

TOPAS

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TOPAS 2500A

Specification for Traffic Signal Controller

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TOPAS 2500A

SPECIFICATION FOR TRAFFIC SIGNAL CONTROLLER

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1 INTRODUCTION

- 1.1 This specification covers the requirements for traffic signal controller equipment for use on roads other than motorways.
- 1.2 TOPAS specifications are explicitly purchasing specifications and compliance with them is not mandatory. However Local and other Purchasing Authorities may typically require that equipment purchased complies with TOPAS specifications and is TOPAS registered.
- 1.3 Manufacturers may register products as being compliant with this specification, using the process defined in TOPAS 0600
- 1.4 TOPAS registration requires manufacturers submit a Technical File to an appropriate Technical Assessor to aid compliance verification. The content requirement for the Technical File is defined in Appendix Z of this specification.
- 1.5 Guidance to potential users of this Product is given in Appendix A.
- 1.6 Within this specification, “The Product” shall mean all components necessary to provide a complete operational unit meeting the requirements of this specification and the common requirements defined in TOPAS0600.

Implementation

- 1.7 This specification implements requirements as originally defined in HA specification TR 2500A. Product Approvals to TR2500A may be used to register products to this specification as defined in TOPAS 0600

- 1.8 This specification will be immediately implemented from the date of issue for all new TOPAS Registrations

Glossary of Terms

- 1.9 A full Glossary of Terms is given in Highways Agency Document TA 84: Code of Practice for Traffic Control and Information Systems for All-Purpose Roads

Abbreviations

- 1.10 All abbreviations that apply in this Specification have been consolidated into the Abbreviations Section within TA 84.

2 EUROPEAN HARMONISED STANDARDS

2.1 Controllers shall meet the requirements of European Harmonised Standards BS 7987:2001 *Road traffic signal systems* (which is the Harmonisation Document HD 638 S1) BS EN 12675:2001 *Traffic signal controllers – functional safety requirements* and BS EN 50293: *Electromagnetic Compatibility Road Traffic Signal Systems Product Standard*.

2.2 Where these documents provide alternatives for variations to requirements by the definition of different classes, the controller shall meet the requirements of the classes set out in the following tables.

BS 7987 (HD 638)

Electrical Supply and Limits	Operating voltage Range	A1
	Low Voltage Switch off response voltage (V_{off})	B0
	Low Voltage Auxiliary state switch response voltage (V_{aux})	C0
	Overvoltage	D0
	Voltage dip	E2
	Mains frequency	F2
	Safety	Criteria – leakage current Road Traffic Signal Systems
Criteria – leakage current Maintenance equipment supply		U1
Earthing		L1
Accepting methods of earthing		M1
Enclosure		V4
Terminations		H0
Controller enclosure doors		J2
Controller signal outputs		K1
Requirements of Signalling Intensity for Safety		AF5
Requirements for signal states (i)		AG5

	Requirements for signal states (ii)	X1
	Location of Monitoring Elements for signals Location of Monitoring Elements for signals	N0
	Location of monitoring elements for detection of unwanted displays	P0
Test of Impedance	Fault Loop Impedance test	AA1
	Insulation of Live parts to earth	R1
	RCD (Residual Current Detector / Earth leakage breaker) For the complete system	S2
	RCD (Residual Current Detector / Earth leakage breaker) For the maintenance socket	S2
Maint- enance	Maintenance Testing Procedures	Y1
Environ- mental	Dry heat	AB3
	Cold	AE2
	Damp heat, cyclic	AK2
	Solar radiation	AH0
	Random vibration	AJ2

BS EN 12675

Fault	Class
Green – Green conflict	AA1
Green – Yellow conflict	AB1
Yellow – Yellow conflict	AC0
Green – Red/Yellow conflict	AD1
Green – Green/Yellow conflict	AE0
Absence of any conflicting Red signal	AF0
Absence for conflicting Red on specified signal heads	AG0
Absence of the last conflicting red signal	AH0
Absent Red/ absent Red	AJ0
National signal regulations (infringement)	BA0
Absence of a Red signal on a specified signal group	CA1
Absence of the last Red signal	CB1

Fault	Class
Absence of a number of Red signals	CC1
Absence of specified Red signals	CD0
Absent signal groups, Yellow or Green signals	CE0
Compliance checking	DA1
Stored values of timings	FA1
Time base frequency	FB0
Minimum values of time settings	FC0
Maximum settings of time settings	FD0
Duration of timings	FE0
National signal sequences (infringement)	GA0
Specified signal group Green to signal group Green movements	GB0
Specified signal start up sequence signal group movements	GC0
Faults of external inputs	HA1

3 NATIONAL REQUIREMENTS

Signal Sequences

3.1 Regulations require that traffic signalling equipment must be designed to present to the road user only those signals and signal sequences defined in the Traffic Signs Regulations and General Directions 2002, Regulations 30(2)(3)(4), 31 and 37 and “The Zebra, Pelican and Puffin Crossing Regulations and General Directions 1997.”

Controller Start Up Sequence

General

3.2 Where junction, junction linked pedestrian and stand-alone Pelican, Puffin and/or Toucan facilities are provided within the same controller, then each facility shall function independently of the other with regard to start up requirements.

Junction Control

3.3 On restoration of the mains supply to the controller, it shall be permissible for no signals to be shown for a period not less than 7 seconds nor exceeding 60 seconds. ('All off' period following power up). The 'All off' period may be omitted if the signals have already been off for a period exceeding 7 seconds. After the expiry of this period, the controller shall recommence operation with the establishment of the stage pattern subject to the following constraints:

- a) vehicular phases which in Stage 1, or any other nominated 'start-up' stage, will show a red signal, shall commence with an amber signal for a period of 3 seconds followed by red;
- b) during the amber period the signals for vehicular phases which will eventually show green, or green arrow, during stage 1 show the all signals off condition. They shall then show a full green signal at the end of a timed period known as the starting intergreen period. This period shall start at the commencement of the red signals of (a). It shall be possible to preset the starting intergreen period; all pedestrian and cycle signals shall be set to show red at the start of the amber in (a);
- c) On restoration of the mains supply to the controller, demands shall be inserted (in appropriate modes of operation) for all phases to ensure that no vehicles are trapped against a phase.

Pelican Control

- 3.4 On restoration of the mains supply to the controller, it shall be permissible for no signals to be shown for a period not less than 7 seconds nor exceeding 60 seconds. ('All off' period following power up). The 'All off' period may be omitted if the signals have already been off for a period exceeding 7 seconds. After the expiry of this period, the controller shall recommence operation at the start of the flashing amber to vehicles/flashing green man period to pedestrians with a stored pedestrian demand.

Puffin/Toucan/Equestrian Control

- 3.5 On restoration of the mains supply to the controller, it shall be permissible for no signals to be shown for a period not exceeding 60 seconds. ('All off' period following power up). After the expiry of this period the controller shall recommence operation in accordance with the following sequence.
- 3.6 The pedestrian (or cyclist or equestrian) signals shall be set to show the red signal. At the end of a timed period, the starting intergreen, a full green signal shall be shown to vehicles. A stored demand for pedestrians/cyclists/equestrian shall be inserted.

Traffic Regulatory Signs

- 3.7 Signs may be switched on or off at specific times, usually under part time control. This action may, (if required), also be delayed until the appearance of specified phase green signals or alternatively the appearance of a specified stage.

Priority Structure

- 3.8 Where the controller provides different methods of control related to different Appendices of this specification they shall operate in the following priority structure unless an alternative priority structure is specified in the Works Specification. The method operated by the Controller shall be the highest priority method for which a request exists, and which is currently available.:
- 1) Hurry Call (Highest Priority);
 - 2) Manual Control;
 - 3) Vehicle Priority (e.g. PSV see Appendix I);
 - 4) Urban Traffic Control (UTC, SCOOT, MOVA);
 - 5) Manually selected other modes (e.g. VA, fixed time);
 - 6) Cableless Linking Facility (CLF);
 - 7) VA or Fixed Time (Lowest Priority).
- 3.9 Any changes in the method of control shall eliminate the risk of vehicles and pedestrians being excessively delayed or trapped due to lost demands or extensions. This shall be performed on every control method change by either inserting demands on all non running phases or by continuously assessing demands and extensions against the associated greens and inserting the outstanding demands and extensions.

Fault recording

- 3.10 Fault recording facilities shall be provided in the controller in accordance with BS EN 12675:2000 5.4 Storage of Faults.

- 3.11 The fault log shall record the date and time of fault clearances.
- 3.12 The fault log shall have, as a minimum, the capacity to record 255 events.
- 3.13 The requirement not to overwrite major fault entries until they have been manually cleared may be met by the provision of a current fault log of uncleared faults with a minimum capacity of 64 fault entries together with an historic record (minimum 255 entries capacity) containing all faults and recorded events which is overwritten when full.
- 3.14 All fault data shall be preserved in the event of a power supply failure for a minimum of 30 days.
- 3.15 The fault recording system shall have the capability of detecting and recording faults from external inputs (such as detectors) as required by class HA1.
- 3.16 Major faults are defined as those described in the following classes of BS EN 12675.

AA1; AB1; AD1; DA1; FA1
- 3.17 Other faults are defined as minor faults.
- 3.18 The Works Specification may require certain other faults to cause the controller to switch off.

Failure mode

- 3.19 In the event of a major fault, the failure mode shall be “all signals off” including non-operation of “wait” and demand indicators and tactile and audible devices.

Reliability

- 3.20 The controller shall be designed to have a minimum in-service life of 15 years with suitable maintenance.

4 REFERENCES

4.1 Where undated references are listed, the latest issue of the publication applies.

British Standards

4.2 The British Standards Institution, London, publishes British Standards.

BS 7987 (HD 638)	Road Traffic Signal Systems
BS EN 50293	Electromagnetic Compatibility Road Traffic Signal Systems Product Standard
BS EN 12675	Traffic signal controllers – functional safety requirements

Specifications

4.3 TOPAS Limited specifications are available at www.topasgroup.org.uk

TOPAS 0600	Self-Certification and Approval of Equipment for the Control of Vehicular and Pedestrian Traffic on Roads
TOPAS 2506	Performance Specification for Above Ground On-Crossing Pedestrian Detection Systems
TOPAS 2507	Performance Specification for Kerbside Detection Systems for use with Nearside Signals and Demand Units
TOPAS 2508	Performance Specification for Tactile Equipment for use at Pedestrian Crossings
TOPAS 2509	Performance Specification for Audible Equipment for use at Pedestrian Crossings
TOPAS 2523	Traffic Control Equipment Interfacing Specification
MCE 0360	Urban Traffic Control - Functional Specification
MCE 0361	High Capacity data transmission system for use in UTC

Other publications

TSR&GD	Traffic Signs Regulations and General Directions:2002
SI 1997: No. 2400	The Zebra, Pelican and Puffin Crossing Regulations and General Directions 1997
TA 12	Traffic Signals on High Speed Roads
TA 84	Code of Practice for Traffic Control and Information Systems for All-Purpose Roads
TA 68	The Assessment and design of Pedestrian Crossings

- 4.4 Legal documents including Acts of parliament, Regulations and Statutory Instruments (SIs) are available from The Stationery Office
- 4.5 Traffic Advice Notes (TAs) are Highways Agency documents which are included in the Design Manual for Roads and Bridges (DMRB).

APPENDIX A FIXED-TIME

A1 This appendix sets out the requirements for a traffic signal controller to be approved for use in Fixed Time mode.

A2 The controller may be approved as either:

- a) Single stage stream; or
- b) Parallel stage streams (2 or more)

A3 Approval to this appendix requires the Design Authority to self-certify that the Product meets the requirements specified.

A4 If, in the opinion of the Design Authority, the Product provides an equivalent facility to that set out in this appendix while not meeting the requirements as specified, the Design Authority may submit the Product for approval to this appendix giving full details of how the facility differs from the specified requirements and how the Product meets the underlying aims of this appendix.

Essential requirements

A5 The controller shall provide, as a minimum, four phases and four stages.

Functional Requirements

A6 With Fixed-time method of control, the stages shall appear in a specified order for pre-set fixed-time periods. If the controller is designed for Vehicle Actuated control the fixed periods under Fixed-time control shall be the currently active stage maximum periods and input signals from the detection systems or pedestrian push buttons shall be ignored.

A7 On controllers with alternative methods of control, Fixed-time method of control may be introduced by a switch or push button on an accessible position on the controller (on the Manual Control Panel if provided) or by timetable or remote command from a UTC or other remote system.

A8 It shall be possible to define the stage sequence for the fixed-time method of control.

A9 Any phases which may run conditionally within stages in the Vehicle Actuated method of control shall always run if the appropriate stage appears in the Fixed-time method of control.

A10 If the controller is switched to Fixed-time, then it shall continue to work in the Fixed-time mode following a power failure, after power is restored,

A11 It shall be possible to define minimum intergreen timings between any pair of conflicting phases which may not be amended manually on-site or by external control signals.

Parallel Stage Streams

A12 Parallel stage streams allow a controller to function as two or more smaller controllers.

A13 Where parallel stage streaming facilities are provided it shall be possible to define in the Works Specification the allocation of the available stages to a minimum of two stage streams. Any split in the number of stages allocated to each stage stream shall be possible, and the streams shall be capable of operating independently of one another at all times during the signal cycle.

Stage Stream Restrictions

A14 It shall be possible to restrict the independent operation of stage streams in the following ways:

- a) by direct influences between stage streams. It shall be possible for one stage stream to have its stage changes conditioned by the state of another stage stream, and/or;
- b) by declaring conflicts (and phase intergreens) between selected phases in the different stage streams.

APPENDIX B VEHICLE ACTUATION

B1 This Appendix sets out the requirements for a traffic signal controller to be approved for use in Vehicle Actuated mode. Any controller approved for use in Vehicle Actuated mode must also meet the requirements for approval for use in Fixed-Time mode as set out in Appendix 1 of this specification.

B2 Approval to this appendix requires the Design Authority to self-certify that the Product meets the requirements specified.

B3 If, in the opinion of the Design Authority, the Product provides an equivalent facility to that set out in this appendix while not meeting the requirements as specified, the Design Authority may submit the Product for approval to this appendix giving full details of how the facility differs from the specified requirements and how the Product meets the underlying aims of this appendix.

Essential Requirements

B4 The requirements of the Functional Specification contained in this Appendix are for a controller which is able to have a variable stage order, and able to omit stages when permitted and when there is no demand registered for that stage. It also has the ability to select stages according to the demands received.

B5 This requires the ability to receive demands for stages or for individual phases. It also has the ability to overlap extensions for the same phase so that, with multiple detectors for the same traffic stream, the total extension granted for an individual vehicle may be varied according to the speed of the vehicle.

B6 It shall be possible to designate which stage-to-stage movements are permitted and which are not permitted. It shall not be possible to change these designations by either manual or remote command.

B7 Any alternative method of operating in a Vehicle actuated mode offered for Approval must provide the same basic facilities including:

- Variable stage order
- Stages may be omitted if not demanded
- Phase and stage demands
- Overlapping green extensions

Functional requirements

B8 The controller shall systematically give green (right-of-way) to demanded vehicular or pedestrian phases. Once a phase has been given right-of-way, this right-of-way shall continue for a preset minimum period – the minimum green period. Vehicular phases greens may be extended by requests from 'on street' detection; each such request shall cause the controller to give the associated phase its preset green extension time.

B9 If a conflicting, or opposing, phase demand exists, the running phase green may be extended up to the expiry of the phase maximum green time (as detailed in clause B17), at which time the controller shall attempt to serve one, or more, of the conflicting, or opposing, demanded phases, by calling a new stage.

Extension of Vehicle Phase Green

B10 The passage of a vehicle through a detection zone as indicated by a detector unit which normally demands a phase may, during the green period of that phase, cause a green extension to be generated for that phase.

B11 The continued output from the detector or detectors associated with a phase shall hold, subject to the maximum green running period, that phase green signal. The cessation of the output from the detector shall normally terminate the green extension request after a fixed extension period, subject to the cessation of extensions from other associated detectors. (See Figure B1) Vehicle detector outputs of a shorter duration than the response time of the controller are ignored.

B12 If at the end of the extension time the stage is held by extensions associated with another phase, further extension requests shall be permitted (subject to the maximum green running period).

B13 It shall be possible to arrange that selected detector input(s) do not extend a phase during a single selected stage.

B14 It shall not be possible for the relevant phase green periods to be terminated before extension inputs that have been accepted are actioned or legitimately overridden (by the maximum green time or a UTC force bit, for example).

B15 It shall be possible to designate a detector input as a Call/Cancel demand. In this case, the demand shall not be stored but shall only persist whilst the detector remains operational. In addition, it shall be possible to arrange that the demand from the detector does not take effect until it has persisted for a preset period – the Call Delay, and/or to prolong the effect when it ceases for a preset period – the Cancel Delay.

B16 It shall be possible to insert a revertive demand such that if a phase green is terminated with the extension timer running, a demand for a return to that phase shall normally be inserted. Where required the demand may alternatively be inserted for another specified phase.

Termination of Vehicle Phase Green

B17 A gap change of stage shall occur when the following conditions are satisfied:

- a) a demand for right-of-way for a conflicting phase exists;
- b) the minimum green running periods of phases which will lose right-of-way have expired; and
- c) the vehicle green extension timers have expired on all phases which will lose right-of-way upon the change to the next stage.

B18 The maximum green running period shall be provided for each vehicle actuated phase such that when a phase obtains right-of-way, the maximum green running period shall start to time off immediately if there is a demand for any conflicting or opposing phase. Alternatively, if there is no conflicting or opposing demand present, it shall start to time off upon the receipt of a subsequent demand for any conflicting, or opposing phase.

B19 It shall also be possible to set the operation of the controller so that the maximum green running period shall start to time off immediately a phase obtains right of way. In this case, if a demand for any conflicting or opposing phase is received during the maximum green period the phase green shall be terminated at the end of the maximum green running period. If no demand for a conflicting or opposing phase has been received by the end of the maximum green running period the phase will remain on green until a demand for a conflicting or opposing phase is received whereupon the running phase shall terminate immediately.

B20 The maximum duration of a particular stage green shall be governed by the termination of the green period of the last associated phase if more than one phase green is to be terminated by the stage change and if the maxima for these phase greens are different.

B21 Alternative values of maximum running periods shall be available and selectable by time of day and day of week.

B22 After the termination of the last phase maximum green for phases not served by the next stage to be introduced, a stage change shall occur to serve the conflicting demanded phase(s) This change may take place irrespective of whether the maximum or minimum green periods for the phase(s) also served by the new stage have expired.

All-Red stage

B23 It shall be possible to designate any stage as an all-red stage where all signals display a red signal (or a stop indication in the case of tram signals). An all-red stage may be demanded and extended by detectors between a maximum and minimum time as with other stages.

Quiescent Signal State

B24 In the absence of demands or extensions, the signals may move to the All-Red or other nominated stage as required in the Works Specification.

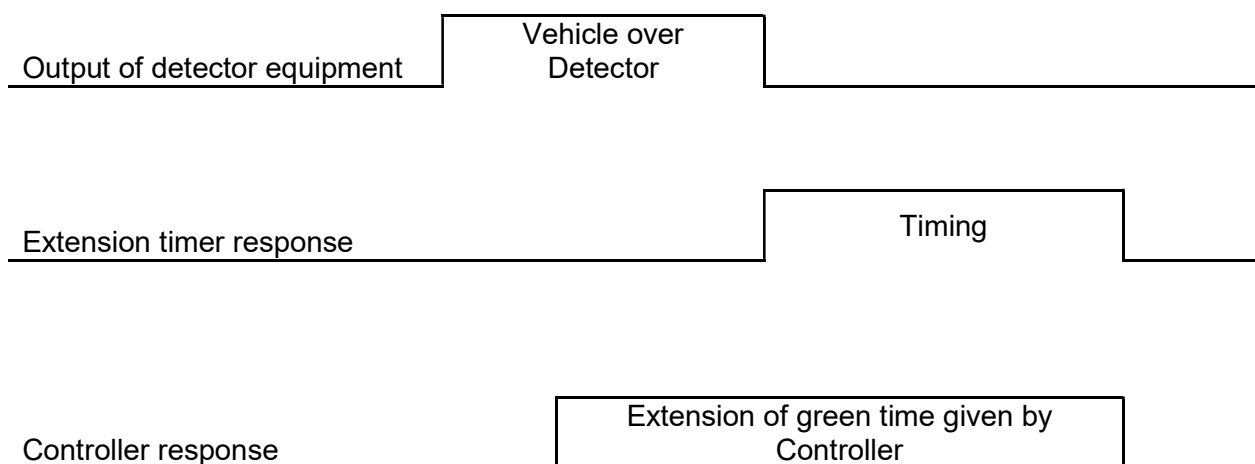


Figure B1 - Detector Logic

Detector Monitoring

B25 The input signals from the detector equipment shall be monitored by the controller. Pedestrian push buttons may, when required, be treated as vehicle detectors for fault monitoring purposes.

B26 If Puffin or other facilities involving on-crossing detection are provided at a junction, on-crossing detector monitoring as specified in Appendix J shall be provided if so required by the Works Specification.

Detector Failure Conditions

B27 Each detector input shall be individually monitored. A detector failure shall be registered if the timeout value for either a permanent detect state and for a permanent non-detect state is exceeded.

B28 The permanent detect state timeout value shall be pre-settable to a maximum of at least 60 minutes with a maximum incremental step of 1 minute.

B29 The permanent non-detect state timeout value shall be pre-settable to a maximum of at least 72 hours with a maximum incremental step of one hour.

B30 It shall be possible to allocate detectors timeout values to at least two different groups. Each group shall be capable of having a different fault reporting time.

B31 It shall be possible to designate a group as being non-monitoring, thereby providing for unmonitored detectors. The timeout values of each group should be switchable to a minimum of one alternative set by time switch.

Detector Failure Action

B32 If a detector failure occurs an artificial demand shall be set which shall be removed only when the detector fault is cleared and b) the fault flag shall be set. If a fault monitor (FM) indicator is provided it shall be lit when the fault flag is set.

B33 Once the fault flag has been set and the FM indicator (if provided) has been lit, it shall be reset only by operator intervention and an indication of which detector has failed shall be stored in the fault log.

APPENDIX C CABLELESS LINKING

C1 This Appendix sets out the requirements for a traffic signal controller to be approved for use in cableless linked mode. Approval for use in cableless linked mode will only be granted if the controller is also approved for use in vehicle actuated mode (Appendix B).

C2 Approval to this appendix requires the Design Authority to self-certify that the Product meets the requirements specified.

C3 If, in the opinion of the Design Authority, the Product provides an equivalent facility to that set out in this appendix while not meeting the requirements as specified, the Design Authority may submit the Product for approval to this appendix giving full details of how the facility differs from the specified requirements and how the Product meets the underlying aims of this appendix.

Essential Requirements

C4 The requirements of the Functional Specification contained in this Appendix are for a controller which is able to maintain coordination with other similarly equipped controllers without communication between them or individual communication with another control source (other than a publicly available time reference source). The cableless linking facility shall provide at least four timing plans switched by time of day and day of week.

Functional requirements

Cableless Linking

C5 The cableless linking facility (CLF) allows a method of linking traffic signals along a route and/or in an area using timing information derived from internal clocks in each controller which are kept in synchronism with each other by being locked to the frequency of the mains electricity supply or other means which effectively eliminates drift between them.

C6 In this way a variety of signal linking can be achieved ranging from a simple co-ordinated two controller link to a fully co-ordinated multi-plan system, or to act as a standby system in a Computer Controlled Urban Traffic Control System.

C7 All signal controllers in a linked system are related to a common cycle time for any particular traffic plan. The cableless linking facility provides instructions to the controller to change from one traffic plan to another and during the plan when to exert specific influences (e.g. to move from one nominated stage to another).

Plan Facilities

Timing Periods

C8 The necessary timing signals for the execution of a specific plan shall be derived from the group timer using the following periods:

- Offset Time – The offset time shall relate the start of the timing cycle on the individual controller to reference time. Alternatively offset times can be derived by varying the times of introduction of particular plans on linked controllers;

- Cycle Time – The cycle time shall be equal to the summation of the individual group timings;
- Group Start Time – Group start time shall be the time that each group commences from the start of the cycle time.

Group Influences

C9 The function of each group and the number of groups within a cycle shall be programmable within the individual plan to exert one of the following influences at a time upon the main controller.

- **Immediate** – An immediate move to the specified stage, subject to the constraints imposed by safety timings and stage to stage movement restrictions.
- **Demand Dependent** – That is an immediate move to a specified stage if demanded by street demands.
- **Isolate** – Allow unrestricted local Vehicle Actuated method of traffic control to operate. Phase maximum periods shall have no effect.
- **Hold** – The hold influence shall not allow any stage-to-stage changes to occur.
- **Prevent** – The prevent influence shall prevent all stage to stage moves except, if demanded by street demands, a move to the stage specified by the next group in cyclic order providing that no extensions exist for the phases losing right-of-way.

C10 The plan may also allow stages to be introduced or deleted, within the constraints of the basic stage/ phase definitions. Hence, phases may be allowed to run or be prevented from running. The stage structure changes made by a plan (by including or deleting stages) shall only apply whilst the controller is operating the Cableless Linking method of control.

Changes to Method of Control and Plan Changes

C11 If the method of control is to change to CLF, implementation of the 'new' stage may be delayed until the start of the next group timing period. This delay shall also apply if a plan change occurs whilst operating the CLF method of control.

C12 It shall be possible to modify the timings of a plan that is currently in operation.

C13 When a new plan is implemented by the timetable it shall always commence with the first group.

CLF Control of Parallel Stage Streams

C14 It shall be possible to allocate the groups of the group timer to the stages of different stage streams. For each stage it shall be possible to specify the particular group influence which shall apply.

C15 It shall be possible for the group timings for any stage stream to be independently adjusted from those of other stage streams.

APPENDIX D PART-TIME OPERATION

D1 This Appendix sets out the requirements for a traffic signal controller to be approved for use for part-time operation. Approval to this appendix requires the Design Authority to self-certify that the Product meets the requirements specified.

D2 If, in the opinion of the Design Authority, the Product provides an equivalent facility to that set out in this appendix while not meeting the requirements as specified, the Design Authority may submit the Product for approval to this appendix giving full details of how the facility differs from the specified requirements and how the Product meets the underlying aims of this appendix.

Essential Requirements

D3 The requirements of the Functional Specification contained in this Appendix are for a controller provided with a means to switch signals in and out of operation by time of day and day of week. Additionally the controller shall have a provision for the signals to be brought into and out of service by local manual command and by remote command (when the controller is connected to a remote control system).

Functional requirements

D4 Part-time traffic signals may be brought in and out of service at specific times or for specific tasks or reasons. Switch-on of signals shall be as defined in Section 3.

D5 The controller shall be provided with a means to switch signals in and out of operation by time of day and day of week. Where the signal controller is under UTC or other remote control system, the signals shall be capable of being brought into and out of service by remote command.

D6 The controller shall also be provided with a manual means to override the commands given by the time clock or by remote command. When part-time operation is selected or terminated manually the controller shall follow the same switch on and switch off procedures as specified for clock or remote commands.

D7 The signals shall be switched off under part-time control during a nominated stage provided that all minimum running periods have expired. Red signal monitoring shall be provided.

D8 When part-time signals are non-operational, all signal displays (including "wait" and demand indicators, tactile and audible devices) shall be switched off.

Red Lamp Monitoring

D9 Upon the confirmation of the failure to illuminate of all the red lamps in the primary signals of a vehicle approach (Class CD1), all the signals shall be extinguished.

D10 Other junction or stand-alone stage streams (as specified in the Works Specification) shall also be extinguished.

D11 Following the shut down of a part-time junction, the facility shall not be restored until the fault has been rectified and the controller reset. The controller will need to be manually reset. The signals shall then go through a controlled start-up sequence.

APPENDIX E HURRY CALL

E1 This appendix sets out the requirements for a traffic signal controller to be approved for use with Hurry Call facility.

E2 Approval to this appendix requires the Design Authority to self-certify that the Product meets the requirements specified.

E3 If, in the opinion of the Design Authority, the Product provides an equivalent facility to that set out in this appendix while not meeting the requirements as specified, the Design Authority may submit the Product for approval to this appendix giving full details of how the facility differs from the specified requirements and how the Product meets the underlying aims of this appendix.

Use of Hurry Calls

E4 The purpose of the Hurry Call is to enter a priority demand for a particular stage to ensure that a green signal is given to certain vehicles. Hurry Calls may be used at junctions, or stand-alone signals near to fire or ambulance stations, to ensure that certain vehicles are given right-of-way, or in conjunction with queue detectors to prevent blocking of a junction. This Specification enables stand-alone pedestrian facilities to reside on All-Red signals which may now be influenced by Hurry Call demands subject to protection of safety timings.

Functional Requirements

Request for Hurry Call

E5 The Hurry Call request for a stage shall normally be generated from special on-site detectors or from a remote push-button. Where more than one request exists, it shall be possible to prioritise the requests.

E6 On receipt of a Hurry Call request the controller shall go into the Hurry Call method of control after a preset delay, (the Hurry Call Delay Period), providing the controller is not in a higher priority method of control.

E7 On expiry of the Hurry Call Delay Period, the controller shall move immediately to the requested stage, provided that the intergreen timings and minimum green timings associated with any phases losing right-of-way in the currently running stage have expired. Extensions for running phases shall be ignored.

E8 If the requested move to the Hurry Call stage is not permitted directly, the controller shall move via the All-Red stage or other specified permitted stage movements to the Hurry Call stage. If the move is accomplished via intervening stage(s) these stage(s) shall terminate when their phase minimum running periods have expired.

Hurry Call Hold

E9 Once the Hurry Call stage has been reached, it shall be possible for the equipment to hold the stage for a preset period – the Hurry Call Hold Period.

E10 No stage change shall take place until the preset Hold Period has expired even though phase minimum green, maximum and extension timings will not be reset or held during the Hold Period. After the Hold Period the equipment shall revert to the next requested lower priority method of control.

Canceling Hurry Call Method of Control

E11 An input shall be provided to cancel the effect of the Hurry Call and return the controller to the next requested priority method of traffic control.

E12 The Hurry Call shall be prevented from being recalled for a preset period, known as the Hurry Call Prevent Period.

E13 The controller shall remain in the current method of control during this period unless other overriding priority control method(s) are requested.

E14 Hurry Call requests input during the Hurry Call Prevent Period shall be invalid. The Hurry Call Prevent period will commence timing when the Hurry Call stage is reached during Hurry Call method of control. The cancel signal shall cause the Hurry Call Prevent Period to be cancelled.

E15 It shall be possible to insert a revertive demand such that if a phase green is terminated with the extension timer running, a demand for a return to that phase shall normally be inserted. Where required the demand may alternatively be inserted for another specified phase.

Interface

E16 A suitable interface as defined by TOPAS 2523 shall be provided for connection to the Hurry Call request and cancel inputs. Condition '1' on the Hurry Call or Cancel inputs shall cause the controller to action the Call or Cancel within 250 milliseconds of the '0' to '1' transition.

E17 When requested in the Works Specification, a Standard Interface shall be provided to indicate the period from when a valid Hurry Call is received until the Hurry Call Delay and Hold Periods have elapsed and the controller has resumed normal operations.

E18 The controller shall be capable of providing at least two Hurry Call facilities which may be allocated to any of the controller stages. Hurry Calls shall be ordered on a priority structure. The presence of a request for the lower priority Hurry Call shall be ignored during the hold periods of the higher priority Hurry Call.

APPENDIX F UTC AND MOVA

F1 This appendix sets out the requirements for a traffic signal controller to be approved for use for integration in an Urban Traffic Control Scheme (Fixed-time or SCOOT to specification MCE 0360) or under MOVA control.

F2 Equipment may be approved under this appendix in one or more of the following subcategories:

- a. UTC/MOVA interface. A controller approved to Appendix F (a) will have an interface which will allow either a standard UTC Outstation Transmission Unit (OTU) or a separate MOVA unit to be connected.
- b. Integrated UTC. A controller approved to Appendix F (b) will incorporate an integrated OTU enabling it to be connected directly to a UTC data transmission system.
- c. Integrated MOVA. A controller approved to Appendix F (c) will incorporate an integrated MOVA unit.

F3 Approval to this appendix requires the Design Authority to self-certify that the Product meets the requirements specified.

F4 This appendix covers only the approval of controllers for connection to standard UTC and MOVA equipment which may be provided by other manufacturers or which provide standard MOVA functions. Consequently there is no flexibility within this appendix to approve non-conforming equipment which provides equivalent facilities.

F5 If, in the opinion of the Design Authority, the Product provides an equivalent facility or facilities to that set out in this appendix while not meeting the requirements as specified, the Design Authority may submit the Product for approval giving full details of how the facility differs from the specified requirements and how the Product meets the underlying aims of this appendix. Approval may then be granted for the facilities as defined by the Design Authority rather than to this appendix.

Functional Requirements

General

F6 In the UTC method of control, the controller is controlled either by a remote computer, via a data transmission system, or by a MOVA unit, which may be either integral to the controller or installed as an ancillary item. More details on UTC, including SCOOT (**S**plit, **C**ycle and **O**ffset **O**ptimisation **T**echnique) can be found in MCE 0360. MCH 1542 provides more details on MOVA (**M**icroprocessor **O**ptimised **V**ehicle **A**ctuation).

F7 This section details the operation and facilities of the controller to be compatible with existing UTC systems under remote computer control and with existing MOVA equipment under local control.

F8 The facilities described in this section shall be available in any combination, as required by the Works Specification. The controller shall operate as indicated by this section when used in a UTC system to MCE 0360.

F9 When operating under Urban Traffic Control, the Controller shall operate in a stage based manner, whereby it is necessary to allocate phases to stages, such allocations being conditioned by the traffic requirements and safety constraints.

F10 Commonly used designations of control/reply signals may be found in TOPAS 2523. Others may be used where a need is identified.

F11 Integral MOVA may be used as a fall-back mode for UTC.

OTU/Controller Interface

F12 The Controller shall be linked to the transmission system by an OTU designed to MCE 0361 or other approved standard, normally housed within the Controller cabinet.

F13 Control and reply information between an OTU and the signal controller shall be presented at the OTU/Controller interface.

F14 The electrical and physical requirements of the interface are specified in TOPAS 2523 Traffic Control Equipment Interfacing Specification.

APPENDIX G MANUAL CONTROL

G1 This appendix sets out the requirements for a traffic signal controller to be approved for use in manual control mode.

G2 Approval to this appendix requires the Design Authority to self-certify that the Product meets the requirements specified.

G3 If, in the opinion of the Design Authority, the Product provides an equivalent facility to that set out in this appendix while not meeting the requirements as specified, the Design Authority may submit the Product for approval to this appendix giving full details of how the facility differs from the specified requirements and how the Product meets the underlying aims of this appendix.

Functional Requirements

General

G4 Under the Manual method of control the normal influence of the detectors shall be suspended and any existing demands ignored. The selection of manual control shall not cause any extended intergreen period introduced by Warden Control, PSV priority or SA/SDE to be omitted or reduced, Stages shall be served as requested by the operator. Any detector whose operation would normally prevent the appearance of a stage shall be inhibited under the Manual method of traffic control.

Manual Control Facilities

G5 A manual panel shall be incorporated in the controller to provide access to one of three sets of facilities as required by the Works Specification.

G6 The manual control facilities sets 1, 2 and 3 shall, unless stated, be operationally latched (including under power failure conditions) until the status of that facility is changed by an alternative command.

G7 The facilities of clauses G9 (c) and (d) shall be rendered inoperative if a higher priority method of control is selected.

Set No. 1

G8 A switch shall be provided to immediately remove the signal light source supply and audible/tactile supplies without interfering with the supply to the controller operating circuits. When the signals are switched on again the controller shall operate in the start-up sequence described in Chapter 3 of this specification.

Set No. 2

G9 The following facilities shall be provided:

- a) a switch as specified in clause G8 above.
- b) switches to select the following individual methods of traffic control:
 - i) normal;
 - ii) fixed time; and
 - iii) manual;

- c) a facility to switch from stage to stage in sequence, called during manual conditions, but having regard to any stage-stage restrictions configured in the controller. Stage switching shall be achieved without interference to any preset clearance periods (such as intergreens or pedestrian clearance periods). Stage requests shall not be stored;
- d) a facility to call an All-Red condition shall be provided. When this condition is called, the controller shall switch to All-Red immediately subject to outstanding minimum green and intergreen periods and shall be terminated by the selection of another stage to which it shall switch via the red/amber period for the new stage and subject to intergreen timings. All-Red condition requests shall not be stored. It shall be possible to select and hold the All-Red condition indefinitely.

G10 The functions of the switches in clause G9(c) and (d) shall not be latched.

Set No. 3 (Part Time Signals Only)

G11 The following facilities shall be provided:

- a) a switch as specified in clause G8;
- b) switches as specified in clause G9 (b);
- c) stage call switches as specified in clause G9 (c);
- d) the facility to call an All-Red condition as specified in clause G9 (d);
- e) a switch to override normal part time operation as follows:

“on” – signals permanently on;

“off” – normal operation where the signals follow the requests for part-time operation.

G12 A facility shall be provided which will inhibit the selection of manual facilities set no 2 with the exception of the signals on/off switch and optionally the All-Red call switch as defined in the Works Specification. An indicator shall be provided to show that the stage switch facilities are not available when this facility is active.

Manual Control of Parallel Stage Streams

G13 Where manual control is provided, it shall be possible to operate all stage streams by a single manual control panel to provide ‘manual conditions’ plus an All-Red condition. The ‘manual conditions’ shall constitute combinations of specified phases provided within the controller.

Automatic Reversion from the Manual Method of Control to Normal Working

G14 Closure of the manual panel door shall cause the controller to revert from manual operation to normal working, (i.e. as if the selection switch had been returned to the Normal position).

G15 Closure of the manual panel door under conditions of power failure shall cause the controller to start up in the normal working mode when power is restored.

Indicators

G16 A test facility shall be provided for the operator to manually verify the satisfactory operation of all manual facility indicators.

G17 In manual control facilities sets 2 and 3, indicators shall be provided to show the current operational status of each control facility (with the exception of the signals on/off switch) that can be accessed.

G18 Upon selection of the manual method of traffic control, indication shall be given that the controller is ready to accept commands from the manual control facility (where applicable).

G19 The indication shall be removed when either: the controller is executing a valid request or a higher priority method of traffic control is requested.

G20 The indication shall not be given when the 'stage switch' facility is not available.

G21 An indication shall be given when a request for a prohibited stage-to-stage movement is made. The indication shall continue to be given until either:

- a) a request for a permitted stage-to-stage movement is requested; or
- b) a higher priority method of control is requested.

G22 An indication shall be given to show that the stage switch facilities are not available.

G23 Manual conditions in clause G9(c) and G11(c) may either be separately indicated or displayed on a common numerical indicator. Under all methods of traffic control except manual, stage indication may be switched off.

G24 All indicators shall be located in a position on the manual control facility (where applicable) such that they are readily visible with the access door open. The visual indicators shall have a high brightness light source appropriate to the application.

Safety Conditions

G25 It shall not be possible for a stage to be terminated under manual control until the minimum times of all currently running phases have expired. It shall not be possible to override the prohibited stage movements specified for the Manual method of traffic control.

G26 In the event of a prohibited move being requested, an indication that the selection is prohibited shall be given and the movement shall not take place. The operator may accomplish this move via permitted stage routes which may include the All-Red stage.

APPENDIX H WARDEN CONTROL

H1 This appendix sets out the requirements for a traffic signal controller to be approved for use with Warden control.

H2 Approval to this appendix requires the Design Authority to self-certify that the Product meets the requirements specified.

H3 If, in the opinion of the Design Authority, the Product provides an equivalent facility to that set out in this appendix while not meeting the requirements as specified, the Design Authority may submit the Product for approval to this appendix giving full details of how the facility differs from the specified requirements and how the Product meets the underlying aims of this appendix.

Essential requirements

H4 The Warden control feature shall allow a school crossing warden to extend a nominated intergreen period by means of an input device (which may be remote from the controller) without access to any other controller functions.

H5 The input device shall provide a non-latching input (e.g a pushbutton or biased key) and must be mounted and/or protected so as to prevent unauthorised use.

Functional Requirements

H6 A push-button or biased key-operated switch may be specified which, when operated, shall cause an intergreen period to be extended for school crossing patrol use. The push-button or switch shall be mounted within or on a remote box, the design of which shall be agreed, prior to manufacture, with the Approval Authority.

H7 The voltage applied to the device(s), specified in clause H6, shall be ELV as defined in BS 7671.

H8 When the switch device is not operated, the extension to the intergreen shall be terminated or cancelled. The extended intergreen shall appear after a nominated stage, and shall provide an extended red period. The facility may be provided by introducing an All-Red stage.

H9 Where a remote box is used it shall incorporate:

- a) either a push button; or a biased key-operated switch;
- b) a white indicator, which may be integral with item (a) and shall be illuminated when a demand for the extended intergreen period has been registered; and
- c) a green indicator, which shall be illuminated for the duration of the All-Red period. The white indicator shall extinguish at the start of this period.

H10 Either the push button together with the white and green indicators shall be mounted behind a locked door in the remote box or the key operated switch together with the white and green indicators shall be mounted on the outside of the box.

H11 The green indicator shall be subject to the green/green conflict monitoring requirements.

H12 It shall not be possible for the green indicator to be illuminated if either the indicator's supply has been turned off or the indicator's supply fuse has blown or the controller has shut down due to a fault.

APPENDIX I PSV PRIORITY

I1 This appendix sets out the requirements for a traffic signal Approval to this appendix requires the Design Authority to self-certify that the Product meets the requirements specified.

I2 If, in the opinion of the Design Authority, the Product provides an equivalent facility to that set out in this appendix while not meeting the requirements as specified, the Design Authority may submit the Product for approval to this appendix giving full details of how the facility differs from the specified requirements and how the Product meets the underlying aims of this appendix.

Functional requirements

I3 Under no circumstances shall the introduction or cancellation of priority facilities override the minimum green period, intergreen periods (including pedestrian blackout periods), or any enforced stage sequences specified for safety or other reasons. A priority demand shall result in each phase of such a sequence running for its minimum period.

I4 An operation of the priority vehicle detection equipment whilst the priority phase does not have right of way shall, in addition to registering as a priority demand, register as a normal demand. For a phase normally called via a call/cancel facility, a latching demand shall be registered if so required by the Works Specification.

I5 Provision shall be made for the full range of priority facilities. It shall be possible to include or exclude facilities and adjust timings via the operator interface.

I6 The minimum facilities are priority extensions and priority maximum running period. To this may be added a priority change, an inhibit period and a compensation period(s).

I7 Priority facilities will need to be provided on a minimum of eight phases.

Servicing of Priority Facilities

I8 The presence of an output from a priority vehicle detector shall, while the priority phase is running, hold the green signal. The cessation of the output shall initiate a priority extension period. A priority demand, for a phase other than those which are running, which is received whilst a priority extension and/or priority maximum period is running, shall be stored and serviced when the priority extension or priority maximum period expires, when no inhibit period is operational.

I9 Should two or more priority demands be stored at the termination of a minimum running period, then the priority demands shall be serviced in the normal cyclic order, and not necessarily in order of receipt.

I10 When a priority extension runs a phase beyond its normal maximum running period then a normal demand shall be entered when the phase loses right-of-way during, or at the end of, the priority maximum running period. This demand insertion may be omitted only if, by monitoring the normal detectors, it is established that no vehicles or vehicle extensions are present.

I11 If a phase green is terminated with an unexpired priority extension present, then a revertive priority demand may be automatically entered, if the priority demand facility is operational. Optionally, a facility may be specified to enable this reversion to be included or excluded.

I12 When the inhibit period is not operational, then, irrespective of the normal cyclic stage sequence, priority demands which are received after the commencement of a priority change, shall be serviced immediately (subject to normal safety periods) after the initial priority demand and after any priority extensions (subject to the priority maximum running period) are satisfied.

I13 An inhibit period shall only be introduced when a priority change has led to a phase green being prematurely terminated or a demanded phase not being run and will normally commence from the termination of the priority phase green or the point where the phase demand would otherwise have been actioned. *Note: Where, following a priority demand, more than one stage change is required to reach the priority stage, it may be necessary to start the inhibit timer later to prevent the final stage change to the priority stage itself being inhibited.*

I14 The inhibit period shall be terminated either after a preselected period has elapsed, or by right-of-way being granted to the phase to which the original priority change was made, whichever occurs first.

I15 A priority demand stored during the inhibit period shall be cancelled if the demanded phase is served at the normal VA level during the inhibit period (this may also cancel the inhibit period).

I16 A preselected extension (the compensation period) to the normal maximum running period shall, when specified, be given to nominated phases the first time they gain right-of-way following a priority change, if their running periods were curtailed or they were caused not to run by the priority change. The compensation period shall be selected individually for each phase for which compensation is specified. Different phases may be compensated as a result of priority changes to each priority phase.

I17 If a compensation period is curtailed by a priority change, the compensation period shall be reapplied on the next cycle, if required in the Works Specification.

I18 If compensation periods are required for a phase as a result of two separate priority changes, these compensation periods should run concurrently.

Note: This may limit the compensation periods to VA mode of operation only.

I19 Each phase caused not to run or whose running period was curtailed by a priority change shall always be serviced in the normal cyclic order following a priority change.

I20 The receipt of a priority extension request, during an inhibit period, for a running priority phase shall result in a priority extension and priority maximum running period being introduced.

I21 A compensation period shall only be introduced on a particular running phase if there is an outstanding vehicle extension present at the expiry of the normal maximum period for that phase. Gap changes may occur during a compensation period.

I22 When a priority change results in a VA extension being curtailed, then a demand shall be entered for the phase losing right-of-way.

I23 In the event of a PSV detector giving a permanent output for a time adjustable in the range 0–600 seconds in 30 second steps then, until reset, the output of the detector shall, have no further effect on the operation of the controller.

I24 The detector output may be either manually or automatically reset. Automatic reset shall only occur after at least 15 operations of the detector output.

I25 It shall be possible to introduce or delete each priority change facility and adjust each priority maximum, inhibit and compensation period by means of timetable entries.

Changes from VA to PSV Level

I26 The priority structure for methods of control are defined in clause 3.8.

Other Change of Level

I27 If a controller is 'taken over' by UTC force signal(s) while a priority level is running, the force signal(s) shall have no effect until all vehicle extensions at the priority level have been satisfied. Subsequently, response to force signals shall comply with the requirements of Appendix F, unless further priority demands and/or extensions are received, and unless compensation periods are specified.

Indicators

I28 A suitable means shall be provided to display the status of all priority vehicle detection inputs, inhibit periods and compensation period(s).

I29 It shall be possible to observe all detection inputs of one priority level simultaneously. These shall preferably be indicated by either a suitable indicator behind the police facility door of the controller, or an indication on an engineer's plug in terminal via the RS232 port.

APPENDIX J PEDESTRIAN/CYCLIST/ EQUESTRIAN FACILITIES

J1 This appendix sets out the requirements for a traffic signal controller to be approved for use with various pedestrian, cyclist and equestrian facilities.

J2 Approval to this appendix requires the Design Authority to self-certify that the Product meets the requirements specified.

J3 If, in the opinion of the Design Authority, the Product provides an equivalent facility to that set out in this appendix while not meeting the requirements as specified, the Design Authority may submit the Product for approval to this appendix giving full details of how the facility differs from the specified requirements and how the Product meets the underlying aims of this appendix.

J4 Equipment may be approved under this appendix in one or more of the following subcategories:

- a) Junction pedestrian facility
- b) Pelicans
- c) Puffins/Equestrian
- d) Toucans/Equestrian.

Functional Requirements

J5 The controller shall be capable of controlling a facility in accordance with the periods, times and sequences required for that facility.

J6 For a stand-alone facility, the controller may be a dedicated stand-alone controller or a junction controller capable of additionally operating the stand-alone facility by using a parallel stage stream.

J7 Details of the requirements for Pelicans, Puffins and Toucans are given in LTN 2/95 "The Design of Pedestrian Crossings" which forms part of TA 68/96 "The Assessment and Design of Pedestrian Crossings". The legal requirements are contained in the Zebra, Pelican and Puffin Pedestrian Crossings Regulations and General Directions 1997.

J8 Equestrian crossings with nearside indicators require the same sequence and timing ranges as Puffin Crossings. Equestrian crossings with far side signals require the same sequence and timing ranges as Toucan Crossings.

J9 Requirements include the ability to operate both audible and tactile indicators on any pedestrian phase and to receive and act on the input from vehicle detectors, pushbuttons, pedestrian presence detectors and on-crossing detectors as required to operate the facility.

J10 The controller shall provide all the interlocks between the signals and other indicators needed to ensure safe operation.

J11 As described in LTN 2/95, the maximum vehicle green time may start at the beginning of vehicle green or on the receipt of a pedestrian or cyclist demand. It shall be possible to select either of these modes by timetable if so required in the works specification.

J12 Any one or a combination of the junction, pedestrian and Toucan facilities may be provided, as called for in the Works Specification. If more than one facility is provided then each facility must operate independently and shall be provided with concurrently accessible manual facilities.

J13 The facilities described in this section are referenced in the Pedestrian Crossing Regulations 1997 and Local Transport Notes (LTN) 1/95 and 2/95. References to periods relate to the sequences detailed in LTN 2/95.

J14 Where a facility is provided with on-crossing detection it shall be possible, subject to the Works Specification, to operate the crossing without on-crossing detection. In this case the variable All-Red or black out periods 6 and vi respectively, may be pre-set at a value within the range of time allocated to the same period.

Detector Monitoring

J15 The input signals from the detector equipment shall be monitored by the controller. Pedestrian push buttons may, when required, be treated as vehicle detectors for fault monitoring purposes..

Detector Fault Conditions

J16 Each detector input shall be individually monitored and fault logged as described in Appendix B including the timing of permanent detect and permanent non-detect states. In addition, the individual on-crossing pedestrian detectors shall be checked as follows. If a signal has not been received from an on-crossing detector in the period between the end of the preceding clearance period (period 6 etc.) and the end of the current pedestrian green period (period 4 etc.), then a temporary artificial demand shall be inserted, being reset at the end of each clearance period. This demand will extend the clearance period (period 6 etc.) to its maximum. A fault does not need to be recorded when this occurs, but if one is, it must be automatically cleared when a signal is subsequently received from the on-crossing detector

Detector Failure Action

J17 If a detector failure occurs:

- a) it shall be possible, where specified, to set an artificial demand as follows:
 - i) for an on-crossing detector, a temporary artificial pedestrian demand shall be inserted, being reset at the end of each pedestrian to vehicle phase intergreen gap or forced change;
 - ii) for all other detectors, the artificial demand shall be permanent and shall be removed only when the detector fault is cleared.
- b) the fault flag shall be set and fault monitor (FM) indicator shall be lit (if provided).
 - i) Once the fault flag has been set and the FM indicator (if provided) has been lit, it shall be reset only by operator intervention and an indication of which detector has failed shall be stored in the fault log.

Note: Where a crossing uses near-sided indicators and has a central refuge which has pushbuttons and indicators mounted on it, it shall be possible for the indicators mounted on the central refuge to display a blackout period after pedestrian green.

Manual Facilities

J18 The following control facilities shall be provided in a stand-alone controller, access to all of which shall be secured (by key operation or otherwise) and not require the opening of the controller door:

- a) a facility by means of which the signal lamps, pedestrian or pedestrian/cyclist/equestrian indicators and audible alarms can be switched off;

- b) a facility by means of which the following can be applied to the pedestrian or pedestrian/cyclist/equestrian stage:
 - i) a continuous artificial pedestrian or pedestrian/cyclist/equestrian demand for a facility with far-sided crossing signals;
 - ii) a continuous artificial pedestrian or pedestrian/cyclist/equestrian demand and clearance extensions for a facility with near sided crossing signals;
- c) a facility by means of which the controller may be switched to operate in the fixed vehicle period or vehicle actuated method of control. When set to the fixed vehicle period method of control the controller shall operate as specified in clauses J23, J40, J56, and clause J72. Where vehicle detection equipment is not fitted, the controller shall operate in the fixed vehicle period method of traffic control regardless of the state of this facility;
- d) a facility by means of which a continuous extension can be applied to the vehicle stage. The timers controlling the 'Maximum Vehicle Period' shall continue to time out and shall not be held or reset whilst this facility is operated.

J19 Facilities (b), (c) and (d) are optional on the manual panel. Where more than one facility is required e.g. a duplicate crossing, then the extra manual facilities must be catered for within the manual panel.

Pelican

J20 This facility is a stand-alone pedestrian crossing which has far-sided crossing signals but does not have pedestrian demand cancelling or on-crossing pedestrian detection. Pedestrian demands shall be in accordance with the requirements of clauses J123 to J124. The method of control of the facility shall be selectable to be fixed vehicle period, vehicle actuated or linked.

J21 Figure J1 provides an overview of the Pelican signal sequence and facilities.

Vehicle Phase – Period A

J22 This period is the quiescent state in which the signals shall normally display vehicle green and pedestrian red, but may reside on All-Red, if called for in the Works Specification. In each operating mode the period shall function in accordance with the following requirements.

Fixed Vehicle Period Method of Control

J23 The vehicle phase green shall terminate on expiry of the vehicle maximum green time, with a pedestrian demand present. This time shall be preset at a value in the range between 20 and 60 seconds, and adjustable in incremental steps no greater than four seconds.

J24 Following the expiry of the vehicle maximum green time, any subsequent pedestrian demand shall be served after a configurable delay period of either 1, 2 or 3 seconds before period 'B' commences.

Vehicle Actuated Method of Control

J25 The vehicle phase green shall be terminated by either a forced change, with a pedestrian demand present, or a gap change.

J26 The minimum green time shall be preset at a value in the range between 6 and 15 seconds, and adjustable in incremental steps no greater than 1 second. This period will be timed from the start of the vehicle green.

J27 The maximum green time shall be preset at a value in the range between 10 and 60 seconds, and adjustable in incremental steps of a maximum of 10 seconds. This period will be timed from either:

- a) the receipt of a demand i.e. to extend; or
- b) with the start of the minimum green i.e. pre-timed maximum.

J28 The extension timer shall be preset at a value in the range between 0.2 and 5 seconds, and adjustable in incremental steps no greater than 0.2 seconds.

J29 Following the expiry of the pre-timed maximum green period, any subsequent pedestrian demand shall be served after a configurable delay period of either 1, 2 or 3 seconds, before period B commences.

Linked Method of Control

J30 The vehicle phase green shall be prevented from terminating if a hold vehicle (PV) signal is present. On removal of this signal the vehicle period shall terminate immediately provided the minimum vehicle, or fixed, green period has terminated and a pedestrian demand is present.

All-Red quiescent state

J31 In absence of vehicle and pedestrian demands the signals may be held on a pedestrian and vehicle All Red state i.e. period C. On receipt of one of the following demands the signals shall:

- a) for a vehicle demand only, respond as in clause J22 (period A) via period G (clause J35); or

- b) for a pedestrian demand only, the signals shall respond as in clause J33 (period D) after a configurable delay of 0, 1 or 2 seconds, as required in the Works Specification.

Vehicle to Pedestrian Phase Intergreen – Periods B and C

J32 These periods immediately follow the vehicle phase green and shall comprise:

Period B – A fixed period of three seconds during which the signals shall display vehicle amber and pedestrian red.

Period C – A period during which the signals shall display vehicle red and pedestrian red. The duration shall be dependent upon the highest of the following criteria applying at the time:

- a) fixed at 1, 2 or 3 seconds for a gap change in vehicle actuated operation;
- b) preset at either 1, 2 or 3 seconds for fixed vehicle period operation, linked operation, a forced change in vehicle actuated operation or if the fault flag specified in clause J17 is set;
- c) fixed at 3 seconds when speed measuring equipment is fitted.

Invitation to Cross Period – Period D

J33 This period during which the signals shall display vehicle red and pedestrian green shall immediately follow the vehicle to pedestrian phase intergreen, and shall be preset at a value in the range between 4 and 9 seconds, and adjustable in incremental steps no greater than one second.

J34 If audible and/or tactile signals are provided they may be activated during this period in accordance with the requirements of clause J128.

Pedestrian to Vehicle Phase Intergreen – Periods E, F and G

J35 These periods shall immediately follow the ‘Invitation to Cross’ period and shall comprise the following:

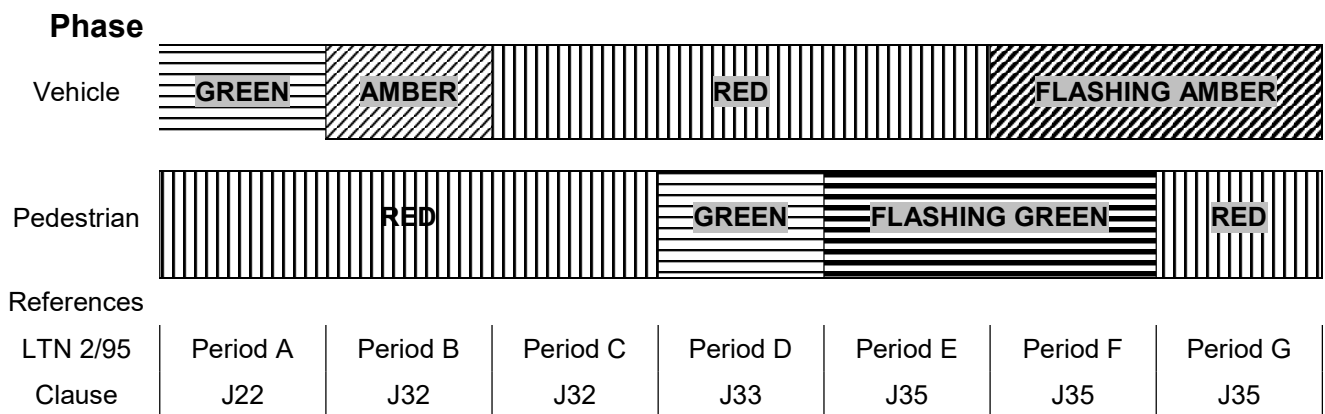
Period E – Operation with either the inclusion or exclusion of a period of 2 seconds during which the signals shall display vehicle red and flashing pedestrian green.

Period F – A period during which the signals shall display flashing vehicle amber and flashing pedestrian green. This period shall be preset at a value in the range between 6 and 18 seconds, and adjustable in incremental steps no greater than 1 second.

Period G – A period during which the signals shall display flashing vehicle amber and pedestrian red. If this period follows period F then this period shall be preset at a value of either 1 or 2 seconds. If this period follows period C then this period will be preset at a value of 3, 4 or 5 seconds. Upon termination the signals shall immediately go to the vehicle phase green (period A).

Vehicle Amber and Pedestrian Green Flash Rate

J36 The flashing rate of the flashing vehicle amber and the flashing pedestrian green signals shall be not less than 70 nor more than 90 flashes per minute. The on/off period of both signals shall be equal and synchronous.



Facilities

- Far Side Signals
- No Call Cancel
- No Crossing Extension
- Latching Push Button Demand
- Audible and Tactile

Figure J1 – Pelican Sequence and Facilities

Puffin/Equestrian Crossing

J37 This facility is a stand-alone pedestrian crossing which has near-sided crossing signals with call/cancel crossing demand and on-crossing pedestrian detection. Pedestrian demands shall be in accordance with the requirements of clauses J124 to J130.

J38 Figure J2 provides an overview of the Puffin signal sequence and facilities.

Vehicle Phase – Period 1

J39 This period is the quiescent state in which the signals shall normally display vehicle green and pedestrian red, but may reside on All-Red, if called for in the Works Specification. In each operating mode the period shall function in accordance with the following requirements.

Fixed Vehicle Period Method of Control

J40 The vehicle phase green shall terminate on expiry of the vehicle maximum green time, with a pedestrian demand present. This time shall be preset at a value in the range between 20 and 60 seconds, and adjustable in incremental steps no greater than 4 seconds.

J41 Following the expiry of the vehicle maximum green time, any subsequent pedestrian demand shall be served after a configurable delay period of either 1, 2 or 3 seconds before period 2 commences.

Vehicle Actuated Method of Control

J42 The vehicle phase green shall be terminated by either a force change with a pedestrian demand present, or a gap change.

J43 The minimum green time shall be preset at a value in the range between 6 and 15 seconds, and adjustable in incremental steps no greater than 1 second. This period will be timed from the start of the vehicle green.

J44 The maximum green time shall be preset at a value in the range between 10 and 60 seconds, and adjustable in incremental steps of 10 seconds. This period will be timed from either:

- a) the receipt of a demand; or
- b) with the start of the minimum green i.e. Pre-timed maximum.

J45 The extension timer shall be preset at a value in the range between 0.2 and 5 seconds, and adjustable in incremental steps no greater than 0.2 seconds.

J46 Following the expiry of the pre-timed maximum green period, any subsequent pedestrian demand shall be served after a configurable delay period of either 1, 2 or 3 seconds before period 2 commences.

Linked Method of Control

J47 The vehicle phase green shall be prevented from terminating if a hold vehicle (PV) signal is present. On removal of this signal the vehicle period shall be terminated provided the minimum vehicle green period has terminated and a pedestrian demand is present.

All-Red quiescent state

J48 In the absence of vehicle and pedestrian demands the signals may be held on a pedestrian and vehicle All Red state i.e. period 3. On receipt of one of the following demands the signals shall:

- a) for a vehicle demand only, respond as in clause J39 (period 1) via period 9 (clause J52 b); or
- b) for a pedestrian demand only, the signals shall respond as in clause J50 (period 4) after a configurable delay of 0, 1 or 2 seconds, as required in the Works Specification.

Vehicle to Pedestrian Phase Intergreen – Periods 2 and 3

J49 These periods shall immediately follow the vehicle phase green and shall comprise:

Period 2 – A fixed period of 3 seconds during which the signals shall display vehicle amber and pedestrian red.

Period 3 – A period during which the signals shall display vehicle red and pedestrian red. The duration shall be dependent upon the highest of the following criteria applying at the time:

- c) fixed at 1, 2 or 3 seconds for a gap change in vehicle actuated operation;
- d) preset at either 1, 2 or 3 seconds for fixed vehicle period operation, linked operation, a forced change in vehicle actuated operation or if the fault flag is set;
- e) fixed at 3 seconds when speed measuring equipment is fitted.

Invitation to Cross Period – Period 4

J50 This period during which the signals shall display vehicle red and pedestrian green shall immediately follow the vehicle to pedestrian phase intergreen, clause J54, and shall be preset at a value in the range between 4 and 9 seconds, and adjustable in incremental steps no greater than 1 second.

J51 If audible and/or tactile signals are provided they may be activated during this period in accordance with the requirements of clause J128.

Pedestrian to Vehicle Phase Intergreen – Periods 5 to 9

J52 This period shall immediately follow the 'Invitation to Cross' (period 4), and shall comprise the following periods.

Periods 5 to 8 which shall display vehicle and pedestrian red signals.

Period 5 – The minimum All-Red time shall be preset at a value in the range between 1 and 5 seconds, and adjustable in incremental steps no greater than 1 second.

Period 6 – This period shall be extended by pedestrian detection, similar to the principle of vehicle actuation, and shall be terminated by either a gap or forced change.

The extendable All-Red time shall be preset at a maximum value in the range between 0 and 30 seconds, and adjustable in incremental steps no greater than 1 second. The extendable All-Red timer shall start at the end of the minimum red period.

The extension timer shall be preset at a value in the range between 0.4 and 5 seconds, and adjustable in incremental steps no greater than 0.2 seconds.

If an associated on-crossing detector has not given a demand during the period defined in clause J16, then an artificial demand will extend this period to the maximum red time followed by the forced change period defined at period 7.

Note: The maximum All-Red time is the sum of periods 5, 6, 7 or 8.

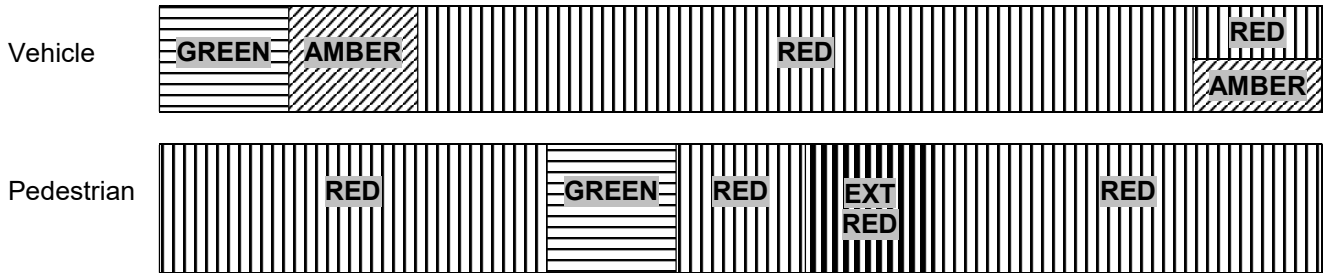
Note: Following period 6 will be periods 7 or 8, not 7 and 8.

Period 7 This period only appears if period 6 runs to a maximum, if a pedestrian is still being detected. This time shall be preset at a value in the range between 0 and 3 seconds, and adjustable in incremental steps no greater than one second.

Period 8 – If preceded by a gap change, this time shall be preset at a value in the range between 0 and 3 seconds, and adjustable in incremental steps no greater than one second.

Period 9 – A fixed period of 2 seconds during which the signals shall display vehicle red and amber and pedestrian red. Upon termination the signals shall immediately go the Vehicle Phase green (period 1).

Phase



References

LTN 2/95	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6	Period 7	Period 8	Period 9
Clause	J39	J49	J49	J50	J52	J52	J52	J52	J52

Facilities

- Crossing Extension.
- Audible and Tactile.
- Call Cancel
- Near Sided Signals

Figure J2 – Puffin Sequence and Facilities

Toucan/Equestrian Stand-alone Far-sided Crossing Signals

J53 This facility is a stand-alone combined pedestrian and cyclist or equestrian crossing which has far-sided pedestrian/cyclist or equestrian crossing signals with on-crossing pedestrian/cyclist/equestrian detection, but with no call/cancel crossing demand.

J54 Figure J3 provides an overview of the Toucan sequence and facilities (far sided signals).

Vehicle Phase – Period i

J55 This period is the quiescent state in which the signals shall normally display vehicle green and pedestrian red, but may reside on All-Red, if called for in the Works Specification. In each operating mode the period shall function in accordance with the following requirements.

Fixed Vehicle Period Method of Control

J56 The vehicle phase green shall terminate on expiry of the vehicle maximum green time, with a pedestrian and/or cyclist/equestrian demand present. This time shall be preset at a value in the range between 20 and 60 seconds, and adjustable in incremental steps no greater than 4 seconds.

J57 Following the expiry of the vehicle maximum green time, any subsequent pedestrian demand shall be served after a configurable delay period of 1, 2 or 3 seconds before period ii commences.

Vehicle Actuated Method of Control

J58 The vehicle phase green shall be terminated by either a forced change, with a pedestrian and/or cyclist/equestrian demand present, or a gap change.

J59 The minimum green time shall be preset at a value in the range between 6 and 15 seconds, and adjustable in incremental steps no greater than 1 second. This period will be timed from the start of the vehicle green.

J60 The maximum green time shall be preset at a value in the range between 10 and 60 seconds, and adjustable in incremental steps of 10 seconds. This period will be timed from either:

- a) the receipt of a demand i.e. to extend; or
- b) with the start of the minimum green i.e. pre-timed maximum.

J61 The extension timer shall be preset at a value in the range between 0.2 and 5 seconds, and adjustable in incremental steps no greater than 0.2 seconds.

J62 Following the expiry of the pre-timed maximum green period, any subsequent pedestrian/cyclist/equestrian demand shall be served after a configurable delay period of either 1, 2 or 3 seconds, before period ii commences.

Linked Method of Control

J63 The vehicle phase green shall be prevented from terminating if a hold vehicle (PV) signal is present. On removal of this signal the vehicle period shall terminate provided the minimum vehicle, or fixed, green period has terminated and a pedestrian demand is present.

All-Red Quiescent State

J64 In the absence of vehicle and pedestrians/cyclist/equestrians demands the signals may be held on pedestrian/cyclist/equestrian and vehicle All Red state i.e. period iii. On receipt of one of the following demands the signals shall:

- a) for a vehicle demand only, respond as in period i (clause J55) via period ix (clause J68); or

- b) for a pedestrian demand only, the signals shall respond as in clause 6.5.3 (period iv) after a configurable delay of 0, 1 or 2 seconds, as required in the Works Specification;

Vehicle to Pedestrian/Cyclist/Equestrian Phase Intergreen – Periods ii and iii

J65 This period shall immediately follow the vehicle phase green and shall comprise:

Period ii – A fixed period of 3 seconds during which the signals shall display vehicle amber and pedestrian/cyclist/equestrian red;

Period iii – A period during which the signals shall display vehicle red and pedestrian/cyclist/equestrian red. The duration shall be dependent upon the highest of the following criteria applying at the time:

- a) fixed at 1, 2 or 3 seconds for a gap change in vehicle actuated operation;
- b) preset at either 1, 2 or 3 seconds for fixed vehicle period operation, linked operation, a forced change in vehicle actuated operation or if the fault flag is set;
- c) fixed at 3 seconds when speed measuring equipment is fitted.

Invitation to Cross Period – Period iv

J66 This period during which the signals shall display vehicle red and pedestrian/cyclist/equestrian green shall immediately follow the vehicle to pedestrian/ cyclist/equestrian phase intergreen (clause J65), and shall be preset at a value in the range between 4 and 9 seconds, and adjustable in incremental steps no greater than 1 second.

J67 If audible and/or tactile signals are provided they may be activated during this period in accordance with the requirements of clause J128.

Pedestrian/Cyclist/Equestrian to Vehicle Phase Intergreen – Periods v to ix

J68 This period shall immediately follow the 'Invitation to Cross' period iv and shall comprise the following periods:

- a) periods v, vi and vii shall display vehicle red and pedestrian/cyclist/equestrian blackout signals;

Period v – the minimum blackout time shall be preset at a value in the range between 1 and 5 seconds, and adjustable in incremental steps no greater than 1 second;

Period vi – this period may be extended by pedestrian/cyclist/equestrian detection, similar to the principle of vehicle actuation, and shall be terminated by either a gap or forced change.

The extendable blackout time shall be preset at a maximum value in the range between 0 and 30 seconds, and adjustable in incremental steps no greater than 1 second. The extendable blackout timer shall start at the end of the minimum blackout period.

The extension timer shall be preset at a value in the range between 0.4 and 5 seconds, and adjustable in incremental steps no greater than 0.2 seconds.

If an associated on-crossing detector has not given a demand during the period defined in clause J16, then an artificial demand will extend this period to the maximum blackout time followed by the forced change period defined at period vii.

Period vii – This period only appears if period vi runs to a maximum, if a pedestrian and/or cyclist/equestrian is still being detected. This time shall be preset at a value in the range between 1 and 3 seconds, and adjustable in incremental steps no greater than 1 second.

b) **Period ix** – A fixed period of 2 seconds during which shall display vehicle red and amber and pedestrian/cyclist/equestrian red signals. Upon termination the signals shall immediately to the Vehicle Phase green (period i).

Period viii – which shall display red vehicle and pedestrian/cyclist/equestrian red signals. This time shall be preset at a value in the range between 1 and 3 seconds, and adjustable in incremental steps no greater than 1 second.

Phase



References

	Period i	Period ii	Period iii	Period iv	Period v	Period vi	Period vii	Period viii	Period ix
LTN 2/95									
TR2210A	J55	J65	J65	J66	J68	J68	J68	J68	J68

Facilities

- Far Side Signals
- No Call Cancel
- Crossing Extension
- Audible and Tactile

Figure J3– Toucan Sequence and Facilities Far-Side Signals

Toucan Stand-alone Near-sided Crossing Signals

J69 This facility is a stand-alone combined pedestrian and cyclist/equestrian crossing which shall have near-sided pedestrian/cyclist/equestrian crossing signals, call/cancel crossing demand and on-crossing pedestrian and cyclist/equestrian detection.

J70 Figure J4 provides an overview of the Toucan sequence and facilities (near side signals)

Vehicle Phase – Period 1

J71 This period is the quiescent state in which the signals shall normally display vehicle green and pedestrian/cyclist/equestrian red, but may reside on All-Red, if called for in the Works Specification. In each operating mode the period shall function in accordance with the following requirements.

Fixed Vehicle Period Method of Control

J72 The vehicle phase green shall terminate on expiry of the vehicle maximum green time, with a pedestrian and/or cyclist/equestrian demand present. This time shall be preset at a value in the range between 20 and 60 seconds, and adjustable in incremental steps no greater than 4 seconds.

J73 Following the expiry of the vehicle maximum green time, any subsequent pedestrian demand shall be served after a configurable delay period of 1, 2 or 3 seconds before **period 2** commences.

Vehicle Actuated Method of Control

J74 The vehicle phase green shall be terminated by either a forced change, with a pedestrian and/or cyclist/equestrian demand present, or a gap change.

J75 The minimum green time shall be preset at a value in the range between 6 and 15 seconds, and adjustable in incremental steps no greater than 1 second. This period will be timed from the start of the vehicle green.

J76 The maximum green time shall be preset at a value in the range between 10 and 60 seconds, and adjustable in incremental steps of 10 seconds. This period will be timed from either:

- a) the receipt of a demand i.e. to extend; or
- b) with the start of the minimum green i.e. pre-timed maximum.

J77 The extension timer shall be preset at a value in the range between 0.2 and 5 seconds, and adjustable in incremental steps no greater than 0.2 seconds.

J78 Following the expiry of the pre-timed maximum green period, any subsequent pedestrian/cyclist/equestrian demand shall be served after a configurable delay period of 1, 2 or 3 seconds before **period 2** commences.

Linked Method of Control

J79 The vehicle phase green shall be prevented from terminating if a hold vehicle (PV) signal is present. On removal of this signal the vehicle period shall terminate provided the minimum vehicle, or fixed, green period has terminated and a pedestrian demand is present.

All-Red Quiescent State

J80 In the absence of vehicle and pedestrian/cyclist/equestrian demands the signals may be held on a pedestrian/cyclist/equestrian and vehicle All Red stage i.e. **period 3**. On receipt of one of the following demands the signals shall:

- a) for a vehicle demand only, respond as in clause J71 (period 1) via period 9 (clause J84)); or for a pedestrian demand only, the signals shall respond as in clause J82 (period 4) after a configurable delay of 0, 1 or 2 seconds, as required in the Works Specification.

Vehicle to Pedestrian/Cyclist/Equestrian Phase Intergreen – Periods 2 and 3

J81 These periods shall immediately follow the vehicle phase green and shall comprise:

Period 2– a fixed period of 3 seconds during which the signals shall display vehicle amber and pedestrian/cyclist/equestrian red;

Period 3– a period during which the signals shall display vehicle red and pedestrian/cyclist/equestrian red. The duration shall be dependent upon the highest of the following criteria applying at the time:

- a) fixed at 1, 2 or 3 seconds for a gap change in vehicle actuated operation;
- b) preset at 1, 2 or 3 seconds for fixed vehicle period operation, linked operation, a forced change in vehicle actuated operation or if the fault flag is set;
- c) fixed at 3 seconds when speed measuring equipment is fitted.

Invitation to Cross Period – Period 4

J82 This period during which the signals shall display vehicle red and pedestrian/cyclist/equestrian green shall immediately follow the vehicle to pedestrian/cyclist/equestrian phase intergreen, and shall be preset at a value in the range between 4 and 9 seconds, and adjustable in incremental steps no greater than 1 second.

comprised of periods 4, 5 and 6.

J83 If audible and/or tactile signals are provided they may be activated during this period in accordance with the requirements in clause J128.

Pedestrian/Cyclist/Equestrian to Vehicle Phase Intergreen – Periods 5 to 9

J84 This period shall immediately follow the 'Invitation to Cross' **Period 4** and shall comprise the following periods:

- a) periods 5 to 8 which shall display vehicle and pedestrian red signals;

Period 5 – the minimum All-Red time shall be preset at a value in the range between 1 and 5 seconds, and adjustable in incremental steps no greater than 1 second.

Period 6 – this period shall be extended by pedestrian/cyclist/equestrian detection, similar to the principal of vehicle actuation, and shall be terminated by either a gap or forced change.

The maximum extendable All-Red time shall be preset at a value in the range between 0 and 30 seconds, and adjustable in incremental steps no greater than 1 second. The extendable All-Red timer shall start at the end of the minimum red period.

The extension timer shall be preset at a value in the range between 0.4 and 5 seconds, and adjustable in incremental steps no greater than 0.2 seconds.

If an associated on-crossing detector has not given a demand during the period defined at J16, then an artificial demand will extend this period to the maximum red time followed by the forced change period defined at period 7.

Note: Following period 6 will be period 7 or 8, not period 7 and 8.

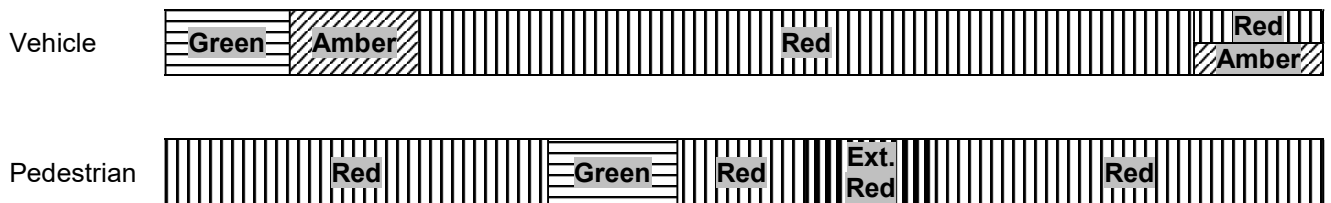
Period 7 – This period only appears if period 6 runs to a maximum, if a pedestrian and/or cyclist/equestrian is still being detected. This time shall be preset at a value in the range between 0 and 3 seconds, and adjustable in incremental steps no greater than 1 second.

Period 8 – If preceded by a gap change, this time shall be preset at a value in the range between 0 and 3 seconds, and adjustable in incremental steps no greater than 1 second.

Note: The maximum All-Red time is the sum of the periods 5, 6 and 7 or 8.

- b) **Period 9** – A fixed period of 2 seconds during which the signals shall display vehicle red and amber and pedestrian red. Upon termination the signals shall immediately go to the Vehicle Phase green (**period 1**).

Phase



References

LTN 2/95	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6	Period 7	Period 8	Period 9
Clause	J71	J81	J81	J82	J84	J84	J84	J84	J84

Facilities

- Near Side Signals
- Call Cancel
- Crossing Extension
- Audible and Tactile

Figure J4 – Toucan Sequence and Facilities Near-Side Signals

Intersection Pedestrian (Far-Sided Crossing Signals)

J85 This facility is a pedestrian crossing used at or closely linked to junctions which shall have far-sided crossing signals but shall not have call/cancel crossing demand but may have on-crossing pedestrian detection.

J86 A pedestrian phase may run more than once within a stage.

J87 In the case of a shared stage, it shall not be possible to violate the minimum green, extensions or intergreens for a vehicular phase, or the pedestrian 'invitation to cross' or pedestrian to vehicle phase intergreen for the pedestrian phase.

J88 Figure J5 provides an overview of the pedestrian signal sequence and facilities.

Vehicle Phase – Period i

J89 This period is the quiescent state in which the signals shall normally display vehicle green and pedestrian red, but may reside on All-Red, if called for in the Works Specification. In each operating mode the period shall function in accordance with the following requirements.

Fixed Vehicle Period Method of Control

J90 The vehicle phase green shall terminate on expiry of the vehicle maximum green time, with a pedestrian demand present. This time shall be preset at a value in the range between 20 and 60 seconds, and adjustable in incremental steps no greater than 4 seconds.

J91 Following the expiry of the vehicle maximum green time, any subsequent pedestrian demand shall be served after a configurable delay period of 1, 2 or 3 seconds before period ii commences.

Vehicle Actuated Method of Control

J92 The vehicle phase green shall be terminated by either a forced change, with a pedestrian present, or a gap change.

J93 The minimum green time shall be preset at a value in the range between 3 and 15 seconds, and adjustable in incremental steps no greater than one second. This period will be timed from the start of the vehicle green.

J94 The maximum green time shall be preset at a value in the range between 10 and 60 seconds, and adjustable in incremental steps of 10 seconds. This period will be timed from either:

- a) the receipt of a demand, or
- b) with the start of the minimum green i.e. Pre-timed maximum.

J95 The extension timer shall be preset at a value in the range between 0.2 and 5 seconds, and adjustable in incremental steps no greater than 0.2 seconds.

J96 Following the expiry of the pre-timed maximum green period, any subsequent pedestrian demand shall be served after a configurable delay period of 1, 2 or 3 seconds, before period ii commences.

Linked Method of Control

J97 The vehicle phase green shall be prevented from terminating if a hold vehicle (PV) signal is present. On removal of this signal the vehicle period shall terminate provided the minimum vehicle green period has terminated and a pedestrian demand is present.

All-Red Quiescent State

J98 In the absence of vehicle and pedestrian demands the signals may be held on a pedestrian and vehicle All Red state i.e. period iii. On receipt of one of the following demands the signals shall:

- a) for a vehicle demand only, respond as in clause J89 (period i) via period ix (clause J102 b); or
- b) for a pedestrian demand only, the signals shall respond as in clause J100 (period iv) after a configurable delay of 0, 1 or 2 seconds, as required in the Works Specification.

Vehicle to Pedestrian Phase Intergreen Periods ii and iii

J99 This period shall immediately follow the vehicle phase green and shall comprise:

Period ii a fixed period of 3 seconds during which the signals shall display vehicle amber and pedestrian red;

Period iii a period during which the signals shall display vehicle red and pedestrian red. The duration shall be dependent upon the highest of the following criteria applying at the time:

- a) fixed at 1, 2 or 3 seconds for a gap change in vehicle actuated operation;
- b) preset at 1, 2 or 3 seconds for fixed vehicle period operation, linked operation, a forced change in vehicle actuated operation or if the fault flag is set;
- c) fixed at 3 seconds when speed measuring equipment is fitted.

Invitation to Cross – Period iv

J100 This period during which the signals shall display vehicle red and pedestrian green shall immediately follow the vehicle to pedestrian phase intergreen in clause J99, and shall be preset at a value in the range between 4 and 9 seconds for stand-alone and 4–99 for junctions, both adjustable in incremental steps no greater than one second.

J101 If audible and/or tactile signals are provided they may be activated during this period in accordance with the requirements of clause J128.

Pedestrian to Vehicle Phase Intergreen Periods v to ix

J102 This period shall immediately follow the 'Invitation to Cross' period iv and shall comprise the following periods:

- a) periods **v**, **vi** and **vii** shall display vehicle red and pedestrian blackout signal.

period v – the minimum black-out time shall be preset at a value in the range between 3 and 15 seconds, and adjustable in incremental steps no greater than 1 second.

Period vi – this period may be extended by pedestrian detection, similar to the principal of vehicle actuation, and shall be terminated by either a gap or forced change.

The extendable blackout time shall be preset at a maximum value in the range between 0 and 30 seconds, and adjustable in incremental steps no greater than 1 second. The extendable black-out timer shall start at the end of the minimum blackout period.

The extension timer shall be preset at a value in the range between 0.4 and 5 seconds, and adjustable in incremental steps no greater than 0.2 seconds.

If an associated on-crossing detector has not given a demand during the period defined in clause J16, then an artificial demand will extend this period to the maximum black-out time followed by the forced change period defined at period vii.

Where on-crossing detection is not provided, the blackout period shall be preset at a value within the same range as that defined for the extendable blackout time.

Period vii – This period only appears if period vi runs to a maximum, if a pedestrian is still being detected. This time shall be preset at a value in the range between 1 and 3 seconds, and adjustable in incremental steps no greater than 1 second.

Period viii – which shall display red vehicle and pedestrian red signals. This time shall be preset at a value in the range between 1 and 3 seconds, and adjustable in incremental steps no greater than 1 second, and

b) **Period ix** – A fixed period of 2 seconds during which shall display vehicle red and amber and pedestrian red signals. Upon termination the signals shall immediately to the Vehicle Phase green (period i).

Phase



References

LTN 2/95	Period i	Period ii	Period iii	Period iv	Period v	Period vi	Period vii	Period viii	Period ix
Clause	J87	J99	J99	J100	J102 (a)	J102(a)	J102 (a)	J102 (a)	J102(b)

Facilities

- Far Side Signals
- No Call Cancel
- Crossing Extension
- Audible and Tactile

Figure J5 – Pedestrian Sequence and Facilities

Intersection Puffin

J103 The signal sequence and requirements for an intersection Puffin shall be as per a stand-alone Puffin, as detailed in clauses J37 to J52

J104 As with clauses J37 to J52, the on-crossing detection shall control the All-Red period of the intergreen.

J105 Exceptionally, kerb side call/cancel and/or on-crossing pedestrian detection is optional, as required in the Works Specification.

J106 Where on-crossing detection is not provided, the All-Red period t_6 shall be pre-set at a value within the range between 0–30 seconds, adjustable in 1 second steps.

J107 A pedestrian phase may run more than once within a stage.

J108 In the case of a shared stage, it shall not be possible to violate the minimum green, extensions or intergreens for a vehicular phase, or the pedestrian 'invitation to cross' or pedestrian to vehicle phase intergreen for the pedestrian phase.

Intersection Toucan (Far-sided Crossing Signals)

J109 The signal sequence and requirements shall be as for a stand-alone Toucan, as detailed as clauses J53 to J68.

J110 As with clauses J53 to J68, the on-crossing detection shall control the black-out period of the intergreen.

J111 Exceptionally, kerb-side call/cancel and/or on-crossing pedestrian/cyclist/equestrian detection is optional, as required in the Works Specification.

J112 A Toucan phase may run more than once within a stage.

J113 In the case of a shared stage, it shall not be possible to violate the minimum green, extensions or intergreens for a vehicular phase, or the 'invitation to cross' in clause J66 or the pedestrian/cyclist/equestrian to vehicle phase black-out periods in J68.

J114 Where on-crossing detection is not provided, the All-Red period t_6 shall be pre-set at a value within the range between 0–30 seconds, adjustable in 1 second steps.

Intersection Toucan (Near-sided Crossing Signals)

J115 The signal sequence and requirements shall be as per a stand-alone Toucan, as detailed in clauses J69 to J84.

J116 As with clauses J69 to J84, the on-crossing detection shall control the All-Red period of the intergreen.

J117 Exceptionally, kerb side call/cancel and/or on-crossing pedestrian/cyclist/equestrian detection is optional, as required in the Works Specification.

J118 A Toucan phase may run more than once within a stage.

J119 In the case of a shared stage, it shall not be possible to violate the minimum green, extensions or intergreens for a vehicular phase, or the 'invitation to cross' in clause J82 or the pedestrian/cyclist/equestrian to vehicle phase All-Red periods in clause J84.

J120 Where on-crossing detection is not provided, the All-Red period t_6 shall be pre-set at a value within the range between 0–30 seconds, adjustable in 1 second steps.

Pedestrian Demands

J121 Appropriate means shall be provided so that the pedestrian phase can be demanded. Demands shall be registered at any time other than during the pedestrian phase green and shall be removed on commencement of the pedestrian phase green. A registered demand from detection equipment shall be in accordance with the following requirements as applicable.

Push Button only Demand

J122 The registered demand shall be latching and shall be removed on commencement of the pedestrian phase green.

Push Button Demand and Kerbside Cancel

J123 Where kerbside detection is provided, pedestrian/cyclist/equestrian demands shall be registered and removed as follows:

- a) when both a push button box and an associated kerb side detector demand exist simultaneously an unlatched demand shall be registered. Once registered, the demand shall remain registered while a kerb side demand persists, irrespective of the state of the push– button demand. The registered demand shall be removed either upon expiry of kerb side detector extension and the registered demand extension or on commencement of the pedestrian phase green; or

- b) when a push button box demand exists but an associated kerb side detector demand does not exist a latched demand shall be registered. Once registered the demand shall remain registered and shall be removed on commencement of the pedestrian phase green.

J124 Each registered demand (push button or kerbside) shall have an extension which shall be preset at a value in the range between 0 and 5 seconds, and adjustable in incremental steps of no more than 0.2 seconds.

On–crossing Extension Demands

J125 The controller shall receive inputs from the on–crossing detection system and provide the variable All–Red period of the pedestrian to vehicle phase intergreen.

J126 Demand Indicators

J127 The Pedestrian (Wait [Pelican], Demand Accepted [Puffin]) or pedestrian/cyclist/equestrian indicator shall be illuminated to indicate that a demand exists for the pedestrian (pedestrian/cyclist/equestrian) phase. All indicators associated with the same phase shall be displayed concurrently.

Audible/Tactile Signals

General

J128 The controller shall be designed to operate with audible and tactile signals meeting the requirements of TOPAS 2508 and TOPAS 2509. Audible and/or tactile signals may be provided to indicate the steady green man period. Audible signals shall not be used unless the red signal displayed to motorists is such that all vehicular movements are signalled to stop. Tactile signals may be used where the red signal displayed to motorists is such that all conflicting vehicular movements are signalled to stop.

J129 Where required by the Works Specification the audible and/or tactile signals may operate for a reduced period at the start of the steady green man period.

J130 Where required by the Works Specification the audible signals shall be operative for only part of the day or switched to a lower audible level. The tactile signals in this case shall be fully operative.

Safety of Audible and Tactile Signals

J131 The output, to audible/tactile drives, shall either be configurable, or driven directly from the appropriate green pedestrian signal

J132 Outputs to drive audible and/or tactile signals shall only be provided during the steady pedestrian green signal periods.

J133 During normal operation, under fault conditions, or with permitted operator intervention, the controller shall only present an output to an audible and/or tactile signal if all vehicle phases conflicting with the pedestrian phase are at red.

Red Lamp Monitoring for Pedestrian Facilities at Junctions

Single Vehicle Red Lamp Failure

J134 If called for in the Works Specification, a single vehicle red lamp failure, shall, within one signal cycle of the failure, cause the All-Red period of the relevant intergreens to be extended up to a value of 5 seconds, unless it is already 5 seconds or greater when no action will be taken.

Second or Total Vehicle Red Lamp Failure

J135 Upon the event of a second vehicle red lamp failure on the same phase, vehicle red lamp feed failure or failure of the vehicle red lamp monitor, the following actions shall be taken:

J136 If the failure occurs during the pedestrian stage, the stage shall terminate unless it is within the minimum green period when it shall terminate at the end of the minimum green period.

J137 If the failure occurs during the pedestrian blackout period, the blackout shall terminate at the end of its period.

J138 If the failure occurs at any other time, the following actions shall be taken:

- a) for exclusive pedestrian stages, subsequent pedestrian stages shall be omitted. All pedestrian demands shall be disabled and all pedestrian red signals and indicators shall be illuminated;
- b) for other parallel pedestrian stages, subsequent pedestrian stages shall run normally but without the green pedestrian and audible/tactile signals. All pedestrian red signals and indicators shall be permanently illuminated;
- c) selected stand-alone streams shall be extinguished..

Restoration of Facilities

J139 Following the shut down of a facility the facility shall not be restored until the fault has been rectified and the controller reset. This may be achieved either manually or by automatic reset, as called for in the Works Specification. Where action has been taken that affects pedestrian facilities, either at junctions or stand-alone, then the controller will have to be manually reset.

J140 In either case the controller shall go through a controlled start-up sequence (see Section 3).

Red Lamp Monitoring for Stand-alone Pedestrian Facilities

J141 The controller shall provide a minimum of four red lamp monitors which will monitor for red lamp and red lamp supply failure.

Operation of Red Lamp Monitor

J142 On the event of all red lamps failing on a monitor, two red lamps on a monitor failing or a failure of the red lamp monitor being detected then all signals and pedestrian indicators shall switch off.

Restoration of Facilities

Facilities shall not be restored until the fault has been rectified. The controller will need to be manually reset.

APPENDIX K USER INTERFACE

K1 This appendix details the various controls and indications that are to be provided to enable:

- a) operation in manual method of control by authorised personnel; and
- b) adjustment of programming; and
- c) verification of the operational integrity of the controller.

K2 This Appendix should be read in conjunction with TOPAS 2523 Traffic Control Equipment Interfacing Specification.

K3 Approval to this appendix requires the Design Authority to self-certify that the Product meets the requirements specified.

K4 If, in the opinion of the Design Authority, the Product provides an equivalent facility to that set out in this appendix while not meeting the requirements as specified, the Design Authority may submit the Product for approval to this appendix giving full details of how the facility differs from the specified requirements and how the Product meets the underlying aims of this appendix.

Functional Requirements

Access Levels

K5 To ensure operational safety various levels of access shall be provided. These access levels will be appropriate to the needs and skills of the authorised personnel.

The levels of access to the controller are:

Level 1

K6 Access to the facilities associated with manual control.

Level 2

K7 Access is for modifying non safety data as defined in tables 1-4 which can be modified either by local handset or remote access. It shall be possible to monitor, but not modify, facilities restricted to level 3 access.

Level 3

K8 Access is for modifying safety data as defined in tables 1-4.

Level 4

K9 Access to data appertaining to Traffic Safety Data (BS 7987 3.2.5.2) (site configuration parameters) shall not be changeable on-site or via levels 1, 2 or 3.

Level 5

K10 Access to changes to the basic program. Such facilities will require the agreement of the Type Approval Authority.

Admittance to Access Levels

Level 1

K11 Admittance shall be by means of a locked door and/or key operated switch, which in order to provide compatibility within Local Authorities, shall be a Yale Key, 10½ Section, change 900. Access to level 1 facilities shall be gained without opening the main controller door(s).

All other levels

K12 Admittance to all other access levels shall have security protection before write access is available and shall be provided via either the main controller door(s) or the manual panel access. Admittance shall be in the form of either the operation of a key or the entry of a security code.

Level 3

K13 Access shall only be by an operator on site i.e. at the controller, and only associated with the User Terminal. The facilities are detailed in tables 1-4

User Terminal Interface

K14 The terminal device will normally be associated with the display and modification of data concerned with the parameters listed in tables 1-4. Other parameters may be provided and these shall be allocated to either Level 2 or 3 by agreement with the Approval Authority.

K15 The terminal device should have a display capable of simultaneously displaying a line of information containing the specified parameter and the instruction.

Other Display facilities

K16 Facilities may be provided either independent of the User Terminal, by the User Terminal or in parallel with the user terminal.

- a) Watchdog timer expired.
- b) Sum check error.
- c) Phases currently running and aspects being driven (these may be left on whilst the signals are off to aid controller checking).
- d) Indications and a means of selection to observe the current status of phase timers, (i.e. timing/not timing) for the following:
 - i) minimum;
 - ii) maximum;
 - iii) intergreen;
 - iv) extension.
- e) Detector input states;

K17 Visual indicators may be provided to display facilities (a), (b) and (c).

Timing Tolerance

K18 The total timing tolerance of the controller can be considered in various categories, these categories are related to the various parameters by means of the timing charts.

Category

- A – Tolerance \pm 250 milliseconds
- B – Tolerance \pm one second
- C – Tolerance \pm 1 minute
- D – Mains Sync \pm one second in 30 days or Crystal Clock \pm one second in 24 hours
- E – Tolerance \pm 10 minutes

K19 For the parameters in Table 2 the timing tolerance shall be as specified in that table. All parameters in Tables 3 and 4 shall have tolerance category A.

Engineer's Control Facilities

K20 Control facilities located inside the controller case shall be incorporated as manual switches and/or as part of the user terminal interface for use by engineering personnel.

K21 A switch shall be provided to immediately remove the signal light source supply and audible/tactile supplies without interfering with the supply to the controller operating circuits. When the signals are switched on again the controller shall operate in the start-up sequence described in Chapter 3 of this specification.

K22 A signals ON/OFF facility shall be provided to switch individual phase signal aspects and Pedestrian confirm indicators on and off. This facility shall only be available via Level 3 access of the User Interface and may only be enabled with the signals switched off from the police panel. During the accessing of this facility all signals shall be off but all normal safety monitoring facilities shall remain enabled.

1. British Summer Time advance/retard.
2. Control facilities – insertion of demand for phase; – insertion of demand for phase green extension; – detector inhibit.
3. Fault logs.
4. Detector fault monitor.
5. Current controller mode.

Table 1: Parameters Accessed via User’s Terminal

Parameter	Range	Maximum Step Size	Tolerance	Access Level	Fixed / Alterable
Mandatory Signal Timings					
Red/amber	2 sec	–	A	4	Fixed
Amber	3 sec	–	A	4	Fixed
Signal Timings - Working Values					
Phase Min Green	3–30 sec	1 sec	A	3	ALT
Vehicle extension	0.2–5 sec	0.2 sec	A	3	ALT
Phase green Maximum	0–120 sec	1 sec	A	2	ALT
Phase Intergreen	0–30 sec	1 sec	A	3	ALT
Pedestrian Blackout (preset)	3–30 sec	1 sec	A	3	ALT
Detector Function					
Call Delay	0–60 sec	1 sec	A	2	ALT
Cancel Delay	0–60 sec	1 sec	A	2	ALT

Table 2: Timing Parameters

Parameter	Range	Maximum Step Size	Tolerance	Access Level	Fixed / Alterable	
Detector Fault Monitoring						
Permanent detect state timeout	0–60 min	1 min	C	2	ALT	
Permanent non-detect state timeout	0–72 hrs	1 hr	E	2	ALT	
Start up timings						
‘All Off’ period following power up	7 - 60 sec	–	N/A	4	Fixed	
‘All Off’ period following manual switch on	0 sec	–	N/A	4	Fixed	
Starting intergreen	0–30 sec	1 sec	A	3/4	ALT/Fixed	
Push-button demand with kerbside cancel						
Hold demand after:						
Push button operation	1 – 5 secs	0.2	A	2	ALT	
End of kerb side detection	1 – 5 secs	0.2	A	2	ALT	
Other registered demand	1 – 5 secs	0.2	A	2	ALT	
CLF plans definition						
Plans	Cycle Time	0–200 sec	1 sec	D	2	ALT
	Offs	0–200 sec	1 sec	D	2	ALT
	Gro	0–100 sec	1 sec	D	2	ALT
Speed measurement SA/SDE						
SDE						
	3 sec	–	A	4	Fixed	
Double extension	3.5 sec	–	A	4	Fixed	
Triple extension						
SA	5 sec + delay period	–	A	4	Fixed	

Table 2: Timing Parameters (cont)

Parameter	Range	Maximum Step Size	Tolerance	Access Level	Fixed / Alterable
Vehicle priority					
Priority Extension	0–30 sec	1 sec	B	2	ALT
Priority Maximum	0–31 sec	1 sec	B	2	ALT
Compensation Period	0–30 sec	2 sec	B	2	ALT
Inhibit Period	0–150 sec	10 sec	B	2	ALT
Hurry Call					
Hurry Call Delay	0-99 sec	1 sec	B	2	ALT
Hurry Call Hold	0-99 sec	1 sec	B	2	ALT
Hurry Call Prevent	0-199 sec	1 sec	B	2	ALT

Table 2: Timing Parameters (cont)

Parameter	Facility Type	Range	Maximum Step Size	Access Level	Fixed/ Alterable
Vehicle phase Pelican, Puffin, and Ped/Junction					
Fixed vehicle period	ALL	20 – 60	4	3	ALT
VA vehicle minimum	Pe, Pu	6 – 15	1	3	ALT
VA vehicle minimum	Ped	3 – 15	1	3	ALT
VA vehicle maximum	ALL	10 – 60	10	2	ALT
Vehicle extension	ALL	0.2 – 5	0.2	3	ALT
Vehicle to pedestrian phase Intergreen					
Vehicle amber/ped red	ALL	3	–	4	Fixed
Red/red	ALL	1 – 3	1	3	ALT
- gap change	ALL	1 – 3	1	3	ALT
- forced change					
-					
Pedestrian phase					
Vehicle red/ped green					
Stand-alone (Period D)	Pe)				
(Period 4)	Pu	4 – 9	1	3	ALT
(Period iv))—				

Junction	Pd)	4 – 99	1	3	ALT
Pedestrian to vehicle phase intergreen					
<u>Pelican</u>					
Veh red/FGM (Period E)	Pe	0 or 2	2	3	ALT
FA/FGM (Period F)	Pe	6 – 18	1	3	ALT
FA/ped red (Period G)	Pe	1 – 2	1	3	ALT
<u>Puffin</u>					
Red/Red					
Minimum (Period 5)	Pu	1 – 5	1	3	ALT
Maximum (Period 6)	Pu	0 – 30	1	3	ALT
Force Change (Period 7)	Pu	0 – 3	1	3	ALT
Gap Change (Period 8)	Pu	0 – 3	1	3	ALT
<u>Junction pedestrian</u>					
Red/Blackout					
Minimum (Period v)	Pd	3 – 15	1	3	ALT
Maximum (Period vi)	Pd	0 – 30	1	3	ALT
Force Change (Period vii)	Pd	1 – 3	1	3	ALT
Period viii	Pd	1 – 3	1	3	ALT
Red or Blackout Extension (Ref Period 6 or vi)	Pu Pd	0.4 – 5	0.2	3	ALT
Push-button demand with kerbside cancel					
Hold demand after:					
Push button operation	ALL	1 – 5 secs	0.2	2	ALT
End of kerb side detection	ALL	1 – 5 secs	0.2	2	ALT
Other registered demand	ALL	1 – 5 secs	0.2	2	ALT

Table 3: Timing Parameters for Pedestrian Facilities

Key: Pd – Pedestrian Pu – Puffin Pe - Pelican

Parameter	Range	Maximum Step Size	Access Level	Fixed/ Alterable
Vehicle Phase (Period i or I)				
Fixed vehicle period	20–60	4	3	ALT
VA vehicle minimum	6–15	1	3	ALT
VA vehicle maximum	10–60	10	2	ALT
Vehicle extension	0.2–5	0.2	3	ALT
Vehicle to Pedestrian/Cyclist Phase Intergreen				
Vehicle amber/pedestrian red (Period ii or II)	3	–	4	Fixed
Red/red (Period iii or III)				
– gap change	1–3	1	3	ALT
– forced change	1–3	1	3	ALT
Pedestrian/Cyclist Phase (Period iv or IV)				
Vehicle red/ped and cyclist green				
Stand-alone	4–9	1	3	ALT
Junction	4–99	1	3	ALT
Pedestrian/Cyclist to Vehicle Phase Intergreen				
Variable red/red or blackout				
minimum (Period v or V)	1 – 5	1	3	ALT
maximum (Period vi or VI)	0 – 30	1	3	ALT
ext	0.4 – 5	0.2	3	ALT
Forced Change (Period vii)	1 – 3	1	3	ALT
Forced Change (Period VII)	0 – 3	1	3	ALT
Period viii	1 – 3	1	3	ALT
Gap Change (Period VIII)	0 – 3	1	3	ALT
Red + amber/red (period ix or IX)	2	-	4	Fixed

Table 4 Timing Parameters for Toucan Facilities

APPENDIX L SPEED MEASUREMENT

L1 This appendix sets out the requirements for a traffic signal controller to be approved for use with Speed Discrimination Equipment or Speed Assessment facilities for use on High Speed Roads (defined as roads with an 85 percentile approach speed equal to or greater than 35mph). Approval to this appendix requires the Design Authority to self-certify that the Product meets the requirements specified.

High Speed Road Strategies

L2 This strategies section is provided to explain the background to high speed road strategies and the reason for and application of Speed Assessment and Speed Discrimination facilities. It does not form part of the specification.

L3 The amber signal at traffic signals requires drivers to stop if it is safe to do so. Drivers are not permitted to cross the stop line when the red signal is showing. If the amber appears when a vehicle is so close to the stop line that is possible to stop safely, the driver will be able clear the stop line before the red signal appears.

L4 At further distances from the stop line there is an area (often referred to as the “dilemma zone”) where drivers confronted by a change to amber have to choose between stopping at the stop line or, by continuing at the same speed, to cross the stop line before the onset of red. One of the purposes of System D detection is to extend green periods so that drivers are less likely to be confronted by a change to amber while in the dilemma zone.

L5 The location of the dilemma zone depends on the speed of the vehicle. At speeds up to 30mph, the dilemma zone is within the area covered by System D detection: vehicles which have not reached the X detector before the change to amber will be able to stop safely at the stop line. At higher speeds the dilemma zone is located further back from the stop line. Speed discrimination/speed assessment is designed to ensure as far as possible that signal changes for vehicles travelling in excess of 30mph do not occur within the dilemma zone.

L6 Speed discrimination provides either one (double vehicle extension) or two (triple vehicle extension) additional detectors which operate only when a specific speed threshold is exceeded. These detectors provide sufficient extensions for a vehicle continuing at the same speed to reach the System D detection and prevent the green “gapping out” before the vehicle reaches the stop line.

L7 Speed assessment works on a different principle. The speed assessment detector introduces a delay dependent on the vehicle speed after which a fixed extension is introduced. The delay is calculated to expire when the vehicle is just over 5 seconds travel time from the stop line. If amber appears during the delay period the vehicle will still be able to stop safely at the stop line. The green signal is therefore permitted to “gap out” during the delay period. At the end of the delay period, if the signals have not yet changed to amber, a 5 second extension is introduced so that the green is prevented from gapping out until the vehicle is very close to the stop line, beyond the dilemma zone.

Functional Requirements

General

Speed Measuring Detectors

L8 The use of Speed Discrimination and Speed Assessment requires detectors installed in pairs. The speed is measured from the time interval between the operation of the two detectors as a vehicle passes. The logic for this may be incorporated within the controller.

L9 The strategy for the implementation of speed measuring detectors is described in TA 12.

Speed Discrimination

L10 Where Speed Discrimination (Double Vehicle Extension) is required, if a difference in signal between the inputs from the speed measuring loops of 275 milliseconds or less exists, the phase green shall be extended for a fixed period of 3.0 seconds, subject to the maximum running period.

L11 Where Speed Discrimination (Triple Vehicle Extension) is required, if a difference in signal between the inputs from the speed measuring loops of 183 milliseconds or less exists, or from the inner speed measuring loops of 235 ms or less exists, the phase green shall be extended for a fixed period of 3.5 seconds, subject to the maximum running period.

Speed Assessment

L12 Where Speed Assessment (Double Vehicle Extension) is used, if a difference in signal between the inputs from the speed measuring loops indicates a speed of 45 km/h (28 mph) or more, the phase green shall be extended by a fixed period of 5.0 seconds following a delay period given by the formula:

$$\text{Delay} = (140-5v)/v \text{ Seconds}$$

where v is the measured vehicle speed in metres/second. Above 100 km/h (62 mph), where the above expression is negative, the delay shall be zero.

L13 Other algorithms may be used with the prior approval of the Approval Authority;

L14 A gap change shall be permitted during the speed dependent delay period;

L15 The overall period comprising the fixed extension and the speed dependent delay period shall be subject to the maximum running period.

Extra Clearance Period

L16 A two second extension to the 'All-Red' period shall be automatically added following the running of any phase which is provided with speed assessment or speed discrimination equipments if any one of the following circumstances occur:

- a) any speed extension is curtailed;
- b) any VA extension is curtailed
- c) a speed discrimination or speed assessment extension occurs during the amber signal;
- d) during the phase green period, any vehicle detector connected to speed measurement equipment associated with that phase is not operated.

Speed Discrimination/Assessment Test Facility

L17 A means of testing the SDE/SA facility on site shall be provided. The test method shall be capable of access via the handset or another appropriate test facility. Access shall be level 3 i.e. access only available on-site.

L18 When in the test mode the controller shall either continue to operate normally and just provide a monitoring facility or inhibit normal operation by disconnecting the links between the detector outputs and the corresponding discriminator/assessor inputs.

L19 If the test mode inhibits normal operation or in any way prevents the detection of high-speed vehicles then an extra clearance period as defined in L16 shall be introduced following the termination of any phases that may be affected by the test.

L20 Exiting the test mode shall generate an extension to cover any high speed vehicles which may not have been detected. Typical values are approximately 4 seconds for SDE or 10 seconds for speed assessment.

APPENDIX M INFORMATIVE GUIDE

M1 This Appendix is an informative guide to the Highways Authorities who wish to use Traffic Signal Controller Equipment that has been declared conformant to this specification. Potential users should ensure that the procurement contract addresses the following additional criteria.

Security

M2 The controller door(s) are secured against unauthorised entry by a suitable lock(s) or security device(s).

Compatibility

M3 If compatibility is required with existing UTC or MOVA equipment, a standard parallel interface to TOPAS 2523 should be specified.

Marking, labelling and packaging

M4 Each Controller is clearly marked with a unique serial number and the Appendices of TOPAS 2500 to which it is approved.

M5 The controller is also clearly marked with:

- a) Power supply requirements and power consumption figures
- b) Performance characteristics where there is flexibility with the specification (such as the maximum number of phases/stages).

APPENDIX Z TECHNICAL FILE CONTENT

This appendix defines the necessary content for a Technical File Pack (a collection of relevant documents) which must be reviewed by an appropriate Technical Assessor as part of the TOPAS Registration process (See TOPAS 0600).

Only the 'ticked' items are required to be present in a Technical File Pack used to support TOPAS Registration against TOPAS 2500A.

Ref	Item	Description	Required
1	Technical File overview document.	A summary document outlining the product, specifying which TOPAS and other relevant specification(s) the product has been designed to comply with, together with a detailed table of contents for the Technical File Pack. Where copies of external certificates or documents are referred to these may be included within the Technical File overview document or supplied separately as part of the Technical File Pack.	√
2	QA accreditation certificate(s).	A copy of the Quality Management Registration Certificates for the organisation applying for TOPAS Product Registration.	√
3	Details of all CE markings that apply to the product.	A list of all directives complied with and how achieved. Typically this would be references to explicit CE Technical Files and certificate's, copies of which would be included in the Technical File Pack.	√
4	A functional design description of the product.	A reference to the overall System Design Documentation for the product (by document part number and issue).	√
5	Product part numbers	A list of top level assembly part numbers and their issue states including all firmware / software part numbers and issues.	√
6	Test procedures and results	A reference to all test schedules and test result documents (by document part number and issue).	√

6	Statement of compliance	A clause by clause statement of compliance against TOPAS 2500A confirming compliance and/or listing caveats or deviations.	√
7	EMC test results	A reference to EMC test performance requirements. Copies of the results of EMC testing undertaken by an appropriately qualified independent approved test house must be included in the Technical File Pack.	√
8	Optical test results	A reference to Optical tests performance requirements. Copies of the results of Optical testing undertaken by an appropriately qualified independent approved test house must be included in the Technical File Pack.	N/A
9	Environmental test results	A reference to Environmental tests performance requirements. Copies of the results of the Environmental testing undertaken by an appropriately qualified independent approved test house must be included in the Technical File Pack.	√
10	Radio Agency test results	A reference to Radio Agency tests performance requirements. Copies of the results of Radio Agency testing undertaken by an appropriately qualified independent approved test house must be included in the Technical File Pack.	N/A
11	Primary Safety Test results	For Traffic Control equipment specifically a reference to the Primary Safety Test schedule and test results by part number and issue. A copy of the test results should be included as part of the Technical File Pack.	√
12	Failure Mode Analysis	A reference to the product failure mode analysis requirements and results by document part number and issue.	√