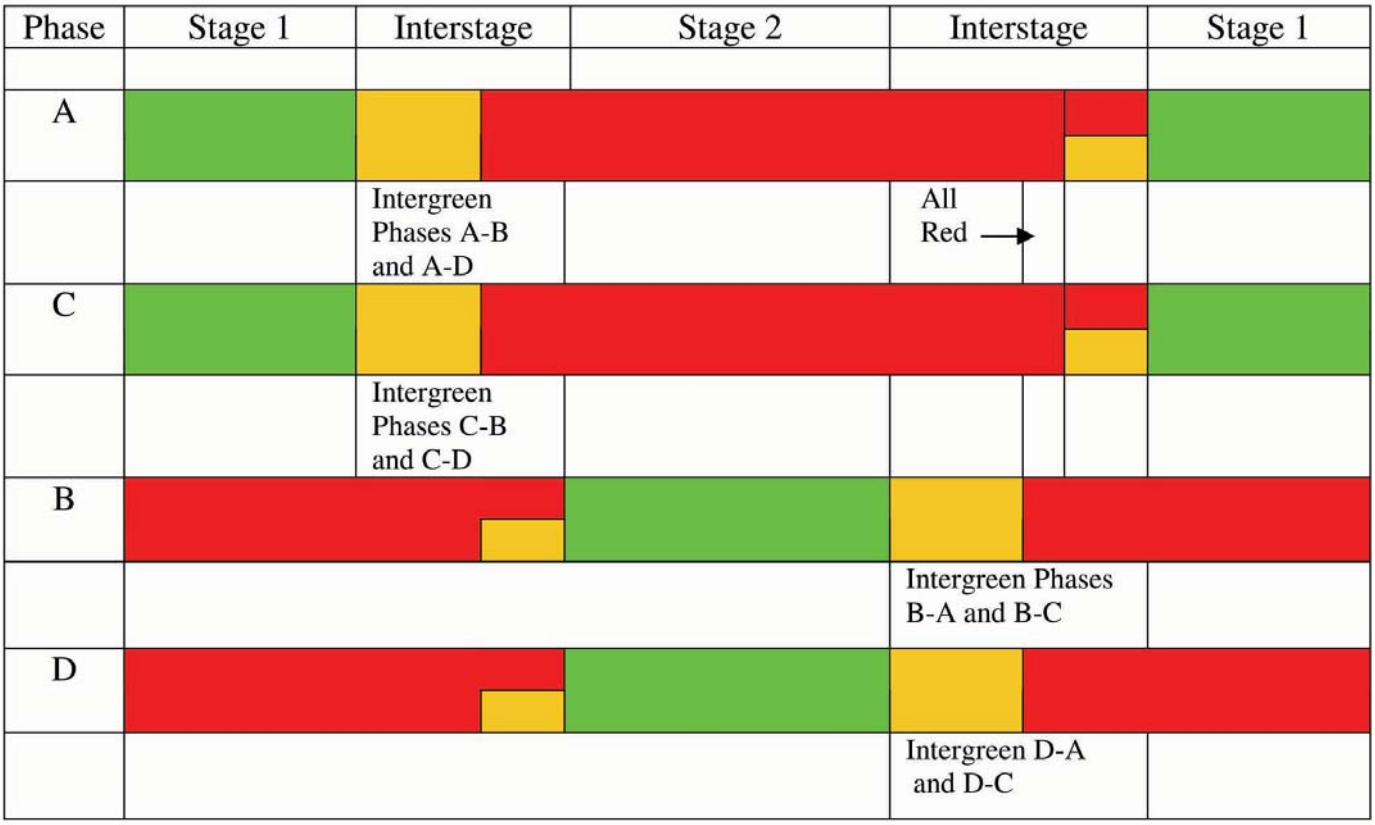
General Principles of Traffic Control by Light Signals Part 4 of 4

This document is Part 4 of Traffic Advisory Leaflet 1/06. It should be read in conjunction with Parts 1, 2 & 3. The Reference section is in Part 1.

PHASES AND STAGES

Example of simplified 4 approach crossroads, with 4 phases and 2 stages. Phase A southbound, Phase B westbound, Phase C northbound and Phase D eastbound. Note: it is conventional to notate phases clockwise round the junction. Interstage 1-2 has a 5 second interstage, made up of a 3 second amber and a 2 second red/amber. The timings for amber and red/ambers are obligatory, with a tolerance of plus or minus 250 milliseconds. The interstage 2-1 is shown with a 1 second all red, making it 6 seconds. The intergreens A-B, A-D, C-B and C-D are the same as the interstages 1-2 and the intergreens B-A, B-C, D-A, D-C are the same as the interstages 2-1.

Diagram 1



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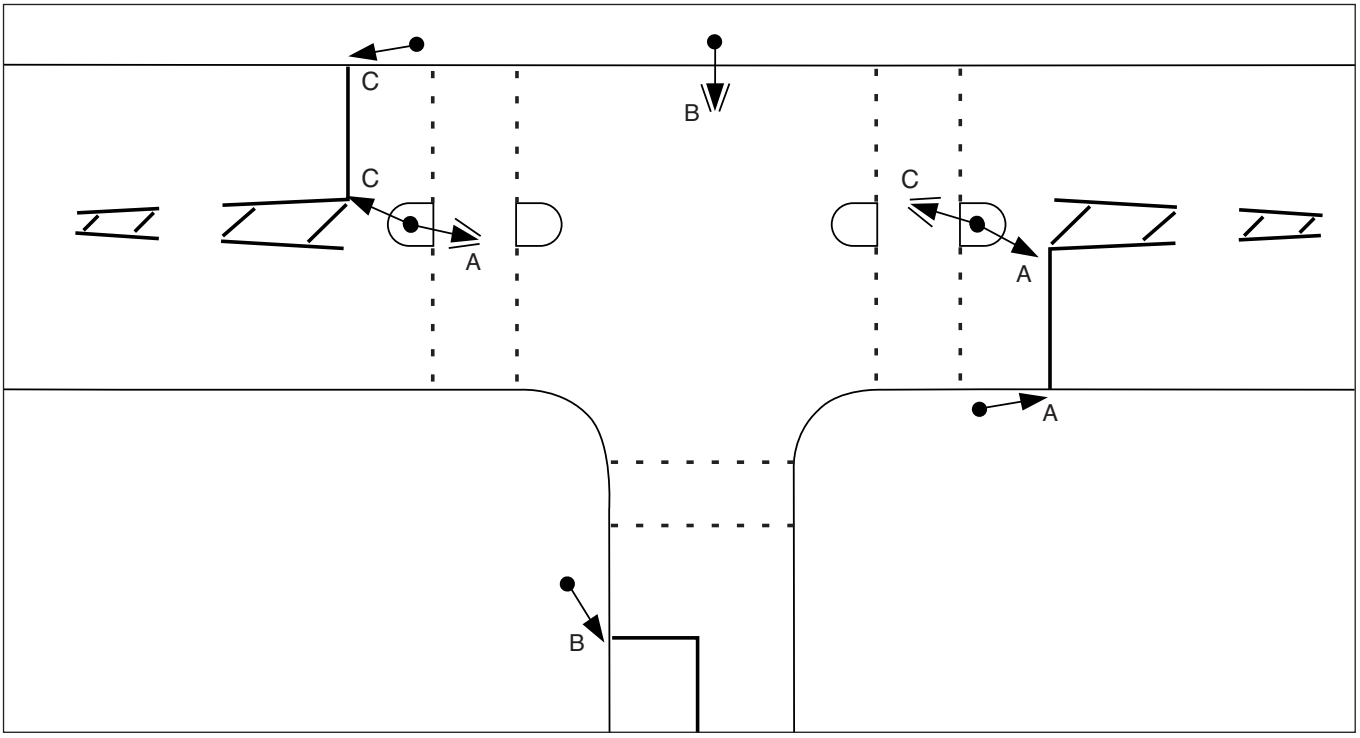
Traffic Advisory Unit



Losing and gaining right of way

The two following examples illustrate Phase Change Delays. This might be a "T" junction, with Phase A being the Westbound main road, Phase B the Northbound side road and Phase C the Eastbound main road. Here only one intergreen in each change is the same as the interstage.

Diagram 2

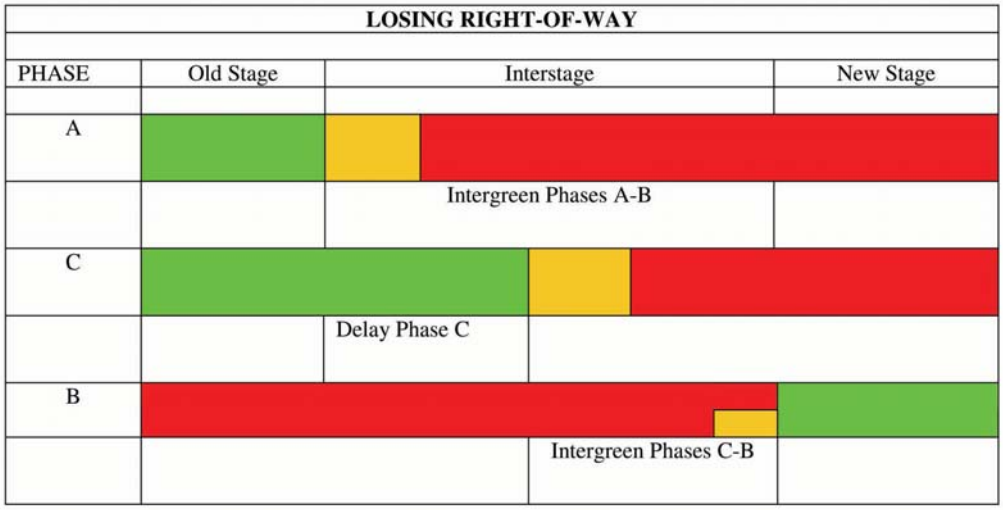
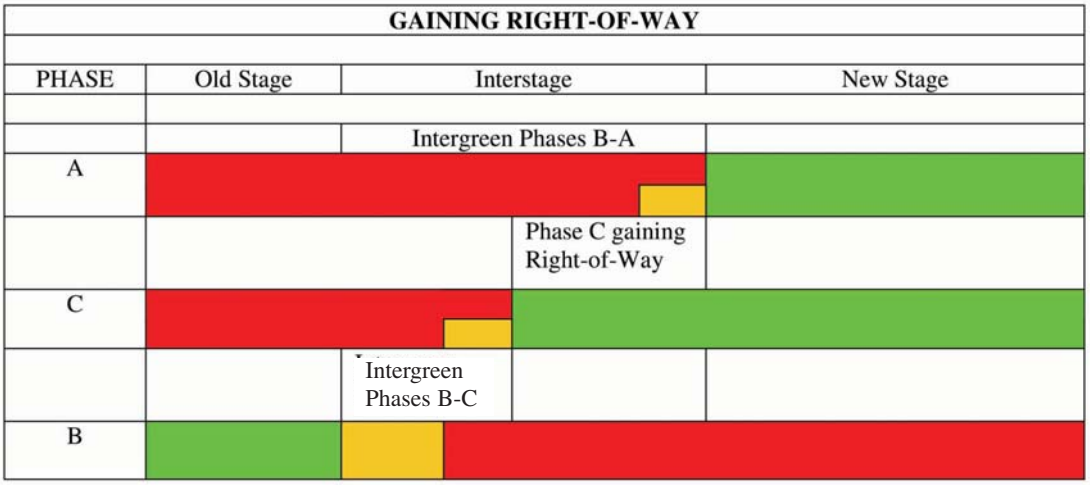


Diagram 3



Early cut-off

Below represents a simple crossroads, Phase A - southbound, Phase B - westbound, Phase C - northbound, Phase D - right turn overlap using an early cut-off of Phase C (see Part 3 of this Traffic Advisory Leaflet), Phase E - eastbound. Here the intergreen between phases A and D does not have a red/amber component. It is common to have a 3 second intergreen but the start of Phase D can be held off by additional red time to give a longer intergreen.

Diagram 4

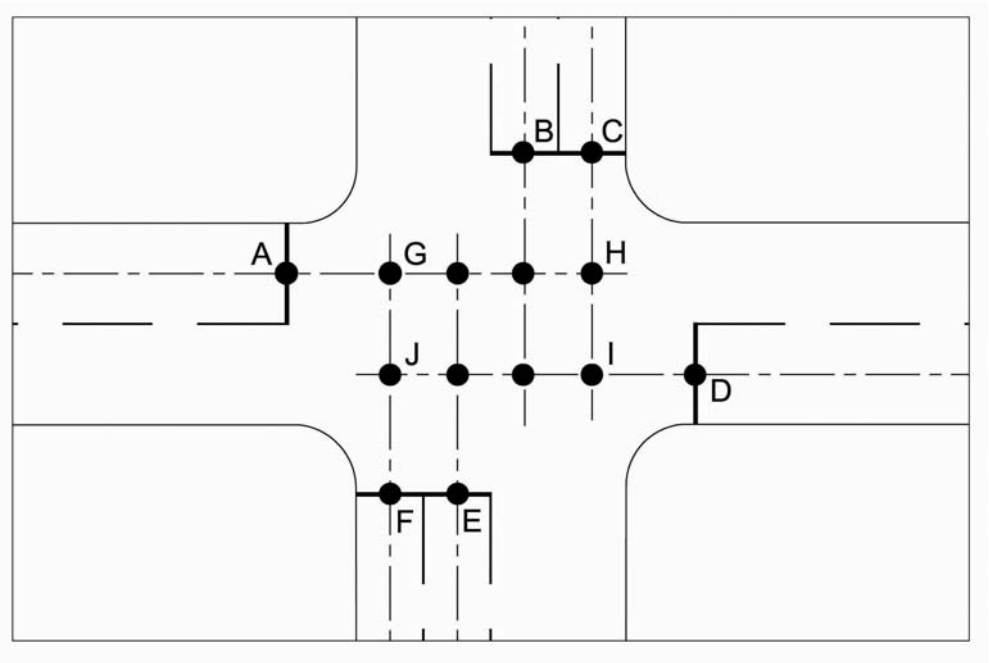
Dummy phases

The preceding diagrams illustrate "real phases". There are also "dummy" phases. The definition is: "A software device, within a controller, which may be used to control traffic movements which are not separately signalled. It does not have any associated traffic signals."

Typical uses are where:

- there are phases which continue across from one stage to another.
  i) There may be a requirement to make the second stage a priority. A dummy phase can be assigned to this stage as the priority phase. A demand for the dummy phase is inserted when priority is required.
  ii) There may not be a set minimum green for the second stage, or it may be zero. Under UTC control a zero length stage will not be detected and an error will be reported. This can be prevented by allocating a dummy phase to the second stage with an assigned minimum green, say, of 2 seconds.
- on UTC, a "G" bit is required to continue through the interstage period. By linking the "G" bit, the dummy phase and associated stages, the "G" bit can be allocated to a nu mber of sequential stages.
- a pedestrian phase runs parallel to a vehicular phase within the same stage but only when called by a push button. A dummy phase can be used as the alternative when a call is not present. If the stage initially starts without the pedestrian signal but a demand is received during the stage the dummy phase is terminated and replaced by the pedestrian phase. This saves the pedestrian waiting another cycle before receiving a green man signal. (See TAL 5/05[4])
- shuttle working is being used.
  i) Detectors can be used to optimise the all-red. Using a dummy phase for the extendable period allows for a settable interstage at the end of the all-red.
  ii) If 'revert to red' is used, the same dummy phase can be used for intergreens between each of the opposing flows. The controller is instructed to revert to the dummy stage in the absence of demands. If demands for green are received for both opposing stages during the all red the controller will choose the next stage green to the one it closed previously and not the same one.
- it is necessary to vary an intergreen because of the presence of slower, or specific vehicles. A dummy phase can be introduced by detectors, time-of-day, or day-of-week. This could, for example, be because of a steep incline on one approach. An all-red stage could be used with its own dummy phase. The dummy phase can be allocated a different extension time to give longer extension periods.
- a more responsive move is needed at a VA junction on receipt of a demand from an opposing stage. Normally, the change to an opposing stage is made following the last extension from the running stage, or at its maximum green. The maximum green starts at the receipt of the demand for the opposing stage. So the running stage could have run for a matter of minutes before the

Diagram 5
Potential collision points



maximum timer starts and the arriving vehicles still have to wait a considerable time, even though the running stage will be likely to be running fairly light. A dummy phase can be used so that its maximum green can start with the minimum green. This then works like the pre-timed maximum, say, at a Puffin.

Determination of intergreen times

Probable Collision Points

The intergreen period can be approximated by considering the relative transit times to the probable collision points. It is assumed that vehicles enter the junction at a constant speed and that the probable collision points are at the intersection of the centre lines of the swept paths, (see TD 50[3]). In practice, of course, there will be collision areas rather than collision points, since vehicles have width and length. Drivers will also take action by swerving, or braking/accelerating to avoid a collision. To take account of all these and other factors would be impracticable. The calculation on the assumptions quoted has been found to give a good basis for the initial settings but it must be stressed that on-site observation is essential and adjustments should be made if necessary.

The probable vehicular collision points for a typical junction are shown in diagram 5. Following the east-west stage those of concern are J and H. G and I are the collision points of concern following the north-south stage.

To calculate the clearance periods, measure the extra distance travelled to the probable collision points by vehicles losing right-of-way compared with those gaining right-of-way and call the longest distance x. For example if AH – CH = 6m and DJ – FJ = 8m then x = 8m.) If x is up to 9m then the minimum intergreen period following the east-west phase should be satisfactory but for distances over 9m the times given in the Table should be used. Repeat for every possible phase* change.

The distance x may be negative and intergreen times lower than that shown in the Table can be used with caution. The following advice applies in either case.

If vehicle speeds on the phase losing right-of-way are substantially less than on the phase gaining right-of-way, possibly because of a steep incline on the approach or a predominance of slow-moving vehicles, the intergreen should be increased. An example may be in determining an intergreen involving opposed right turning vehicles, which are normally slower and may be late starting. This is particularly important when the move is followed by a pedestrian phase. In such cases, after measuring the difference in swept path length and applying the guide below, it is normal to add 1, or possibly 2 seconds.

* See definitions for intergreen and interstage in Part 2 and explanation in the phasing diagram in this part.

Distance "x" (metres)	9	10-18	19-27	28-37	38-46	47-55	56-64	65-73
Intergreen (seconds)	5	6	7	8	9	10	11	12

Table for Calculating Intergreen Times

Note: Where the following stage is a pedestrian stage, the distance 'x' should be determined from the position of the pedestrian crossing. Where pedestrians are losing right of way, the figures in Traffic Advisory Leaflet 5/05[4], "Pedestrian Facilities at Signal-controlled Junctions", should be used to calculate the clearance.

Example of a TR2500 Form

Traffic Signal Data Sheet

Controller	
Manufacturer	Fireball
Type	XL5

Ref No	24/10	Site	A613 Main Road / Side Road	Town	Any Town

		STAGE 0	STAGE 1	STAGE 2	STAGE 3	STAGE	STAGE
STREAM 0	N02C1	ALL RED TT	A T B	A C	TT D		
STREAM 1							
STREAM 2							

PHASE	APPROACH	MIN	EXT	PBT	MAX	MBX	MCX	MDX	MEX	MFX	MGX	MHX	DEMANDED BY DET NAME	EXTENDED BY DET NAME
A	A613 N/Bnd Ahead	7	1.6		60	40	60	40					AX 1 & 2	AXYZ 1 & 2
B	A613 S/Bnd	7	1.6		60	40	60	40					BXZ 1 & 2	BXYZ 1 & 2
C	A613 N/Bnd R/T	7	2.0		10	7	10	7					P1	P1
D	Side Road	7	0.2		16	10	16	7					DX & MVDD9	DX & MVDD9
E														
F														
G														
H														

Phase Intergreen Times

FROM \ TO	A	B	C	D	E	F	G	H	I	J	K	L
A				6								
B			8	8								
C		7		6								
D	7	6	7									
E												
F												
G												
H												
I												
J												
K												
L												

FT Stage Sequence

Stage	Green Time

Optional Standard Features

	Y	N
Dimming	✓	
LMU	✓	
CLF Plans	✓	
RLM		✓
Time Tables	✓	
FT to MAX	✓	
SA / SD	✓	
VA	✓	
TS from Centre	✓	
TS from Rugby		✓
MOVA		✓
Part Time		✓

Additional Phase Delays

NO	Delay Phase	From Stage	To Stage	By (Secs)

Input / Output Port Details

IOP	7	6	5	4	3	2	1	0
6	AYZ1,2	AX1,2	BSA2b	BSA2a	BSA1b	BSA1a	ASA1b	ASA1a
7				MVDD9	DX	P1	BY1,2	BXZ1,2
2			DX1	D3	D2	#F3	#F2	F1
3			TS					
4	RR	CF	DF	DR3	DR2	G3	G2	G1
5			CC			MC	LF	

Hurry Calls

HC	Stage	Demanded By	(Seconds) Call Delay	Hold	Prevent
0					
1					

Manual Control

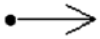
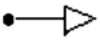
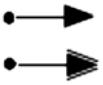
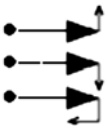
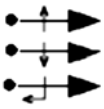
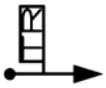
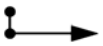
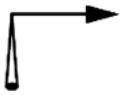
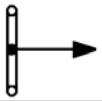
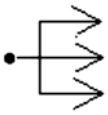
PB	1	2	3	4	5	6	7	0
Stages	1	2	3					0

NOTES

THIS SITE IS PART TIME DIAL UP U.T.C.

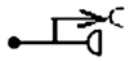
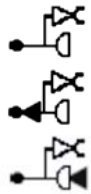
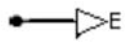
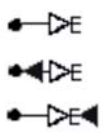
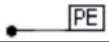
Commissioned	16/12/2004
EPROM Identity	BFR 209-215
Data Prepared	07/03/2005
File reference	
Specification Issue No.	24/10 / Issue 1
Date of Issue	11/11/2004

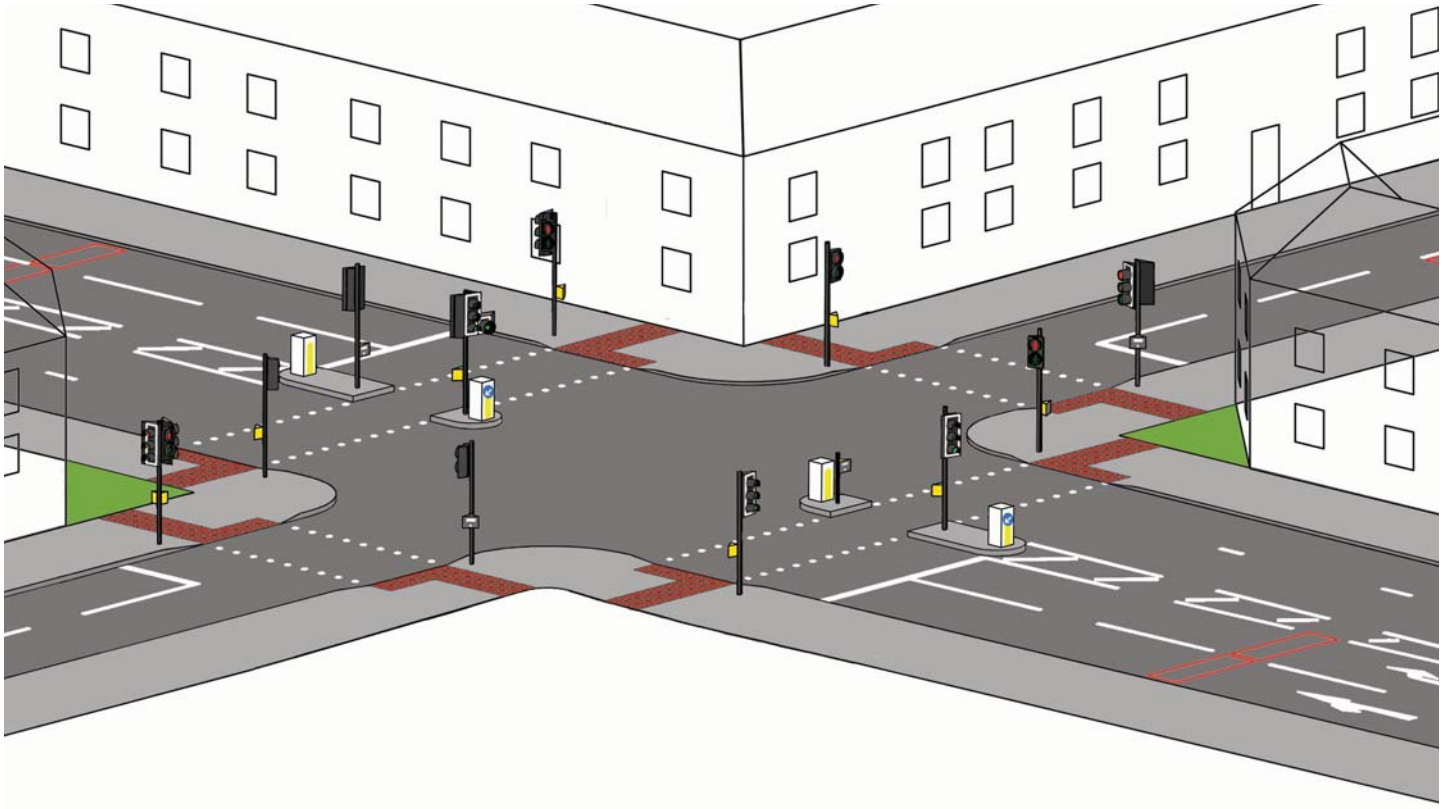
Traffic signal symbols part 1

	SYMBOL	APPEARANCE OR DIAGRAM NO. FROM TSRGD[6] AND DESCRIPTION
SIGNALS FOR VEHICLES		Single aspect signal
		Two aspect signal
		3000 with primary visor 3000 with secondary visor** Three aspect signal
		3000.8, 3000.10 Three aspect primary signals with substitute green arrow signals
		3000.7, 3000.9 Three aspect primary signals with additional green arrow signals
		Three aspect primary signal with box sign. TL-Turn left, TR-Turn right, AO-Ahead only, NLT-No left turn, NRT-No right turn, NUT-No "U" turn Note: TL and NLT normally fitted on left of signals TR and NRT on right
		Bracket mounted three aspect primary signal
		Three aspect primary signal mounted on mast arm support
		Three aspect primary signal mounted on gantry
		Two three aspect signal heads, one at standard height, one at high level
		3000.2 Three aspect primary signal with cycle symbols for amber and green
		3014 Wig-wag signal
		3013 – 3013.5 Tramcar signal

**Secondary visors have a much reduced field of vision compared to the primary. This is to shield the signal from opposing vehicular traffic, or pedestrians in some cases. However, primary visors can be used in the secondary position, for example at a stand-alone pedestrian crossing, where ahead visibility is paramount. It is important to ensure that this is clear to the supplier/installer. Drawing MCX 0402, Traffic Signal Visors, is available through the Highways Agency, giving details of the two types. All the signals above can have primary or secondary visors, as appropriate.

Traffic signal symbols part 2

	SYMBOL	APPEARANCE OR DIAGRAM NO. FROM TSRGD[6] AND DESCRIPTION
SIGNALS FOR PEDESTRIANS, CYCLISTS AND EQUESTRIANS		4003, 4003.3, 4003.6, and part of 4003.1, 4003.4, 4003.7 Push button (p.b)
		4002.1 Two aspect farside pedestrian signal
		**Two aspect nearside pedestrian signals** 4003.1 without p.b. with restricted field of view 4003.1 with combined p.b. 4003.1 with separate p.b.
		4003.5 Farside Toucan signal (cycle symbol can be to right or left)
		**Nearside Toucan signal (cycle symbol can be to right or left, see TSRGD[6])** 4003.7 without p.b. 4003.7 with combined p.b. 4003.7 with separate p.b.
		4003.2 Two aspect farside Equestrian signal
		**Two aspect nearside Equestrian signals** 4003.4 without p.b. 4003.4 with combined p.b. 4003.4 with separate p.b.
DETECTORS		Inductive loop vehicle detector
		Inductive loop MOVA vehicle detector
		Above ground vehicle detector
		Above ground stop line vehicle detector
		On-crossing detector
		Kerbside detector
		Tactile area used as surface kerbside detector
		Photo-electric cell
		Tactile paving
		Guardrailing
		Controller or other equipment housing



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From the DfT homepage, click on Roads and Vehicles, then Traffic and Parking Management and then Traffic Advisory Leaflets.

The Department for Transport sponsors a wide range of research into traffic management issues. The results published in Traffic Advisory Leaflets are applicable to England, Wales and Scotland. Attention is drawn to variations in statutory provisions or administrative practices between the countries.

The Traffic Advisory Unit (TAU) is a multi-disciplinary group working within the Department for Transport. The TAU seeks to promote the most effective traffic management and parking techniques for the benefit, safety and convenience of all road users.

Department for Transport

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e-mail: keith.alexander@wales.gsi.gov.uk

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