Transport for London

Surface Transport

Management Systems Document – Technical Specification

Traffic Directorate

Design Standards for Signal Schemes in London

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MAYOR OF LONDON

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DOCUMENT CONTROL

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3	Aug 11	Document reviewed and updated. Main changes to Signal timings and Pedestrian facilities	KvT	MRG	AES

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1 INTRODUCTION

1.1 SCOPE

1.1.1 The purpose of this document is to provide standards and guidance for the design of traffic signals and associated equipment in London.

1.2 RELATION TO NATIONAL STANDARDS AND ADVICE

1.2.1 Whilst the Department for Transport (DfT) Specifications (TD), Advice Notes (TA) Traffic Advisory Leaflets (TAL) and Local Transport Notes (LTN) (see references) set out the general design principles to be observed they give only limited advice on the location of signals, detectors, road markings, etc. Therefore, where the advice allows for flexibility in design and layout, this document sets out the standards to be used in London to provide consistency in design. It also gives guidance on the design processes for traffic signals and associated equipment to supplement the general information on good practice, which is given in TA 84/06 “Code of Practice for Traffic Control and Information Systems for All-Purpose Roads”.

1.3 POLICY CONTEXT

1.3.1 The Mayor’s Transport Strategy and the Transport for London and London borough Local Transport Plans seek to reduce congestion, improve safety, improve the environment and promote more use of the road network by pedestrians, cyclists and buses.

1.3.2 Conflicts occurring between different streams and categories of road user decrease the operational efficiency of junctions and increase the likelihood of accidents. Traffic signals can reduce such conflicts by separating movements in time and controlling their position on the road in a way which allows traffic performance to be regulated safely. They have the flexibility to assist traffic on specific roads, to assist different categories of road users and to respond to different traffic conditions. When their timings are co-ordinated with adjacent signal installations, they can be used to influence the pattern and speed of traffic in an area.

1.3.3 Traffic signals and their associated equipment provide, therefore, an effective means by which traffic managers can implement their authority’s transport policies.

1.3.4 The Traffic Directorate (TD) – Traffic Infrastructure (TI) has been working with London Councils to prepare a paper setting-out an agreed justification criteria for new traffic signal installations. All clients are asked to observe these criteria, set-out in Appendix L. TD is happy to work with any client to determine if these criteria are not met for any proposal they might wish to consider.

1.4 ROLE OF TRAFFIC DIRECTORATE

1.4.1 In accordance with the GLA 1999 Road Traffic Act clause 276, Transport for London (TfL) is the traffic authority for traffic signals on the Transport for London Road Network (TLRN), the Strategic Road Network (SRN) and on roads for which the London boroughs are the highway authority. Where traffic signals are installed on roads for which a London borough is the highway authority, TfL consults with that borough before making major changes to the signal timings and permits reasonable requests from the borough for modifications to existing traffic signals and the provision of new signals. Traffic Infrastructure (TI) of the Traffic Directorate (TD) is that part of TfL, which is responsible for the design, installation, and commissioning of traffic signal and associated equipment.

1.4.2 The Network Performance Team within the TD (TD–NP) is responsible for maximising and safeguarding the efficient operation of London's computer controlled road network. Its primary focus is to maintain a balance for all road users.

1.4.3 TIS carries out much of the design, operation and supervision of installation works in-house whilst the majority of the installation and maintenance work on site is carried out by contractors appointed by competitive tendering.

1.4.4 The initial concept or feasibility design, some of the preliminary design, impact assessment and cost justification of the scheme are usually carried out by the organisation promoting the scheme. This organisation is also responsible for obtaining any traffic orders required and for the design and management of civil engineering works required for the scheme.

1.4.5 When requested, TI provides comments on these preliminary designs and should always be consulted about the method of control to be used. TI usually carries out the detailed design work but the promoting authority may also carry out this work. In this event, the completed design must be checked and approved by TI before work on the procurement and installation of the scheme commences and the completed installation must also be checked and approved by TI before it is commissioned. TIS should be in attendance at the commissioning.

1.5 DESIGN PROCEDURES

1.5.1 In order to comply with registered Quality Assurance procedures, Health and Safety legislation and the Construction (Design and Management) Regulations it is necessary for design checks to be carried out at various stages in the design process and for any documentation pertinent to the

subsequent operation, maintenance and removal of the equipment to be made available to those responsible for these activities.

1.5.2 Advice on best practice and procedures associated with the safety aspects of a scheme is given in TA 84/06, “Code of Practice for Traffic Control and Information Systems for All-Purpose Roads”. This advice and guidance should be followed by those responsible for the design of a traffic control scheme incorporating traffic signals.

1.5.3 In order to comply with the requirements of the Construction (Design and Management) Regulations 2007, a design file of basic information and certification for such a scheme is produced during the design process to provide a record of the development of the scheme, the decisions made and the safety considerations. This design file is incorporated in a Health and Safety Plan, which also contains records of the construction process and which is passed on to the organisation responsible for maintaining the section of highway affected by the scheme. As part of this process, a Site Installation Commentary must be carried out for each scheme, information on this process can be found in TfL Guidance Note No. GN/TO/008 – Site Installation Commentary.

1.5.4 Traffic signals in London are presently maintained by different contractors to those maintaining the highway and a separate traffic signal design file is therefore maintained by TI for each signal scheme. Figure 1 depicts the overall design process recommended in TA 84/06, the information which should be kept on the scheme design file, the interaction required between the overall scheme designers and TI and the information which should be placed on the signal design file held by TI. In order to comply with quality assurance procedures, it is necessary for the control strategy of the signal installation to be agreed by TD-NP at an early stage in the preliminary design process and for the signal design and drawings to be formally authorised by TI.

1.5.5 The concept, preliminary and detailed design stages should be carried out in accordance with the recommendations of TA 84/06. Additional guidance on design requirements in London is, however, given in the following chapters of this specification.

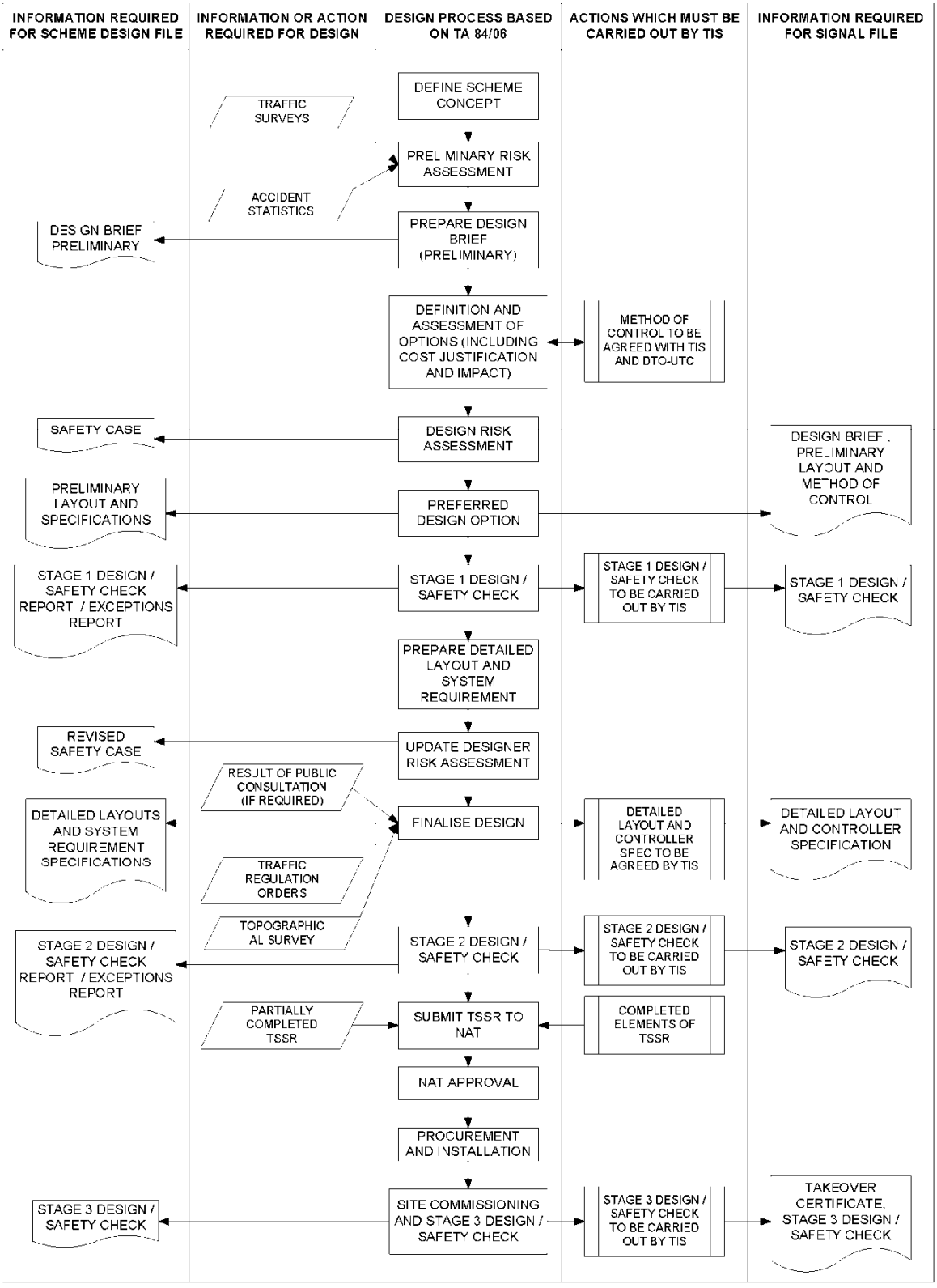


Figure 1: Design Process

2 DESIGN REQUIREMENTS

2.1 OBJECTIVE

2.1.1 The initial objective of the signal design exercise is to produce a proposed scheme drawing that will enable the Stage 2 Design/Safety Check to be completed. This drawing will show the proposed signal layout, method of control and ducting system. It will include a detailed 1:200 scale insert showing all relevant local details together with all existing and proposed TfL plant and equipment. If required, a 1:500 scale insert of outline detail showing detectors/loops on all approaches will also be included. An example of a proposed scheme drawing is shown in drawing number GEN/TTS_06/FIG01. A checklist of items to be included on a proposed scheme drawing is given at Appendix A.

2.2 DESIGN OF SIGNAL SCHEMES

2.2.1 A design brief is required for each scheme. This should consist of a statement of the objectives of the scheme with the reasons for them. This brief must include a list of all the facilities required and any particular design requirements necessary as a result of local factors.

2.2.2 At an early stage TI should be consulted to establish whether:-

i) Network Assurance notification is required

ii) The installation is to be controlled centrally from the UTC computer and if so the restrictions this will place on the design, particularly on the cycle time.

2.2.3 Where TI is requested to carry out the design of the traffic signal scheme, the client should complete a Scheme Brief Form (Appendix C) which details the information required for the design of the scheme.

2.2.4 Where a site is being modernised by TI, the following statements shall apply:

(i) All instructions set-out in this document shall be followed
(ii) Where practicable and requested by the Highway authority, additional facilities shall be incorporated in the design (i.e. new pedestrian facilities).
(iii) Where there are existing facilities at a site, these should not be removed without agreement with the Highway Authority.
(iv) The pedestrian timings to be used shall be as set-out in this document.

2.3 DESIGN CHECK

2.3.1 All signal schemes are required to have a design/safety check and TI carries out an independent check when the design has been completed.

2.3.2 The Design/Safety check is carried out in three stages:

Stage 1 a pre-design inspection of the proposed site to identify possible problems that would have a bearing on the design of the scheme;

Stage 2 a Design/Safety check of the design carried out by the TI checking engineer;

Stage 3 a site inspection carried out at commissioning to check that any problems identified in Stages 1 and 2 have been overcome and no other problems have occurred. If the site has been installed by a third party, TIS must attend the inspection.

2.3.3 The Design Engineer shall visit the site before any design work is started and carry out STAGE 1 of the Design/Safety check by filling in the Design/Safety Check List (DSCL) (see Appendix I) in **any colour other than red** ink, making any comments or suggestions in the appropriate column and then sign the document.

2.3.4 A preliminary Site Installation Commentary (SIC) should also be carried out at this time.

2.3.5 Photographs of each approach would also be beneficial.

Note: On a green field site this may not be very productive but often problems can be anticipated.

2.3.6 The Design Engineer should then prepare the proposed scheme layout drawing (in accordance with TTS 14) incorporating any features identified in the DSCL.

2.3.7 If any feature mentioned in the DSCL cannot be incorporated into the design then the reasons must be noted in red ink on the DSCL alongside the appropriate comment.

2.3.8 When the scheme layout drawing is complete it shall be sent to the TIS Checking Engineer together with the DSCL and the controller specification detailing the method of control, the intergreen and minimum green timings, and any phase delays. Where the design is for a Pelican, Puffin or Toucan installation the proposed timings should also be sent with the scheme drawing and SCL.

2.3.9 The TIS Checking Engineer will carry out STAGE 2 of the Design/Safety check by checking the layout against the Design/Safety Check List (DSCL) STAGE 2 (see Appendix J), marking the list in **blue** ink. The TIS Checking Engineer will respond to the comments of the Design Engineer on the DSCL STAGE 1 in **red** ink or, if satisfied, initial the Check box on the DSCL STAGE 1.

2.3.10 If any amendments to the design, as suggested by the Checking Engineer at STAGE 2, cannot be incorporated into the scheme, then the Design Engineer will respond to the comments of the Checking Engineer on the DSCL STAGE 2 in **red** ink. Where necessary evidence should be provided to show that the Highway Authority are in agreement with the final design.

2.3.11 If, subsequent to STAGE 2 of the check, modifications are made to the layout, the drawing shall be resubmitted to the Checking Engineer for checking and clearance.

2.3.12 If in agreement with the DSCL STAGE 2 document, the Checking Engineer and Design Engineer will both sign it.

2.3.13 A detailed Site Installation Commentary (SIC) should also be carried out at this time.

2.3.14 If any disputes occur between the Checking Engineer and the Design Engineer that cannot be mutually resolved, the matter shall be referred to a Team Leader in TIS or, if not available, to the Chief Engineer Signals.

2.3.15 When the STAGE 2 Design/Safety Check of the scheme layout drawing has been carried out satisfactorily, the Checking Engineer shall confirm the result by dating and initialling the master proposed drawing in the box provided.

2.3.16 The STAGE 2 Design/Safety Check of both the scheme drawing and the controller specification must be completed before the controller is ordered.

2.3.17 When the scheme is installed, the Design Engineer and TI shall carry out STAGE 3 of the Design/Safety check on site and complete the DSCL for STAGE 3 (see Appendix K) in **any colour other than red** ink and then sign it. This can be undertaken by TIS exclusively.

2.3.18 If any safety implications are found at this point Design Engineers will use their discretion and note the outcome on STAGE 3 of the safety check list and take any appropriate remedial action.

2.4 BASIC SITE INFORMATION

2.4.1 The designer should visit the site and note any particular safety features necessary, carrying out a preliminary STAGE 1 Design/Safety check by considering all the factors on the Design/Safety Check List the designer

should also assess the need for any non-standard information that needs to be provided.

2.4.2 The following information will be required to carry out the design:

a) An electronic 1:200 scale plan of the site should be sent to: – DTOSchemeBriefData@streetmanagement.org.uk in DWG. format. If the scheme is an 'improvement', the new, as well as the existing, kerb and building lines should be shown. For schemes that entail no significant alteration to road kerb lines, base ordnance survey data may provide sufficient topographical information but care should be exercised to ensure that the details are both current and accurate. Limited surveys to check certain critical dimensions and to check the location of any physical objects such as statutory undertaker's plant, manhole covers, drainage, lighting cables, lamp columns, road signs, trees etc may be all that is required. For more significant changes in layout, a full three dimensional model of the existing topography may be required. For major changes early consultation with statutory undertakers, who may be affected, is recommended. These consultations may lead to a requirement to commission trial excavations to locate precisely existing plant in relation to the revised kerb alignments.

Hourly classified traffic counts, converted to PCU's/hour (reassigned if the scheme is part of a traffic management package) for each arm of the junction with separate turning traffic figures. These counts should cover the morning and evening peaks, daytime off-peak and any other significant event time, e.g. Saturday shopping period. If the existing situation has queues, their length, in vehicles, should be measured every quarter of an hour. The flows should be in the form of a graphical summary if possible. If major changes to the road network, developments or other factors are likely to result in changed traffic flows, predicted flows from traffic models should be provided.

b) The saturation flow of each arm of the junction should be assessed, either practically by on site measurement using the TRL saturation flow program and a portable computer, or theoretically using the TRL method described in TRL RR 67 'Prediction of saturation flows for road junctions controlled by traffic signals'. Saturation flows should wherever possible be measured practically on site but it is essential at critical junctions. The prediction method may be used as an alternative where site measurement is impractical.

c) Cruise speed - the 85 percentile free flow traffic platoon running speed for each approach.
Where the junction forms part of a linked network the following is also required:-
Journey time – free flow traffic platoon time (seconds) from up-stream stop line to junction stop line.

e) For all proposed installations 85th percentile speeds should be provided so that suitable detection can be determined.

f) Statutory undertakers' drawings should be provided for all proposed designs.

2.4.3 TD–NP must be consulted on the design and timing constraints of any scheme, to establish whether computer control is required.

3 JUNCTIONS

3.1 CHOICE OF CONTROL METHOD

3.1.1 Consideration must be given to the policy requirements of the highway authority and Transport for London. The designer should in particular consider the requirements of pedestrians, cyclists and public transport.

3.1.2 All installations shall be designed to operate in an isolated mode and any other mode required by the client. For individual signal installations outside the UTC area the isolated mode would normally be VA or MOVA. For junctions in the UTC area the isolated mode would normally be the Cableless Linking Facility (CLF) with due regard to adjacent junctions. The fallback system from CLF would be either VA or fixed time operation.

3.1.3 If there are bus routes passing through the scheme with a minimum of 4 buses per hour on any one approach then Bus Priority should be included. TI will advise on the equipment to be provided. To provide maximum efficiency, if the junction has bus lanes on any approach, then the timings will need to be matched to the set back of the bus lane. (TfL Guidance Note No: GN/TO/001 – Bus Priority Implementation within UTC and Userguide No. U/2706/TO/382 – Selective Vehicle Detection in London)

3.1.4 MOVA control (TD 35/91) may be a requirement at signals on the TLRN outside the UTC area and the relevant TfL borough managers should be consulted. In such cases MOVA should be the normal mode of operation and in the event of failure the junction should revert to vehicle actuated control using the MOVA detection loops.

3.1.5 TRL MOVA Application Guides 44 and 45 should be used when designing a MOVA installation.

3.1.6 When the junction is in the SCOOT area TD-UTC will define the detection type, its location and the ducting requirements.

3.2 DESIGN

3.2.1 All junctions shall be designed in accordance with the client's specific requirements.

3.2.2 The detailed analysis of the performance of a traffic signalled junction is helped by the use of a computer program. The use of a computer program should always be considered as an aid to the design of an individual junction or network. Additional factors must be taken into account to achieve a good design, such as turning radii, lane widths, visibility, signing, environmental considerations and plain common sense.

3.2.3 LINSIG is the preferred software package used by TI engineers, being the most straightforward to use and able to model phase based types of controller. It is recommended for use in London as it is capable of modelling accurately different forms of flared approach, allows for parked vehicles, bus lanes and can take into account the number of right turn pcu's (passenger car units) stored in front of the stop line, and can predict the capacity of this movement with or without a right turn indicative signal. Any permitted stage sequence can be run with the traffic model and all constraints of controller data will apply. A list of data requirements for the operation of a computer program is given at Appendix B.

3.2.4 The stage structure selected must deal not only with the junction in its normal operating condition but also cater for contingency and non-optimum working.

3.2.5 Local linking to adjacent signals should always be considered in the design, particularly for Pelicans, Puffins, Toucans and Ped-X crossings, but local factors will influence this decision. The link timings should be provided with the information required for the STAGE 2 Design/Safety check.

3.2.6 Where fixed time plans are required to co-ordinate a signal controlled network TRANSYT and VISSIM are the only acceptable methods of optimising the timings.

3.3 PEDESTRIAN FACILITIES AT JUNCTIONS **(see reference TAL 5/05)**

3.3.1 Where pedestrian facilities are being provided, audible and/or tactile devices must be provided for the visually impaired in addition to the normal Red and Green Man indication. The tactile or audible devices shall always operate at the same time as and be interlocked with the Green Man indication.

3.3.2 In sensitive residential areas it may be necessary to inhibit the audible by time switch between the hours of 23.00 – 07.00 or other appropriate times.

3.3.3 All tactile paving and dropped kerbs are to be constructed in accordance with "Guidance on the Use of Tactile Paving Surfaces" (DETR 1998) and any specific requirements of the highway authority. It should be noted that tactile surfacing is not recommended within pedestrian refuges or separation islands where the signal staging is intended to allow pedestrians to cross the whole width of the carriageway in one movement. *(DMRB Vol 6 Section 2 Part 3 - TD 50/04 - para 4.14)*

3.3.4 Tactile units generally only need to be installed in the right hand push button as you are facing the crossing. Where there is a central refuge on a crossing there should ideally be two push buttons on the refuge, both fitted with tactile units*.(TAL 5/05 Part 3).*

3.3.5 To ensure consistency for visually impaired people the tactile unit should be installed on the right hand side of the bottom of the push button unit. *(Inclusive mobility Para 3.12)*

3.3.6 Red Lamp Monitoring must be provided to monitor any vehicle phase that conflicts with a pedestrian phase when audible and/or tactile facilities have been installed (in accordance with section 3.3.1).

3.3.7 It is preferable for audible devices to only be installed where there is a full pedestrian stage at which all the pedestrian indications appear at the same time on the same phase and there are no additional pedestrian phases

3.3.8 However it is becoming increasingly difficult to include all the necessary signals on a single phase card without overloading it and it is now possible, through special conditioning, to allow audible signals at a full pedestrian stage comprised of more than one phase. It is important to ensure that the audible signal is not activated until all the phases have started and that there is time to provide an adequate invitation period for those relying on the audible signal. The audible signal must not continue past the end of the first green man to finish. Advice should be sought from TI on the necessary special conditioning.

3.3.9 In the following circumstances, only tactile devices shall be used, since audible signals would be unsafe:

a) When parallel pedestrian phases are provided; or

b) When a full pedestrian stage is provided and the appearance of the various pedestrian phases are staggered to take account of clearing traffic such that 3.3.7 or 3.3.8 cannot be applied.

3.3.10 Where parallel pedestrian crossings are displaced from the junction, a stop line and associated traffic signals should normally be provided for the protection of pedestrians. Detailed site requirements may need discussion with the client. Care should be taken to ensure the parallel pedestrian phase operates at a suitable time.

3.3.11 Where audible and/or tactile devices are provided for parallel crossings without the protection of a stop line, ‘All Red’ extending detectors may be desirable to inhibit the pedestrian signal while vehicles are still on the crossing.

3.3.12 If ‘All Red’ detectors are used in a cableless linked system or in UTC care must be taken in arranging the group timings in order to prevent stage skipping.

3.3.13 For both non UTC and UTC installations all round pedestrian stages should only appear if demanded and a parallel pedestrian phase should

normally only appear if a demand is present at the start of the preceding interstage.

3.3.14 At an installation in the UTC area where the pedestrian phases has been configured to always appear, push button must be provided to ensure that tactile units can be facilitated. Where the vehicle phase does not have detection the push button will not insert a demand but the 'WAIT' indicator should illuminate when a button has been pressed (and the Green Man is not lit).

3.3.15 Where there is a pedestrian phase in parallel with a vehicle phase that is detector demanded, the UTC demand bit (DX) shall be specified to demand both traffic and any parallel pedestrian phase, i.e. STAGE DEMAND.

3.3.16 Pedestrian push button units associated with far side signals should normally be mounted at an angle of 45˚ to the kerb line with the base of the unit 1.0m from the surface of the footway. Where near side signals are used they should generally be mounted at an angle of 25-30˚ to the kerb line. See recommendations in TAL 1/02 The Installation of Puffin Pedestrian Crossings and Puffin Good Practice Guide.

3.3.17 PEDESTRIAN TIMINGS

There is flexibility in the interpretation of the Green-Man invitation period for signal controlled junctions. The following statement is the bass for pedestrian timings and is consistent with DfT guidance

"Pedestrian timings should enable waiting pedestrians (who commence their crossing at some point during the invitation period) to cross the carriageway in a single movement, without stopping or turning back.

Waiting pedestrians are further defined as the standing queue of pedestrians as observed at the start of the green-man"

3.3.18 Figures 1 and 2 show the process maps that are to be followed when determining the green-man invitation period for existing sites. Figure 1 relates to far-sided aspects and Figure 2 relates to near-sided pedestrian aspects.

3.3.19 Where there is a considerable distance between a pedestrian facility and the conflicting traffic stopline; consideration should be given to reducing the intergreen following the pedestrian phase to take into this travelling time into account. Calculations regarding such reductions must be documented, accepted by the Stage 2 Design/Safety Check and confirmed by a Team Leader or the Chief Engineer Signals before they are adopted for the design.

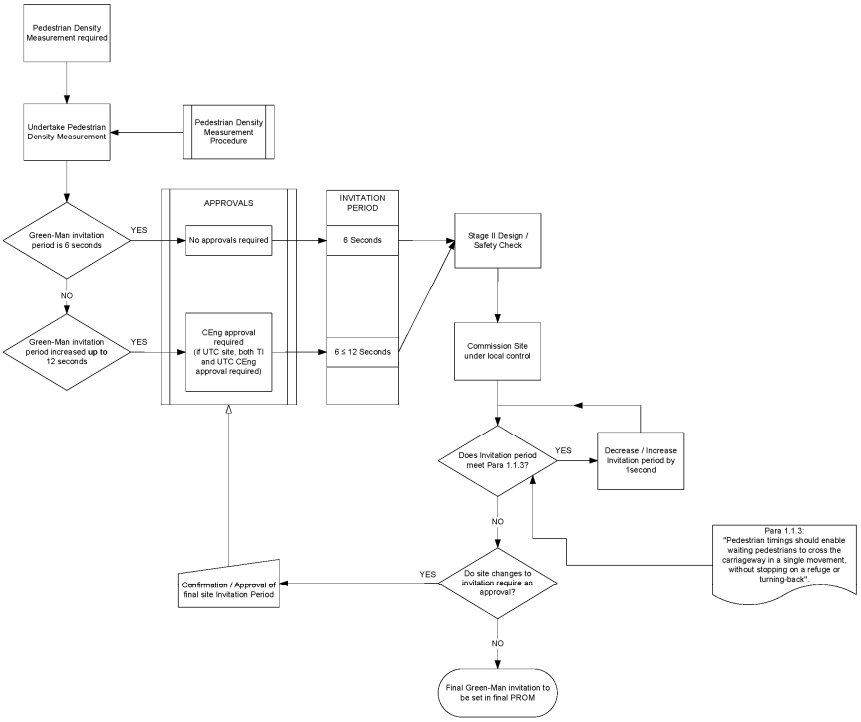


Figure 1 – Process Map for Junctions – Far-sided

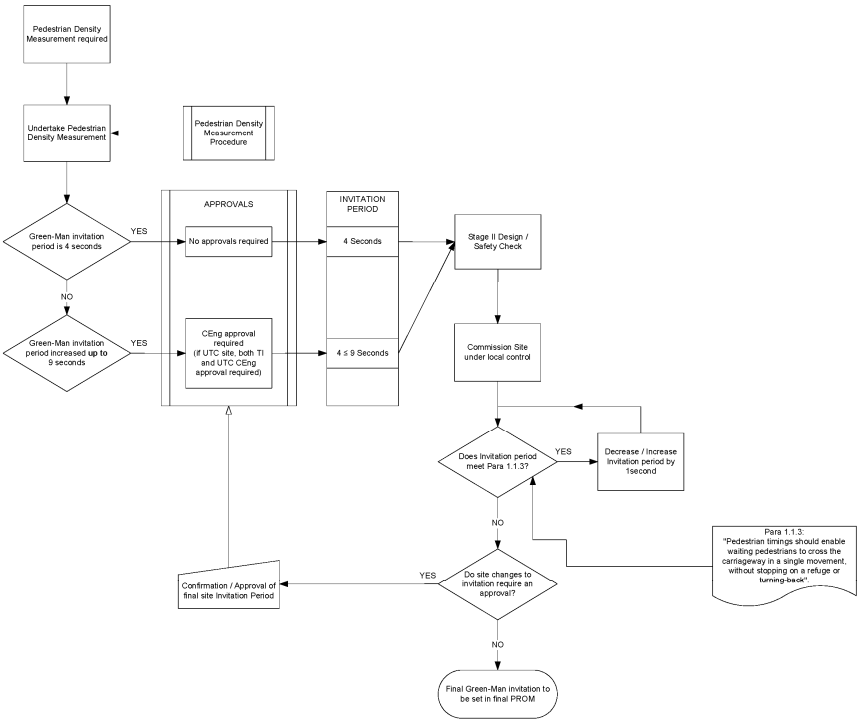


Figure 2 – Process Map for Near-sided signals

3.3.20 CONTROL OF OFFSET PEDESTRIAN CROSSINGS IN UTC

3.3.20.1 Controller specifications that are required to provide control of an offset pedestrian crossing should include a leaving amber (L/A) link between the pedestrian crossing and an appropriate phase within the main controller. This will operate whenever there are no control bits being received for the pedestrian crossing. The proposed link delay time will be determined following modelling and discussions with TD-NP staff.

3.3.20.2 When commissioning the UTC plans (which will be carried out with the pedestrian crossing being fully UTC controlled) the final pedestrian offset will be established as part of the UTC plans. If necessary the L/A link delay time in the specification should be updated to reflect any changes made during commissioning.

3.3.20.3 Thereafter the pedestrian crossing may not be controlled directly by UTC, and by the omission of control bits the local linking will operate (although the site will still continue to be monitored on UTC through its reply bits).If it should become necessary to control the pedestrian, for whatever reason, this would still be possible.

3.3.20.4 There is a further risk in the operation of pedestrian crossings as described above, if the end of the road green to the “main” road is, at any time of the day, dependant on a demand for another stage. This situation applies both when the controller is operating under UTC control or on local control. If there is demand for the pedestrian, but no linking stage, it is possible that the over-ride timer for the pedestrian crossing will cause the pedestrian crossing to turn red to traffic while the main road itself remains on green. This is potentially a very dangerous situation. It is therefore imperative that provision is made within the specification, using special conditioning, for the pedestrian crossing to also insert a demand for the relevant linking stage. This will ensure that the pedestrian is only shown a green man at the appropriate point in the cycle.

3.3.20.5 If the pedestrian is specified to demand the leaving amber phase / stage then an over-ride timer will not be required.

3.3.21 INTERSECTION PUFFIN AND TOUCAN FACILITIES

3.3.21.1 The signal sequence and design requirements for an intersection PUFFIN/TOUCAN shall be the same as for the stand alone PUFFIN/TOUCAN. The use of kerbside call/cancel and/or on-crossing pedestrian detection is optional. The on-crossing detection will extend the All Red period of the intergreen. Where on-crossing detection is not provided the All Red period shall be pre-set at a value within the range 0 to 30 seconds which is greater than the distance in metres divided by 1.2. Only near sided pedestrian signals can be used with the PUFFIN option.

3.4 JUNCTION LAYOUT

3.4.1 PRIMARY AND SECONDARY SIGNALS (see ref TA 12/81, TD 50/04, TAL 1/06,)

3.4.1.1 The Traffic Signs Regulations and General Directions 2002 (TSRGD 2002) requires all junctions to have at least two signal heads per approach.

3.4.1.2 The primary signal post is located 2.5m beyond the stop line normally on the near side of each approach and 0.5m from any pedestrian studs. Two primary signals are preferred for approaches wider than one lane.

3.4.1.3 Secondary signals typically have the same information as the primary and may have additional information, which must not conflict with that shown on the primary signal.

3.4.1.4 At least one secondary signal should be provided on each approach so that the signal is visible from the centre of the stop line. It should normally be sited within an arc of 30° to the offside from the centre of the stop line.

3.4.1.5 The secondary signal should be sited no further than 50m from its relative stop line. *(TA 50/04 Para 2.64)*

3.4.1.6 Closely associated secondary signals should be considered when it is inadvisable for pedestrians or certain streams of traffic to see the secondary signals.

3.4.1.7 They must always be considered on the approach opposite one with a right turn overlap facility. Closely Associated signals do not have to be provided where the approach opposed one with a right turn overlap has a prohibited right turn Traffic Regulation Order in place, and is signed with the appropriate regulatory box sign.

3.4.1.8 Consideration should be given to the reduction of street furniture by incorporating signal heads on to lamp columns where appropriate. Advice can be sought from the TD Electrical Design Team on the measures necessary to achieve suitable design.

3.4.1.9 The layout of green arrows on signal heads must be in accordance with Diagrams 3000.7 & 3000.8 of TSRGD 2002.

3.4.1.10 The minimum visibility distance to the primary signal required by drivers is (*TA 12/81*):

85 percentile approach Speed in mph to nearest 5mph	Visibility Distance metres
30	70
35	85
40	110
50	150
60	210
70	270

3.4.1.11 The absolute minimum clearance between the kerb edge and any street furniture should be 450mm. The placement of the signal pole depends on the signal arrangement. If the footway is less than 1.8m wide, and the client specifically request cranked poles, then these may be installed. Diagrams of signal installations with their dimensions and clearances are given in Drawings Nos. GEN/TSS_6/SIGDIM1, GEN/TSS_6/SIGDIM2 and GEN/TSS_6/SIGDIM3

3.4.1.12 The distance between the bottom of a sign or signal and the footway must legally be a minimum of 2.1m but distances of 2.15m or 2.3m are preferred. For signals solely controlling pedal cycles the minimum distance is 2.4m.

3.4.2 BOX SIGNS (Ref TAL 1/06, Traffic Signs Manual Chapter 3)

3.4.2.1 There is no requirement for erecting a regulatory box sign to TSRGD 2002 diagram 606 where an exclusive traffic movement is required at the signals, as indicated by a substitute green arrow. They should only be used in conjunction with a Traffic Regulation Order (TRO) associated with the junction and attached to each of the primary and secondary signals.

3.4.2.2 Designers should ensure with the Highway Authority that a traffic order exists or is proposed for any box sign associated with the signals.

3.4.2.3 Ideally a TL sign should be mounted on the left of the signal head, a TR should be mounted on the right of the signal head.

3.4.2.4 The AO sign should be mounted on right hand side of the nearside primary and on the left hand side of the duplicate primary and secondary signal.

3.4.2.5 All versions of 606 may be mounted 4 in-line under the green arrow.

3.4.2.6 When required, NRT (612) and NLT (613) signs should be mounted, on the relevant approach, on all signal heads alongside the green aspect. The NRT sign should be mounted to the right of the signal head and the NLT to the left hand side.

3.4.2.7 The following are the only signs allowed to be fixed to traffic signals as box signs.

At **junctions** the following are allowed:-

606 White arrow on blue background (AO,TL,TR)
612 NRT
613 NLT
614 No U-turn
616 No entry (**Exceptional** – Traffic Signs Manual Chapter 3 – para 6.2.5 – no indication in TSRGD 2002 for junctions)

The following ”exemption” plates may be added:- *(Note: exemption plates should not be used with a 606 associated with a green arrow)*

954.5 Except buses (may be varied to “Except cycles”)
954.6 Except buses & cycles (may be varied to “local buses” or “buses & Taxis”)
954.7 Except buses, taxis & cycles (may be varied to “local buses & cycles” or “local buses & taxis”)

3.4.3 HOODS AND LOUVRES

3.4.3.1 Louvres, long hoods or long cut-away hoods should be specified as necessary to avoid ‘see through’ problems particularly where there may be internal stop lines in a junction. Advice on the circumstances, which warrant the use of vertical and horizontal louvers, can be obtained from TI. In no circumstances should louvers be used on red aspects. *(TA 15/81)*

3.4.4 MAST ARMS AND 6M POLES

3.4.4.1 Mast arm signals or alternatively 6m poles with dual signal heads should only be provided where there is a visibility problem, for example, on wide roads or on adverse gradients.

3.4.4.2 On mast arm signals LED signal aspects should be used and primary hoods used on all aspects.

3.4.4.3 Backing boards must always be provided with outreach signals on Mast-Arms. *(TR 2006A Paragraph 3.2)*

3.4.4.4 LED signals should also be used on 6m poles. Because of the different response times for LED and halogen it is recommended that all signals on the approach with the 6m pole should have LED signals as it is more noticeable to motorists than signals on a mast arm.

3.4.4.5 At present LED signals must not be used at red light camera sites.

3.4.4.6 It is now necessary for the signal maintenance companies to use “cherry pickers” and suitable Traffic Management measures when installing or maintaining equipment on any signal pole greater than 4.0m high. This has considerable cost implications on maintenance. Without compromising the most appropriate method of signalling, and with safety in mind, it is important to take maintenance costs into consideration during the design stage.

3.4.5 BACKING BOARDS

3.4.5.1 Backing boards are normally not fitted in London except on signals on TLRN roads with speed limits greater than 30mph and on other roads where, in the designer’s judgement there is a problem with the sun on east/west alignments, street lighting or other valid reason. If backing boards are not used consideration should be given to the use of white borders on signal heads.

3.4.6 DIMMING

3.4.6.1 Unless specifically requested by the Highway Authority signals should be dimmed at night time (by photoelectric cell).

3.4.6.2 Dimming should be used where LED signals are fitted.

3.4.7 SKID RESISTANT SURFACING

3.4.7.1 All new installations on the TLRN shall have at least 50m of skid resistant surfacing applied on all approaches that should be extended to the first row of studs. On a gradient or on roads with a speed limit greater than 30 mph it may be necessary to increase this length. Consideration should also be given to extending the surface to the centre of the junction as this will help to reduce cross road and right turning collisions.

3.4.8 TRAFFIC ISLANDS (see references TD 50/04 and LTN 2/95)

3.4.8.1 Where islands which pedestrians use exist in the carriageway, they should be at least 2.0m wide to permit a pedestrian with a pram or wheelchair to wait in safety. Islands that are not used by pedestrians can be reduced to 1.4m wide for a simple 3 aspect signal head or 1.7m if the signal head has a side mounted arrow or box sign.

3.4.8.2 Where there is a staggered pedestrian facility the island should be a minimum of 3m wide. This can be reduced to 2.5m if guard railing is not provided on the central island.

3.4.8.3 Where there is a staggered facility catering for shared-use (i.e. Toucan crossings), the island should be a minimum of 4.0m wide. This can be reduced to 3.5m wide if guard railing is not provided on the central island.

3.4.8.4 With a staggered pedestrian facility the minimum distance between crossings (i.e. the distance between the inside line of studs on each side of the island) should be 4m to reduce the problems of "see-through".

3.4.9 LANE WIDTHS (see reference TD 50/04)

3.4.9.1 Entry Lane widths should be between 3.0m and 3.65m although lane widths down to a minimum of 2.5m are acceptable in some cases. Consideration should be given to the safety of cyclists when narrow lanes are proposed.

3.4.10 EARLY CUT-OFF/LATE START OPERATION (see reference TA 16/81)

3.4.10.1 Early cut-off operation (e.c.o.) is acceptable but late start operation is not permitted in London except when applied in specific circumstances such as bus priority systems or where the approach with the early start is not able to turn right, either due to road layout or the right turn movement is prohibited by means of a Traffic Regulation Order.

3.4.11 TIMING PERIODS (see reference TA 16/81)

Recommended traffic minimum green	7	secs
Green Arrow minimum	4	secs
Recommended minimum intergreen	5	secs
Minimum intergreen prior to e.c.o.	4	secs
Stopping amber	3	secs
Starting amber	2	secs
Minimum 'Blackout Period'	3	secs
VA extensions for loops normally	1.6	secs
VA extensions for MVDs normally	0.4	secs

3.4.11.1 Intergreen periods required for safety or clearances are determined according to Advice Note TAL 1/06 shown in Appendix Hii

3.4.11.2 At junctions with pedestrian crossing facilities, cycle times should only exceptionally be longer than 90 seconds. Cycle times greater than 120 seconds are deprecated and only acceptable in certain special cases such as at junctions on high speed roads, MOVA sites and where green periods appear twice in a cycle.

3.4.11.3 The project engineer is responsible for ensuring that any changes made in RAM must be followed-up with a revised PROM.

3.4.12 STOP LINES

3.4.12.1 The recommended distance between the stop line, primary signal post and studs shall be:

	Distance (metres) from stop line to:	
	Primary Signal Post	Studs
Junctions: with or without pedestrian push buttons	2.5	3

3.4.12.2 Carriageway markings are specified in Chapter 5 of the Traffic Signs Manual and in the TSRGD 2002.

3.4.12.3 Stop lines should always be positioned at right angles to the centre line of the carriageway even at skew junctions (*Traffic Signs Manual Chapter 5 Para 9.4*)

3.4.13 ADVANCE CYCLE STOP LINES (see TAL 8/93 and 5/96)

3.4.13.1 Advance Cycle Stop Lines (ASL) are recommended at all TLRN sites, except at stand alone sites (Pelicans, Puffins, Toucans) where they are not allowed under the TSRGD 2002 (*Regulation 18(2) Page 421*).

3.4.13.2 The preferred length of the reservoir is 5.0m with a minimum of 4.0m.

3.4.13.3 All cycle ASLs must have a lead in lane whether advisory or mandatory *(DfT Circular 02/2003 Para. 14)* and should be at least as long as the maximum queue length during peak periods with a recommended width of 1.5m.

3.4.13.4 If there is inadequate space for a lead-in lane it is possible to provide a “gate” or stub access to the ASL. At present these require DfT authorisation, as they are not covered by TSRGD 2002.

3.4.13.5 The following factors should be taken into account during the design:

a) the positioning of the cycle lane on the approach to ensure that there is adequate vehicle lane width to accommodate a lead in lane

b) intergreens, which should be calculated from the vehicle stop line (the one furthest from the signals)

c) an appropriate method of detection for cycles:

d) at existing sites where ASL's are being installed, it may be necessary to relocate existing stop line detection or replace with overhead detection.

e) when undertaking swept paths, the width of carriageway should be taken from the outer edge of the cycle feeder lane and not from the kerb edge.

f) when proposing an ASL, designers should take into account the existence of any red light cameras as the may need to be relocated.

3.4.14 DETECTORS

3.4.14.1 Above ground detectors are to be used in preference to sub surface loops. The performance of above ground detectors shall comply with DfT Specification TR 2123. The siting of loop detectors shall comply with DfT Specification MCE 0108. In the UTC area detectors (other than for SCOOT) are not provided except on roads with minor flows. These roads must be provided with stop line detection where there is a likelihood that the stage could be skipped through lack of demand for a significant period of the day or night.

3.4.14.2 The following Detector Fault Monitor times should be used as a basis for specifications:

Detector Type	Active Timer	Inactive Timer
Above-Ground Detectors and inductive loops	30mins	9hrs
Push-button units	30mins	96hrs (196hrs to 255hrs for central islands)*
On-Crossing Detectors	1hr	18hrs

* - The PEEK TSC3 controller has an upper limit of 72hrs for DFM timers.

3.4.15 DETECTION AND SPEED ASSESSMENT (SA) EQUIPMENT AT JUNCTIONS (see references TA 12/81, MCE 0108, TR 2123 and TR 2500)

Detection equipment shall be fitted as follows:

3.4.15.1 **30 mph roads - new installations**

3.4.15.1.1 85 percentile speed less than 35mph

Microwave vehicle detection (MVD) should be used. Only where microwave detection is unsuitable should loop detectors be used.

3.4.15.1.2 85 percentile speed greater than 35mph

MVDs should normally be used unless there are special circumstances based on traffic engineering judgement, which require speed assessment equipment. **However consideration should be given to speed reducing measures or changing the speed limit.**

Intergreen values should be set at the upper level which would exist if SA was present and a vehicle was detected at a max change.

If however SA is required then a fully ducted feeder cable system should be provided with funding by the client.

3.4.15.1.3 85 percentile speed 45 mph or higher

SA should be provided as well as simple system D. As MVDs will not be used with SA, ducts should be provided for all feeder cables at the client or the highway authority's expense.

3.4.15.2 **Over 30 mph roads irrespective of speed - new installations**

As 3.4.15 & 3.4.15.1.3

3.4.15.3 **Modernisation of existing installations**

The same general rules apply although due to the absence of information on speeds it may not be possible to make an accurate assessment. It may therefore be necessary to obtain speed-readings to confirm the precise requirements. Although it is not envisaged that additional detection facilities such as speed

assessment will be required at many sites a fully ducted system should be provided when required.

3.4.16 SITING OF CONTROLLERS (see reference TD 50/04)

3.4.16.1 A controller shall be sited so that its position will allow unimpeded use of the footway by pedestrians, those using wheelchairs or pushing prams. It should allow the outercase door and panels to be opened to their full extent. When the doors are open they should not cause undue obstruction on the footway but there should be sufficient clearance for an operative to work. The controller should not obstruct other street furniture and should not mask waiting pedestrians from approaching vehicles.

3.4.16.2 When the controller is installed on unmade ground a concrete pad or paving slabs should be provided in front of the outercase doors to assist maintenance.

3.4.16.3 When working at the controller an engineer should preferably be able to view the junction and the stop-lines.

3.4.16.4 Where controllers are situated in places such as the centres of roundabouts or gyratories consideration should be given to providing a hard standing area for the maintenance company's vehicles.

3.4.17 SITING OF ELECTRICITY SUPPLY PILLARS

3.4.17.1 Guidelines for siting a pillar are as follows:

- The supply pillar should usually be a minimum of 5.0m from the signal controller and usually not more than 10m, where there is a risk of the controller being knocked down.
- It should be sited at the back of the footpath close against a wall or fence where generally it will be safe from vehicular collision.
- It must not obstruct private property, doorways, accesses or shop windows.
- It must not obstruct the footway or cause a hazard to pedestrians.
- It must not obstruct access, panels or openings to other street furniture.
- It must be positioned so that engineers working on the pillar can do so without danger to themselves from vehicles
- .Feeder Pillars should not be positioned abutting pedestrian guard railing, as the railing may be removed at a later date, making the Feeder Pillar a trip hazard.

4 STAND ALONE CROSSINGS

4.1 GENERAL

4.1.1 To assist in the design process, it is recommended that the client should complete a “Site assessment record sheet” as shown in Appendix D when submitting schemes.

4.1.2 At stand alone crossings, multi-lane approaches are not recommended and where possible should be designed out, if necessary by provision of a central refuge. If that is not possible, tall poles or mast arms may have to be considered.

4.1.3 (TI preferred layouts shown at Appendix E)

4.1.4 All crossings shall be designed according to LTN 2/95. The particular requirements for a crossing installation in London are given below.

4.2 PUSH BUTTONS, AUDIBLES AND TACTILES

4.2.1 All single crossings should be provided with both audible and tactile facilities. However if the highway authority do not want audibles fitted, because they are socially unacceptable, they can be arranged to switch off at night by means of a timeswitch, or, providing tactile facilities are in place, they may be omitted.

4.2.2 With far sided signals, pedestrian push buttons should normally be mounted at an angle of 45˚ to the kerb line.

4.2.3 Where near side signals are used the Pedestrian Display Units (PDU’s) should generally be mounted at an angle of 25-30˚ to the kerb line except at staggered crossings where the guidance in the Puffin Good Practice Guide should be followed. High level repeaters must always be provided.

4.2.4 Where PDU’s are fitted on central refuge islands, the controller must be configured so that the units on the central island display a Black Out sequence during the extension periods.

4.2.5 Tactile cones should normally only be installed in the right hand push button when facing the crossing. If there is a central refuge, then two push buttons should be installed on the refuge, both with tactile units. (*TAL 5/05 Part 3*)

4.2.6 To ensure consistency for visually impaired people the tactile unit should be installed on the right hand side of the bottom of the push button unit. *(Inclusive mobility Para 3.12)*

4.3 SIGNAL ASPECTS AND HOODS

4.3.1 At sites where there are two or more lanes on an approach an offside secondary signal should be included and the offside primary signal aspect should be offset to allow clear visibility of the secondary signal.

4.3.2 Primary hoods should be used on secondary signals at crossings as it improves the visibility both on the approach and from the stop line.

4.4 BOX SIGNS

4.4.1 For **signal-controlled pedestrian facilities** (TSRGD Reg 47 (3) (d) (ii)), **equestrian crossings** (Reg 48 (3) (d) (ii)) and for **Toucans** (Reg 49 (3) (d) (ii)) the following signs are allowed as box signs:

606 White arrow on blue background (AO, TL, TR)
612 NRT
613 NLT
616 No entry (although not mentioned in Schedule 17 item 6 of TSRGD 2002)

The following ”exemption” plates may be added:-

954.7 Except buses (may be varied to Except cycles)
954.7 Except buses & cycles (may be varied to local buses or buses & taxis)
954.8 Except buses, taxis & cycles (may be varied to local buses & cycles or local buses & taxis)

4.5 SKID RESISTANT SURFACING

4.5.1 At least 50m of skid resistant surfacing shall be provided on the approach to all crossings, which should be taken up to the first row of studs. On a gradient, or on a road with a speed limit above 30mph, it may be necessary to increase this length.

4.5.2 An installation will not be switched on unless such surfacing has been provided or in its absence the highway authority has supplied a written statement of indemnity, that confirms that it will be proved within the next 6 months.

4.6 ROAD MARKINGS

4.6.1 These shall be in accordance with TSRGD 2002, The Zebra, Pelican and Puffin Pedestrian Crossings Regulations and General Directions 1997 and Chapter 5 of the Traffic Signs Manual.

4.6.2 All forms of stand alone crossings, including ped-x's must have zig-zag road markings (*TSRGD 2002 Dir 49*).

4.6.3 The recommended distance between the stop line and studs is 3m and between the stop line and the primary signal post is 2.5m.

4.7 DETECTION

4.7.1 Where vehicle detection is required and speed assessment equipment is not to be provided above ground detectors are preferred. The performance of above ground detectors shall comply with DfT Specification TR 2123. The siting of loop detectors, when used, shall comply with DfT Specification MCE 0108.

4.7.2 Kerbside call/cancel detectors should ideally not to be used on installations that have pre-timed max.

4.8 LINKING

4.8.1 Linking may be provided to nearby crossings as site conditions dictate, e.g. to avoid frustration or congestion. If so, the reason should be recorded in the project file. This link may be in the form of:

- A line share for UTC control;
- A leaving/starting amber link; or
- Cableless linking (also used to link junctions when the UTC system is not operating).

4.8.2 Local links and delay timers may be overridden by UTC.

Note: All link cables should be ducted.

4.8.3 Cross Inhibit Linking must be provided at staggered stand alone crossings except when they are controlled by another controller or stream, as this facility is likely to interfere with the operation of the local linking. Pedestrian progression achieved by a call-ahead facility may be implemented if requested by the client but shall be assessed on an individual site basis. On UTC sites Cross Inhibit Linking will be overridden when under computer control where applicable.

4.9 TIMINGS

4.9.1 Dual Vehicle Precedence periods shall be provided on all installations under UTC control. The higher period to be used when the crossing is working isolated, the lower period when under UTC so that the crossing can be double cycled where possible.

4.9.2 Pre-timed max is included as standard on TfL pedestrian controllers, but it should not be used on roads with a speed limit greater than 30mph.

4.10 VEHICLE DETECTION AND SPEED ASSESSMENT (SA)

These shall be provided as follows:

4.10.1 30 mph roads - New installations

4.10.1.1 <u>85 percentile speed less than 35 mph</u>

No detection. These sites shall operate fixed time. However if, using engineering judgement, some form of vehicle actuation is required or would be beneficial, then MVDs should be used.

No SA required.

4.10.1.2 <u>85 percentile speed between 35 mph and 45 mph</u>

VA detection (c) or (d) in Table 2 of LTN 2/95 and Speed Assessment (SA) are a requirement in this speed range. There is a provision to allow the use of MVDs on high speed roads in Scotland but confirmation of such a provision in London may be required.

If the installation is under UTC control, detection is not provided.

For installations outside the UTC area MVDs should be used to provide vehicle actuation.

The ‘Red Man / Red to Traffic’ (period 3) should be set on its maximum value of 3 seconds.

4.10.1.3 <u>85 percentile speed greater than 45 mph</u>

If the installation is under UTC control, no detection shall be provided but the ‘Red Man / Red to Traffic’ (period 3) should be set on its maximum value of 3 seconds.

For vehicle actuation SA should be provided as well as simple system D detection. MVDs should not be used.

Ducts should be provided for all feeder cables at the client or highway authority's expense.

4.10.1.4 **Over 30 mph roads - irrespective of 85 percentile speed - New installations**

As 4.10.1.3

4.10.1.5 **Modernisation of existing installations**

The same general rules should apply although due to the absence of the relevant information on speeds it may not be possible to make an accurate assessment. It may therefore be necessary to obtain speed readings to confirm the precise requirements. Although it is not envisaged that additional detection facilities, i.e. SA, will be required at many sites, a fully ducted system should be provided when required as above.

5 PELICANS

5.1 GENERAL

5.1.1 Design standards for Pelican crossings are given in LTN 2/95.

5.1.2 The Vehicle Precedence time is currently either fixed at 20 seconds or given an extension. When VA extensions are applied the minimum period shall be 7 seconds up to a maximum of 20 seconds. There must be good traffic engineering reasons for a longer period, e.g. where there is a very heavy vehicle movement and a continuous light pedestrian demand.

5.1.3 Vehicle Actuated extensions shall be as given in Appendix F. Timing periods 1, 2 and 3 are given in Appendix F. Timing periods 4, 5, 6 and 7 shall be determined according to the crossing length. A chart to determine these is given in Appendix F.

5.1.4 An ‘overlap’ stage (Flashing Green Man / Red to Traffic) must be provided. The ‘overlap’ stage should not exceed 2 seconds and this time should be taken from the Flashing Green Man/Flashing Amber stage.

5.1.5 The minimum recommended crossing width is 3.0m.

6 TOUCANS

6.1 GENERAL

6.1.1 Design standards for Toucan crossings are given in LTN 2/95; advice is given in TAL 10/93 and 4/98.

6.1.2 Zig-Zags at Toucans are now a requirement as set out in TSRGD 2002. Some existing Toucans were installed without zig-zags and Highway Authorities had until 1st January 2007 to install them at these sites.

6.1.3 Far sided signals can be used with on-crossing pedestrian / cycle detection, near sided signals shall be used with on-crossing detection.

6.1.4 For Far sided Toucans timings are shown in Appendix G(ii)

6.1.5 For Near sided Toucans timings are shown in Appendix G(i) (Puffin sequence timings). The green man invitation is to be measured as detailed in paragraph 3.3.21 and Figure 3.

6.1.6 High Level repeater signals shall be used at near sided Toucans. The minimum recommended crossing width is 4.0m.

6.1.7 Where possible the preference is to convert far-sided Toucans to near-sided Toucans.

7 PUFFINS

7.1 GENERAL

7.1.1 Where Pedestrian crossings are being replaced by Puffin crossings, the designers should make allowances for the Puffin requirements for:

- Tactile paving
- The position of the nearside signal poles to accommodate the nearside pedestrian indication unit.
- The position of detection equipment

7.1.2 Design standards for Puffin crossings are given in LTN 2/95. Further information is given in TAL 1/01 “Puffin Pedestrian Crossing” and TAL 1/02 “The Installation of Puffin Pedestrian Crossings” and in the TI Puffin Design Guide Document No: U/S000/TS/603 and in the Puffin Good Practice Guide

7.1.3 Near sided signals shall be used together with on-crossing detection.

7.1.4 The minimum recommended crossing width is 3.0m

7.1.5 High Level Repeaters shall be used.

7.1.6 Timings are as shown in Appendix G.

8 PEDESTRIAN CROSSINGS (PED-X)

8.1 GENERAL

8.1.1 This layout is only to be used if specifically requested by the Highway Authority.

8.1.2 The layout is as a Pelican, but the traffic light sequence is as a signalised junction.

8.1.3 Far sided signals shall be used.

8.1.4 Timings are as shown in Appendix H (i).

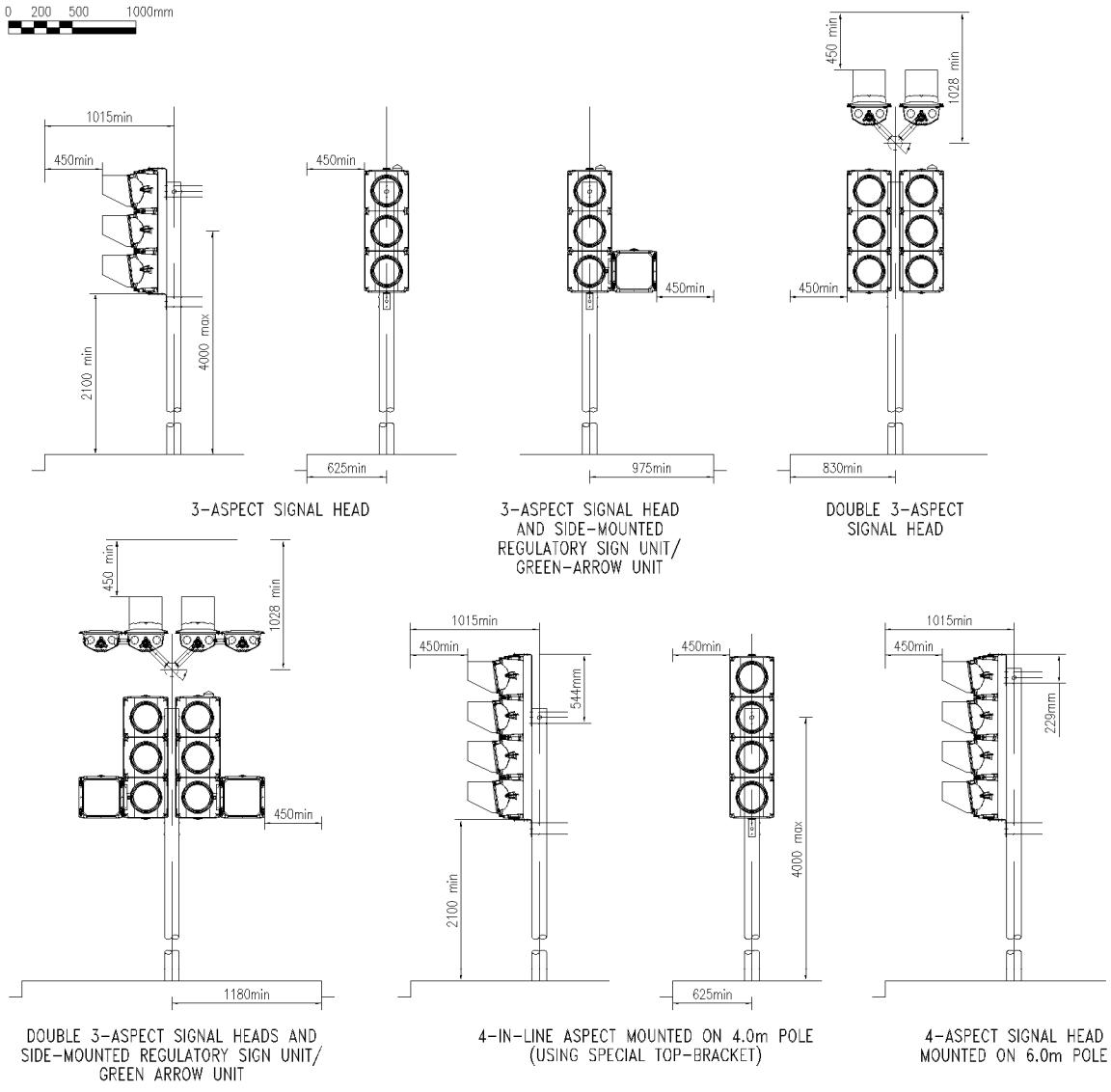
9 DOCUMENTATION FOR DESIGN FILE

9.1 GENERAL

9.1.1 If a third party has designed the scheme, the designer shall send TI the following information:

- The design brief
- The Stage 1 Design / Safety Check List
- Traffic and Pedestrian Count data
- Speed Surveys for the 85%tile approach speeds.
- A proposed scheme layout drawing to a scale of 1:200 which includes the method of control and the proposed ducting system. Drawing number GEN/TTS_06/FIG01 is an example of the detail required. This drawing should extend to at least 50m on all approaches.
- The controller specification
- The output of the modelling program (refer to modelling guidelines)
- Any local link timings
- Collision Data

9.1.2 This information will enable TI to carry out a Stage 2 design check of the scheme drawing and the controller specification. Only when the scheme design has been approved can work start on site. The Stage 3 design check will be carried out by TI at the time of commissioning.



Transport for London **Surface - Streets**	scale A4 AS SHOWN	date FEB 05	TMP drn	TMP eng	GTU chk

STREETS

Directorate of Traffic Operations

Windsor House
42-50 Victoria Street
LONDON SW1H 0TL
Telephone 020 7343 5000

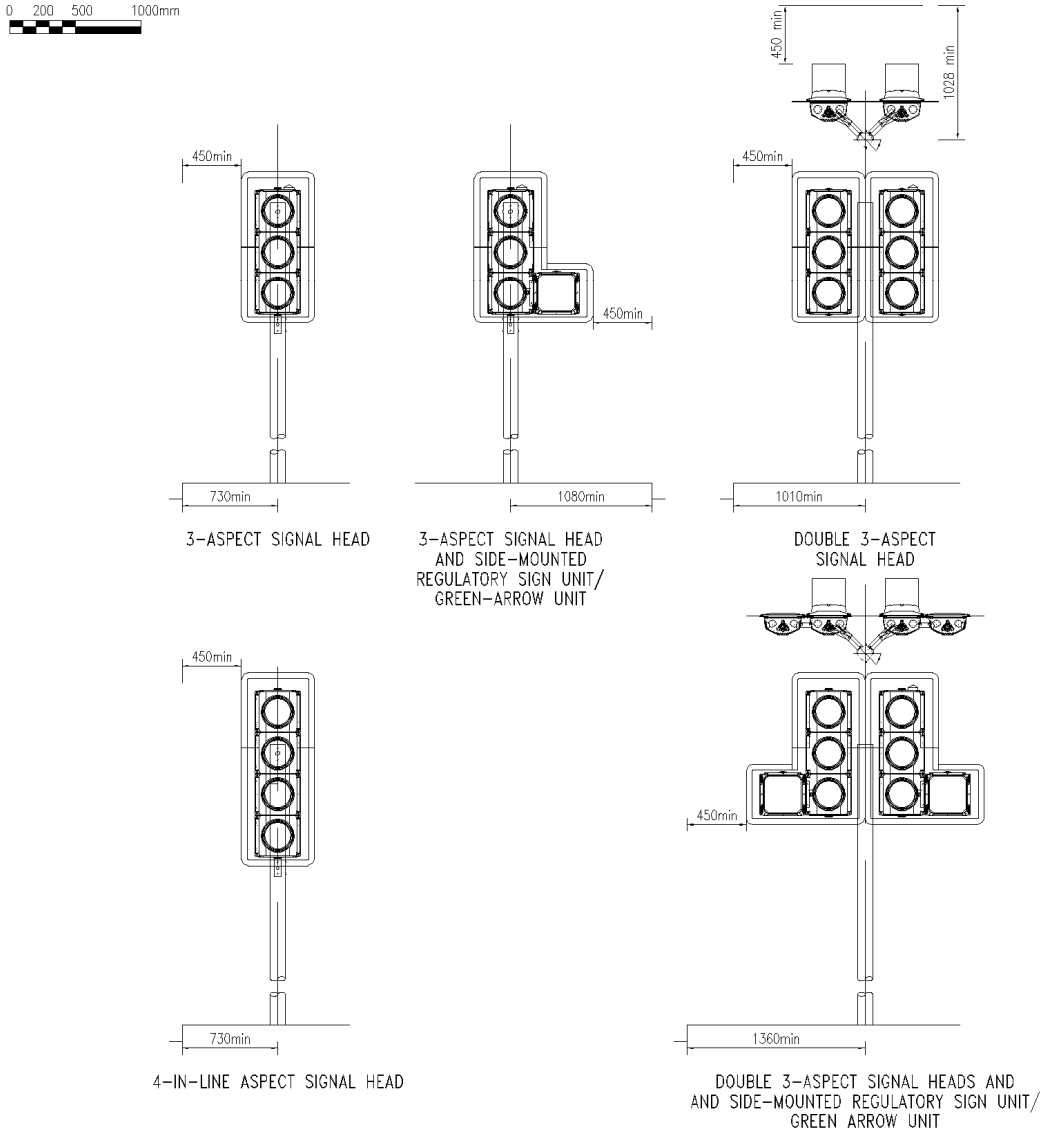
scheme

PEEK ELITE TRAFFIC SIGNAL
MINIMUM CLEARANCE DIMENSIONS
(ALL DIMENSIONS IN MILLIMETRES)

SIGNAL HEADS WITHOUT BACKING BOARDS

NO GEN/TSS_6/SIGDIM1

23/02/05 T PIPER \\GENERAL\TSS_6\SIGDIM1



Transport for London
Surface - Streets

STREETS

Directorate of Traffic Operations

Windsor House
42-50 Victoria Street
LONDON SW1H 0TL
Telephone 020 7343 5000

scale	A4	date	TMP	TMP	GTU
AS SHOWN		FEB 05	drn	eng	chk

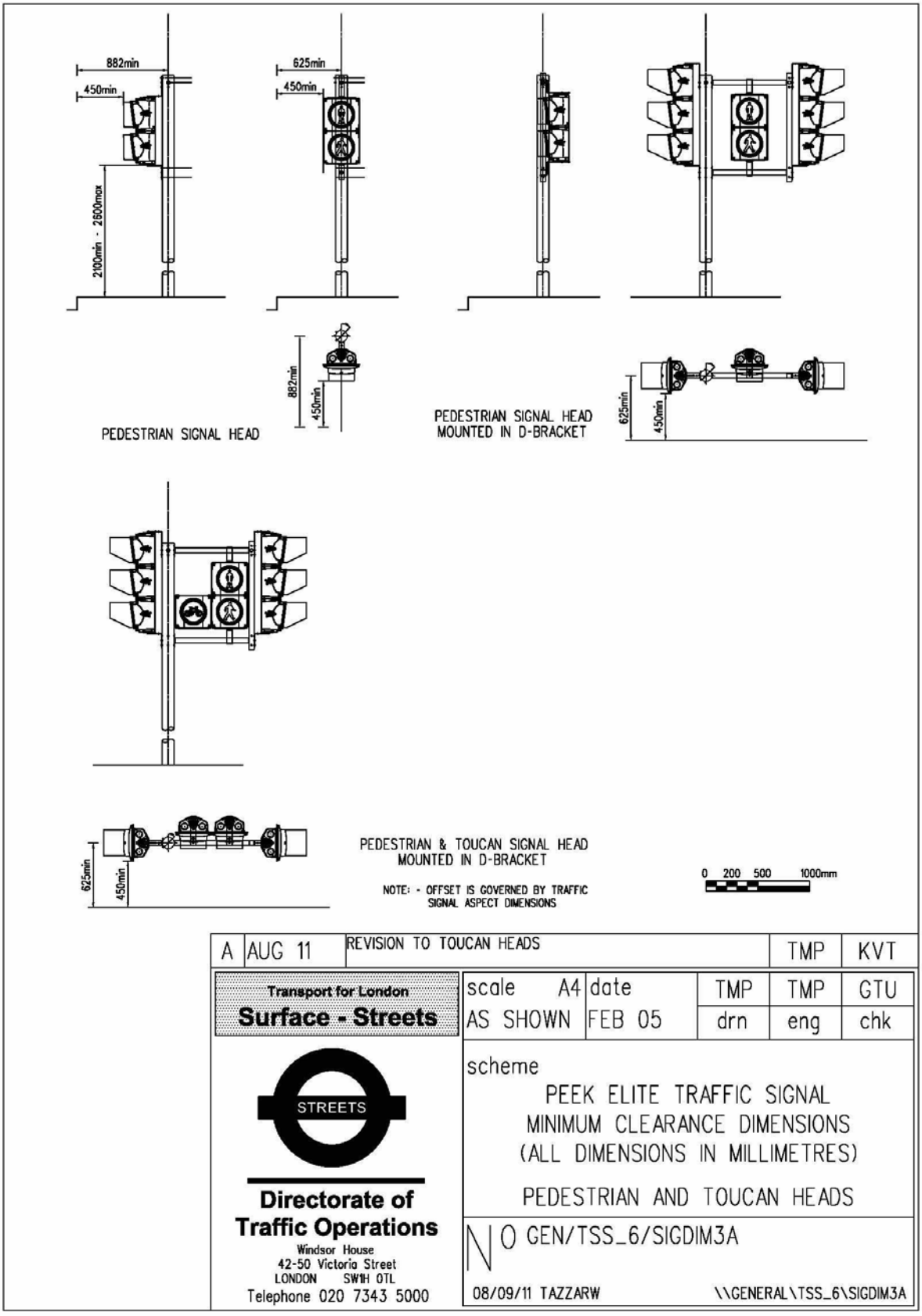
scheme

PEEK ELITE TRAFFIC SIGNAL
MINIMUM CLEARANCE DIMENSIONS
(ALL DIMENSIONS IN MILLIMETRES)

SIGNAL HEADS WITH BACKING BOARDS

NO GEN/TSS_6/SIGDIM2

23/02/05 T PIPER \\GENERAL\TSS_6\SIGDIM2


882min
450min
2100min - 2600max
625min
450min
882min
450min
PEDESTRIAN SIGNAL HEAD
PEDESTRIAN SIGNAL HEAD
MOUNTED IN D-BRACKET
625min
450min
625min
450min
PEDESTRIAN & TOUCAN SIGNAL HEAD
MOUNTED IN D-BRACKET
NOTE: - OFFSET IS GOVERNED BY TRAFFIC
SIGNAL ASPECT DIMENSIONS
0 200 500 1000mm
A AUG 11 REVISION TO TOUCAN HEADS TMP KVT
Transport for London
Surface - Streets
scale A4 AS SHOWN
date FEB 05
TMP drn
TMP eng
GTU chk
STREETS
Directorate of
Traffic Operations
Windsor House
42-50 Victoria Street
LONDON SW1H 0TL
Telephone 020 7343 5000
scheme
PEEK ELITE TRAFFIC SIGNAL
MINIMUM CLEARANCE DIMENSIONS
(ALL DIMENSIONS IN MILLIMETRES)
PEDESTRIAN AND TOUCAN HEADS
NO GEN/TSS_6/SIGDIM3A
08/09/11 TAZZARW
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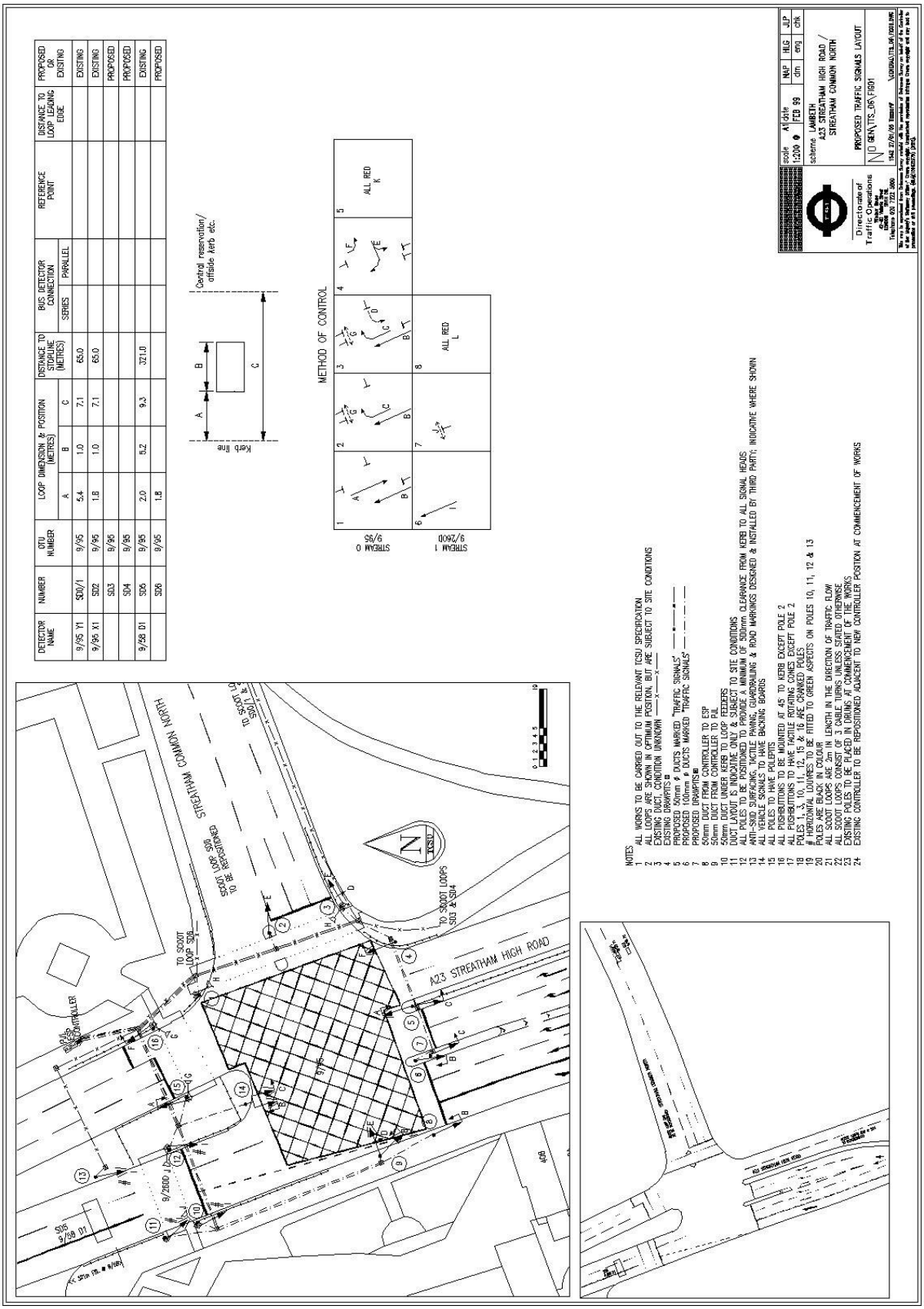
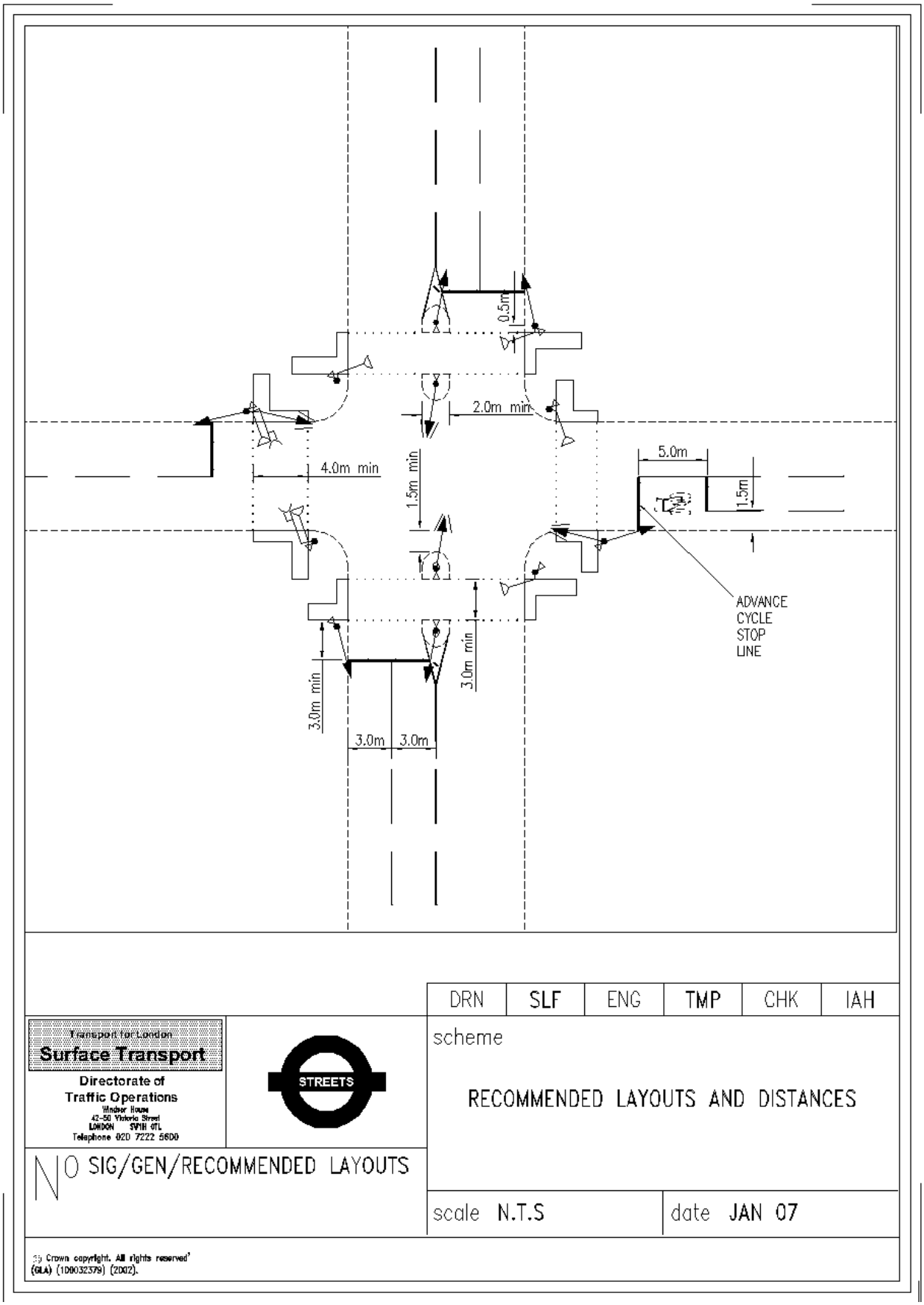

DETECTOR NAME
NUMBER
OTU NUMBER
LOOP DIMENSION & POSITION (METRES)
DISTANCE TO STOPLINE (METRES)
BUS DETECTOR CONNECTION
REFERENCE POINT
DISTANCE TO LOOP LEADING EDGE
PROPOSED OR EXISTING
9/95 Y1
SD0/1
9/95
5.4
1.0
7.1
65.0
EXISTING
9/95 X1
SD2
9/95
1.8
1.0
7.1
65.0
EXISTING
SD3
9/95
PROPOSED
SD4
9/95
PROPOSED
9/58 D1
SD5
9/95
2.0
6.2
9.3
321.0
EXISTING
SD6
9/95
1.8
PROPOSED
SERIES
PARALLEL
Kerb line
Central reservation/ offside kerb etc.
METHOD OF CONTROL
STREAM 0
9/95
STREAM 1
9/260D
ALL RED
K
ALL RED
L
NOTES
1 ALL WORKS TO BE CARRIED OUT TO THE RELEVANT TCSU SPECIFICATION
2 ALL LOOPS ARE SHOWN IN OPTIMUM POSITION, BUT ARE SUBJECT TO SITE CONDITIONS
3 EXISTING DUCT, CONDITION UNKNOWN
4 EXISTING DRAMPTS
5 PROPOSED 150mm ø DUCTS MARKED "TRAFFIC SIGNALS"
6 PROPOSED 110mm ø DUCTS MARKED "TRAFFIC SIGNALS"
7 PROPOSED DRAMPTS
8 50mm DUCT FROM CONTROLLER TO ESP
9 50mm DUCT FROM CONTROLLER TO PJL
10 50mm DUCT UNDER KERB TO LOOP FEEDERS
11 DUCT LAYOUT IS INDICATIVE ONLY & SUBJECT TO SITE CONDITIONS
12 ALL POLES TO BE POSITIONED TO PROVIDE A MINIMUM OF 500mm CLEARANCE FROM KERB TO ALL SIGNAL HEADS
13 ANTI-SKID SURFACING, TACTILE PAVING, GUARDRAILING & ROAD MARKINGS DESIGNED & INSTALLED BY THIRD PARTY; INDICATIVE WHERE SHOWN
14 ALL VEHICLE SIGNALS TO HAVE BACKING BOARDS
15 ALL POLES TO HAVE POLEPITS
16 ALL PUSHBUTTONS TO BE MOUNTED AT 45 TO KERB EXCEPT POLE 2
17 ALL PUSHBUTTONS TO HAVE TACTILE ROTATING CONES EXCEPT POLE 2
18 POLES 1, 3, 10, 11, 12, 15 & 16 ARE CHANNEL POLES
19 # HORIZONTAL LOUVRES TO BE FITTED TO GREEN ASPECTS ON POLES 10, 11, 12 & 13
20 POLES ARE BLACK IN COLOUR
21 ALL SCOOT LOOPS ARE 2m IN LENGTH IN THE DIRECTION OF TRAFFIC FLOW
22 ALL SCOOT LOOPS CONSIST OF 3 CABLE TURNS UNLESS STATED OTHERWISE
23 EXISTING POLES TO BE PLACED IN DRUMS AT COMMENCEMENT OF THE WORKS
24 EXISTING CONTROLLER TO BE REPOSITIONED ADJACENT TO NEW CONTROLLER POSITION AT COMMENCEMENT OF WORKS
TO SCOOT LOOP SD6
TO SCOOT LOOPS SD0/1 & SD2
TO BE REMOVED
TO SCOOT LOOPS SD3 & SD4
STREATHAM COMMON NORTH
A23 STREATHAM HIGH ROAD
9/260D
SD5 9/58 D1
P.J.L. ESP CONTROLLER
scale 1:200
A1 date FEB 99
MAP dm
HLG dwg
AJP chk
scheme LAMBETH
A23 STREATHAM HIGH ROAD / STREATHAM COMMON NORTH
PROPOSED TRAFFIC SIGNALS LAYOUT
Director/rate of Traffic Operations
GEN\TTS_DS\FIG01



APPROXIMATE SIGNAL EQUIPMENT WEIGHTS - BASED ON PEEK ELITE

Equipment	Weight – Kg (approx.)
RAG Aspect (without brackets)	10.5
Pedestrian Aspect (without brackets)	7.0
Green Arrow Aspect – single	3.5
Box Sign Unit	3.5
RAG brackets	2.5
Pedestrian brackets	2.0
4-in-line brackets	3.0
RAG backing-boards (top and bottom)	1.5
Wait Lamp Transformer	1.0
2m Pole	18.7
4m Pole	35.1
4m Formed Pole	39.3
4.85m Pole	42.5
6m Pole	52.6
6m Pole with Base Plate	77.6
800mm D-Bracket	9.7

APPENDIX A

DRAWING CHECKLIST

CHECK THAT THE FOLLOWING ARE INCLUDED AS NECESSARY:

1. North point
2. Pole numbers
3. Ducts & drawpits/polepits (including any associated notes)
4. Feeders from drawpits to poles
5. P.E. cell
6. P.J.L./Haldo Pillar/Electricity Pillar
7. Controller position and type
8. Zig-zag markings & number required.
9. Method of Control (M.O.C.)
10. Phase letters (shown on signals and M.O.C.)
11. Loops (including distances, names and any feeders)
12. Indicate if pedestrian aspects are pole or side-mounted
13. Whether all necessary road markings are included (e.g. stop lines, studs, lane markings etc.)
14. Whether all necessary signal information is included (e.g. P/B's, secondaries, box-signs, filter arrows, etc.)
15. Barrier Rails
16. Amendment notes & new issue letter.
17. Any deletions in correction fluid to be highlighted.
18. All other amendments to be shown in red ink.
19. Title (with site reference number, project number, date, etc)
20. Street names.

APPENDIX B

1 DATA REQUIREMENTS FOR COMPUTER MODELLING PROGRAMS

1.1 Geometric data

1.1.1 A scale drawing at 1:200 (or 1:500 for preliminary analysis) of the junction or junctions and/or a 1:1250 (or 1:2500) if a network is under investigation. The junction drawing should show the number of lanes including short flared lanes, bus lanes and cycle lanes, width of lanes, gradient, turning radii and exit widths. Time of day changes to geometry should be shown, such as bus lane operation, parking (controlled and illegal), loading and other kerbside activity (taxi ranks etc.).

1.1.2 The network drawing provides link length details and how they are interconnected on the network.

1.2 Junction Control Data

1.2.1 Type of junction control, i.e. priority, roundabout, signalled or grade separated. If signal controlled, then phasing and staging arrangements are required, including full stage and interstage diagrams showing phase delays.

1.3 Traffic Data

1.3.1 A classified (buses, articulated buses, HGV's, LGV's, trams, taxis, motorcycles, pedal cycles and cars) survey covering peak and off peak periods. Additional data covering the weekend (e.g. Saturday mid-day and Sunday PM) is particularly useful for shopping areas or where there is a significant change in traffic demand.

1.3.2 A queue survey before and after each 15 minute traffic survey interval (number of vehicles at end of green) will permit actual demand to be better assessed.

1.3.3 Number of vehicles using short lanes, gap acceptance figures for give ways / right turners, number of vehicles turning right in intergreens and other non-standard behaviour.

1.3.4 Pedestrian flows and proposed control.

1.3.5 Bus routes, flows / frequencies.

1.3.6 Measured saturation flows for each traffic lane, if available.

1.3.7 Accident data.

1.3.8 In addition, for LINKED or NETWORK DESIGN:

1.3.9 Origin and destination survey.

1.3.10 Journey time information for each link and for key routes through the network.

1.3.11 Further information can be found in Modelling Guidelines – Traffic Schemes in London Urban Networks which can be found at www.londonstreetworks.net in Library > traffic signals.

APPENDIX C

TfL Traffic Directorate

TfL DIRECTORATE OF TRAFFIC OPERATIONS (DTO)
SCHEME BRIEF FORM

HOW TO USE THIS FORM

This Scheme Brief Form must describe the scope for the Signals work and provide all the technical data that are required to start the detailed signals design. In addition, the necessary financial authorisation must have been received by the DTO before the work can start. On receipt of the data, the information is reviewed by the Signals Team for completeness, and the scheme is entered onto the Borough extranet

Please click on the following links to find out: Who You Should Speak To for Signals Advice/Guidance

The matrix below indicates the type of technical data that should be submitted with this form, depending on the type of scheme. A detailed traffic model will be required for most schemes, as part of the detailed design work. Definition of the extent of modelling and the data that are required, are given in DTO procedure documents, as indicated on the pop-up comments in the matrix. These key documents are (hyperlinked on Borough extranet):

1. Design Standards for Signals Schemes in London, Specification No. TTS6, August 2002 (to be revised 2007)
2. DTO Modelling Guidelines, Traffic Schemes in London and Urban Networks, July 2006
3. Civil Engineering Guidance

A budget cost is also given for each signals installation category, as a pop-up, in the matrix below.

REQUIRED TECHNICAL DATA TO ACCOMPANY THIS FORM

Scheme Data Requirement * Boxes in red indicate that data are required.Please indicate what data are being provided by marking adjacent box (x).	1:200 CAD Drawing	Traffic Data	Accident Statistics	85%ile Speed	Speed Limits	Traffic Modelling	Queue Lengths	Scheme Design Sheet
New Signals Installation								
Major Modification (existing junction)								
Minor Modification (existing junction)								
Pelican/Toucan Crossing								
Puffin Crossing								

CLIENT DETAILS

CLIENT / SENDER — BOROUGH

Indicate who this request is from

SENDERS EMAIL & TEL NO.

PURSEHOLDER

Indicate the slot holder

LOCATION DETAILS

SCHEME TITLE

Provide scheme title

SIGNALS SITE REFERENCE — * Streets ID NO.

If existing signalled junction, provide the ref no. (99/999999) — * ***LIPS Reference No.*** *if LIPS funded*

ROAD NAMES PINPOINT

Please use PINPOINT to look up accurate road names for this site using the signal reference number if applicable

BOROUGH / TLRN ROAD — PART OF THE SRN?

Indicate if Borough or TLRN road — *If Yes, a review by NA is required*

NEW SIGNALS JUSTIFICATION APPROVED? (SQA0064)

YES — NO

DO YOU WISH DTO TO CONSIDER ADVANCED STOP LINES FOR CYCLES AS PART OF THE SCHEME DESIGN?

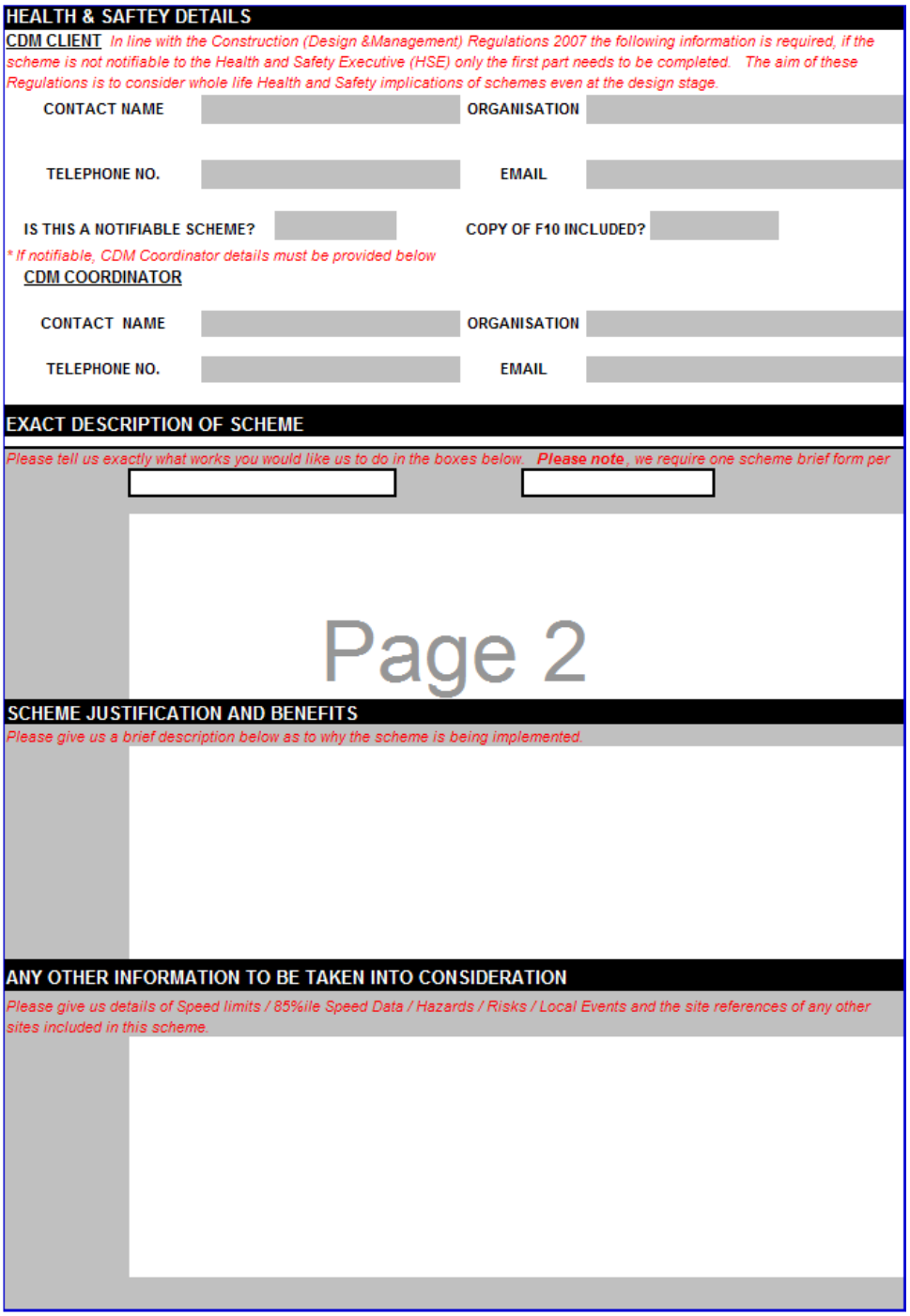
It has been requested by the Mayor for all new schemes to have these

IF NO, WHY NOT?

FINANCE DETAILS

FUNDING

Supply WBS code (internal work); Cheque (developers); or Works Order (Boroughs) making sure to include an electronic copy of the finance.



HEALTH & SAFTEY DETAILS

CDM CLIENT *In line with the Construction (Design &Management) Regulations 2007 the following information is required, if the scheme is not notifiable to the Health and Safety Executive (HSE) only the first part needs to be completed. The aim of these Regulations is to consider whole life Health and Safety implications of schemes even at the design stage.*

CONTACT NAME | ORGANISATION

TELEPHONE NO. | EMAIL

IS THIS A NOTIFIABLE SCHEME? | COPY OF F10 INCLUDED?

** If notifiable, CDM Coordinator details must be provided below*

CDM COORDINATOR

CONTACT NAME | ORGANISATION

TELEPHONE NO. | EMAIL

EXACT DESCRIPTION OF SCHEME

*Please tell us exactly what works you would like us to do in the boxes below. **Please note**, we require one scheme brief form per*

Page 2

SCHEME JUSTIFICATION AND BENEFITS

Please give us a brief description below as to why the scheme is being implemented.

ANY OTHER INFORMATION TO BE TAKEN INTO CONSIDERATION

Please give us details of Speed limits / 85%ile Speed Data / Hazards / Risks / Local Events and the site references of any other sites included in this scheme.

APPENDIX D

STAND ALONE CROSSING – SITE ASSESSMENT RECORD SHEET
LOCAL SITE CHARACTERISTICS

1.1	**Site Location** Ordnance Survey Grid Reference	Description (Attach annotated sketch)	
1.2	**Carriageway Type**	Single One-Way Number of lanes Cycle lanes/tracks Gradients	Double Two-Way
1.3	**Carriageway Width**		Metres
1.4	**Cycle Lane/Track Width**	Side 1	Metres
		Side 2	Metres
1.5	**Footway Width**	Side 1	Metres
		Side 2	Metres
1.6	**Useable Verge Width**	Side 1	Metres
	(after carriageway/margin/footway)	Side 2	Metres
1.7	**Refuge Island**		Yes / No
	Width		Metres
1.8	**Road Lighting Standard**		
	BS 5489 classification		Category
	Is the existing lighting in accordance with BS 548		Yes / No
	Any rearrangement necessary?		Yes / No
	Better lighting standard needed?		Yes / No
	Supplementary lighting needed?		Yes / No

1.9	**Minimum Visibility**		
	Pedestrian/cyclist/equestrian to approaching vehi	Direction 1	Metres
	(note visibility through barriers for young pedestrians)	Direction 2	Metres
	Vehicle to proposed site crossing	Direction 1	Metres
		Direction 2	Metres
1.10	**Waiting/Loading/Stopping Restrictions**		
	At prospective site		Yes / No
	Within 50m of the site		Yes / No
1.11	**Public Transport Stopping Points**		
	At prospective site		Yes / No
	Within 50m of the site		Yes / No
	Relationship to crossing		
	[in direction of travel]	Direction 1	Approach / Exit
		Direction 2	Approach / Exit
1.12	**Nearby Junctions**		
	Distance to nearest significant junction	Direction 1	Metres
		Direction 2	Metres
1.13	**Other Cyclist/Pedestrian Crossings**		
	Distance to next crossing	Direction 1	Metres
		Direction 2	Metres
	Type of crossing	Zebra / Pelican / Puffin / Toucan / Other	
1.14	**School Crossing Patrol**		
	Distance if less than 100m		Metres
1.15	**Skid Risk**		
	Does surface meet skid resistance requirements?		Yes / No

1.16	**Surroundings**	
	(within 100m)	
	Hospital/sheltered housing/workshop for disabled people	Yes / No
	Older persons and/or disabled persons residential home	Yes / No
	(within 1km)	
	Local Shop	Yes / No
	Primary School	Yes / No
	Secondary School	Yes / No
	Post Office	Yes / No
	(up to 8km)	
	Railway/Bus Station	Yes / No
	Pedestrian leisure/shopping area	Yes / No
	Sports stadium (including race course)/entertainment venue	Yes / No
	Equestrian centre	Yes / No
	Junction with cycle route	Yes / No
	Junction bridle path or other Equestrian route	Yes / No
	Others (for example a Fire Station)	Yes / No

Crossing Traffic Information

2.1	**Flow and Composition**		
	Crossing cyclists	Number per ……..hours	
	Unaccompanied young cyclists		%
	Pedestrian count	Number per ……..hours	
	Prams/pushchairs		%
	Disabled People/Older People		%
	Unaccompanied young children		%
	Severe mobility difficulties	Number per day	
	Visually impaired	Number per day	
	Equestrians	Number per day	
	Others	Number per day	
	General Purpose of Crossing		
2.2	**Time to Cross The Road (Measured Sample)**		
	Able pedestrians/dismounted cyclists		Seconds
	Mounted cyclists		Seconds
	Older people or disabled people		Seconds
	Equestrian		Seconds
2.3	**Difficulty crossing**		
	Able pedestrians/dismounted cyclists		Yes / No
	Mounted cyclists		Yes / No
	Older people or disabled persons		Yes / No
	Equestrian		Yes / No
2.4	**Latent Crossing Demand**		
	Estimate for pedestrians	Number per ……..hours	
	Estimate for older people or disabled persons	Number per ……..hours	
	Estimate for cyclists	Number per ……..hours	
	Estimate for equestrians (up to 8km)	Number per ……..hours	

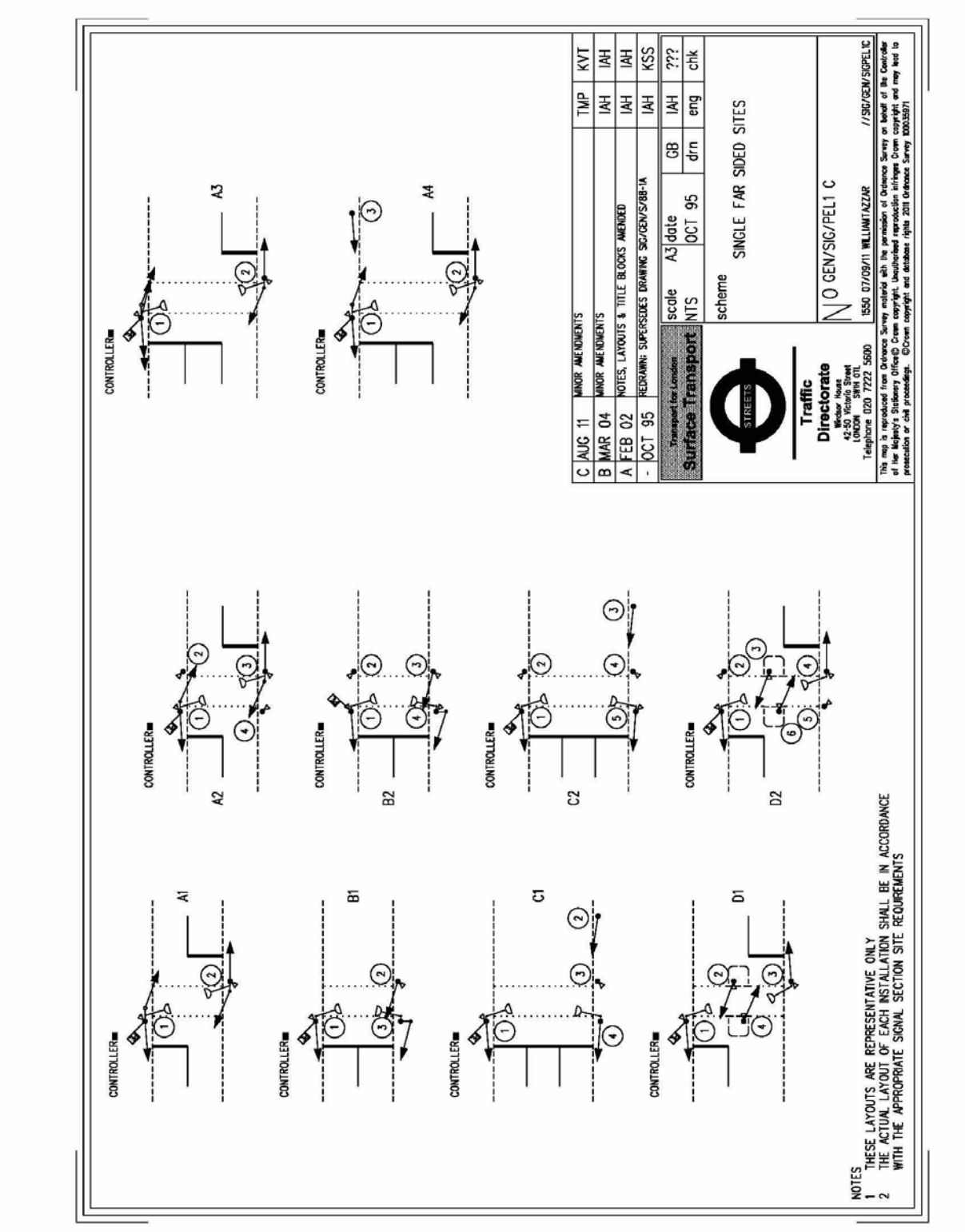
Traffic Information on Highway

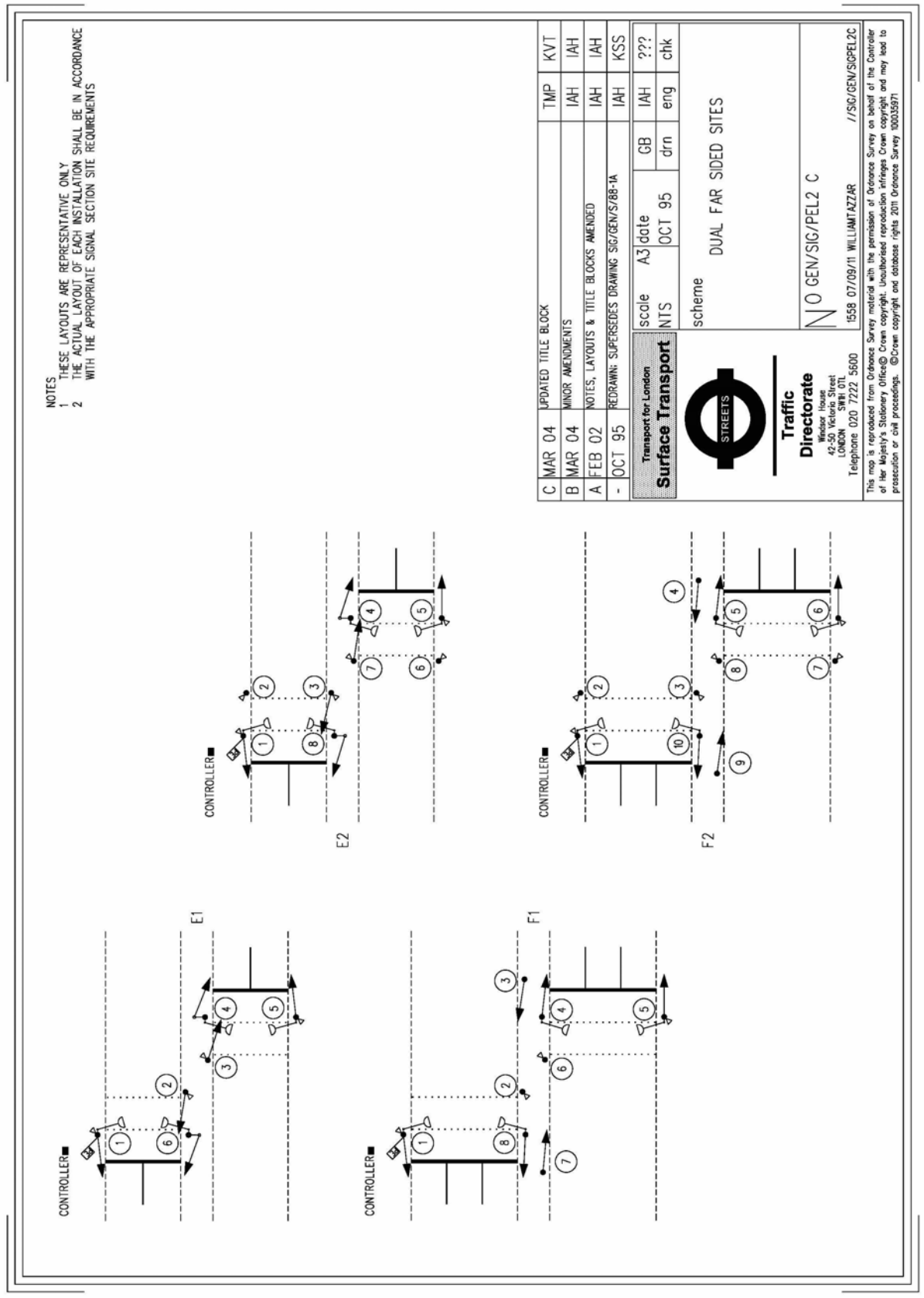
3.1	**Flow and Composition on Carriageway to be crossed (note if one way)**		
	Motor vehicle count	Number per ……..hours	
	Cyclists	Number per ……..hours	
	Heavy Goods vehicles	Number per ……..hours	
	Public Services vehicles	Number per ……..hours	
3.2	**Vehicle Speeds**		
	85^{th} percentile		Mph
	Cyclists		Mph
3.3	**Level of Use of Footways/Cycle Track/Bridlew**		
	Pedestrians	Number per ……..hours	
	Cyclists	Number per ……..hours	
	Equestrians	Number per ……..hours	
3.4	**Traffic Delays (Measured)**		
	Existing delay to traffic if any		Seconds
	Purpose of Road		

Road Accidents

4.1	**Mean Personal Injury (PI) Accident Frequency**		
	Number per year at site (over 5 years if available)	PI accidents/year	
	Number per year at an average local site (over 5 years if available)	PI accidents/year	
	Number per year specifically involving NMU's	PI accidents/year	

PREFERRED LAYOUTS FOR STAND ALONE CROSSINGS **APPENDIX E**




NOTES
1 THESE LAYOUTS ARE REPRESENTATIVE ONLY
2 THE ACTUAL LAYOUT OF EACH INSTALLATION SHALL BE IN ACCORDANCE WITH THE APPROPRIATE SIGNAL SECTION SITE REQUIREMENTS
C MAR 04 UPDATED TITLE BLOCK TMP KVT
B MAR 04 MINOR AMENDMENTS IAH IAH
A FEB 02 NOTES, LAYOUTS & TITLE BLOCKS AMENDED IAH IAH
- OCT 95 REDRAWN: SUPERSEDES DRAWING SIG/GEN/S/88-1A IAH KSS
Transport for London
Surface Transport
STREETS
Traffic Directorate
Windsor House
42-50 Victoria Street
LONDON SW1H 0TL
Telephone 020 7222 5600
scale NTS
A3 date OCT 95
GB drn
IAH eng
??? chk
scheme
DUAL FAR SIDED SITES
NO GEN/SIG/PEL2 C
1558 07/09/11 WILLIAMT.AZZAR //SIG/GEN/SIGPEL2C
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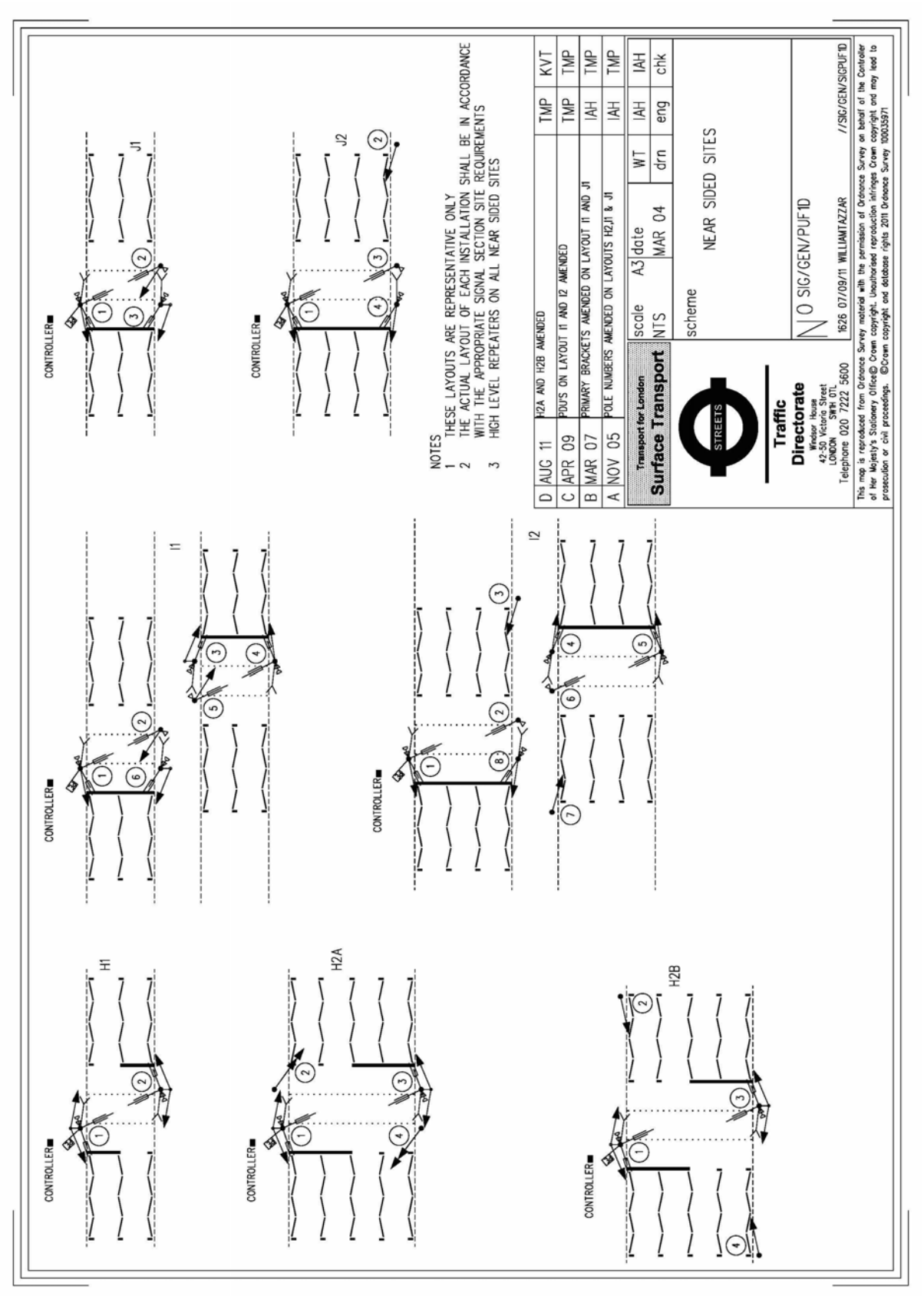
CONTROLLER
E1
F1
E2
F2


J1
J2
I1
I2
H1
H2A
H2B
CONTROLLER
NOTES
1 THESE LAYOUTS ARE REPRESENTATIVE ONLY
2 THE ACTUAL LAYOUT OF EACH INSTALLATION SHALL BE IN ACCORDANCE WITH THE APPROPRIATE SIGNAL SECTION SITE REQUIREMENTS
3 HIGH LEVEL REPEATERS ON ALL NEAR SIDED SITES
D AUG 11 H2A AND H2B AMENDED TMP KVT
C APR 09 PDU'S ON LAYOUT I1 AND I2 AMENDED TMP TMP
B MAR 07 PRIMARY BRACKETS AMENDED ON LAYOUT I1 AND J1 IAH TMP
A NOV 05 POLE NUMBERS AMENDED ON LAYOUTS H2,J1 & J1 IAH TMP
Transport for London
Surface Transport
scale NTS
A3 date MAR 04
WT drn
IAH eng
IAH chk
scheme
NEAR SIDED SITES
STREETS
Traffic Directorate
Windsor House
42-50 Victoria Street
LONDON SW1H 0TL
Telephone 020 7222 5600
O SIG/GEN/PUF1D
1626 07/09/11 WILLIAMTAZZAR
/SIG/GEN/SIGPUF1D
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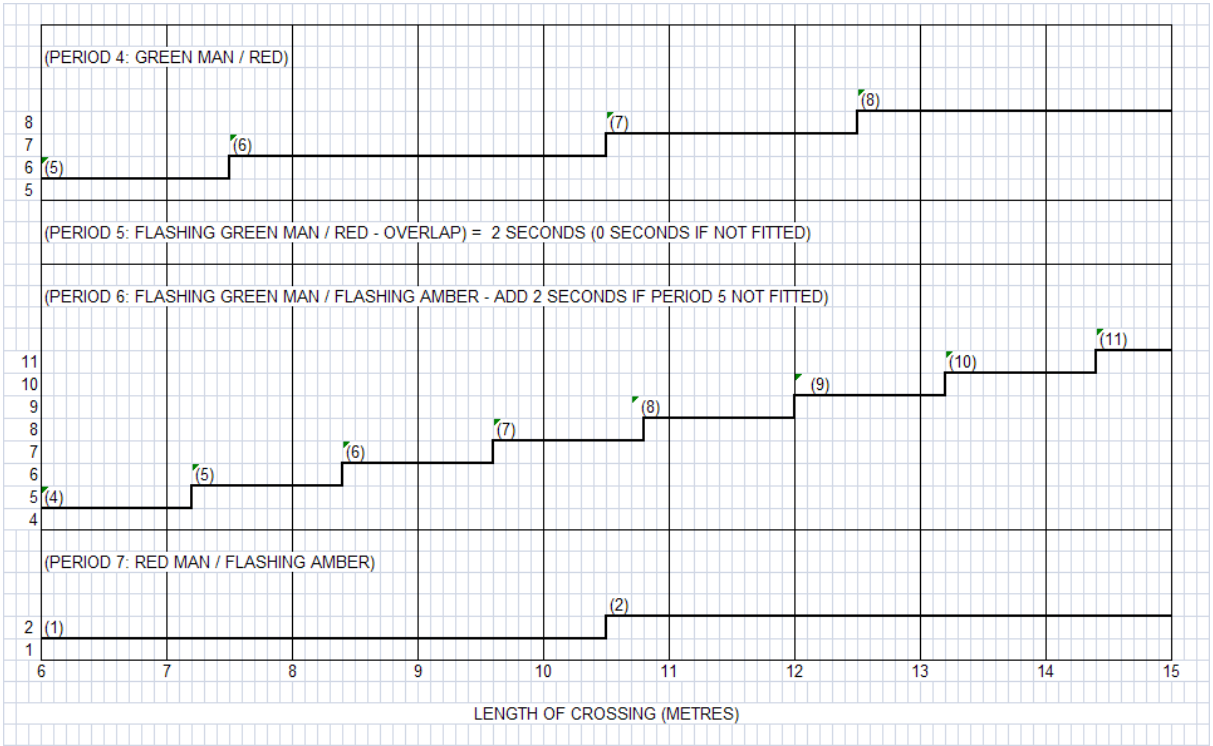
APPENDIX F

PELICAN TIMINGS - GREATER LONDON AREA

PERIOD TIMINGS

Period 1	Red Man - Green	20 seconds (FVP) 20 seconds max, 7 seconds min (VA)
ALT Period 1 (where dual VP required)		7 - 20 seconds
Period 2	Red Man - Amber	3 seconds - mandatory
Period 3	Red Man - Red	2 seconds - gap change 2 seconds - max change 2 second - fixed time 3 seconds - SDE change 2 second - computer change



VA EXTENSIONS

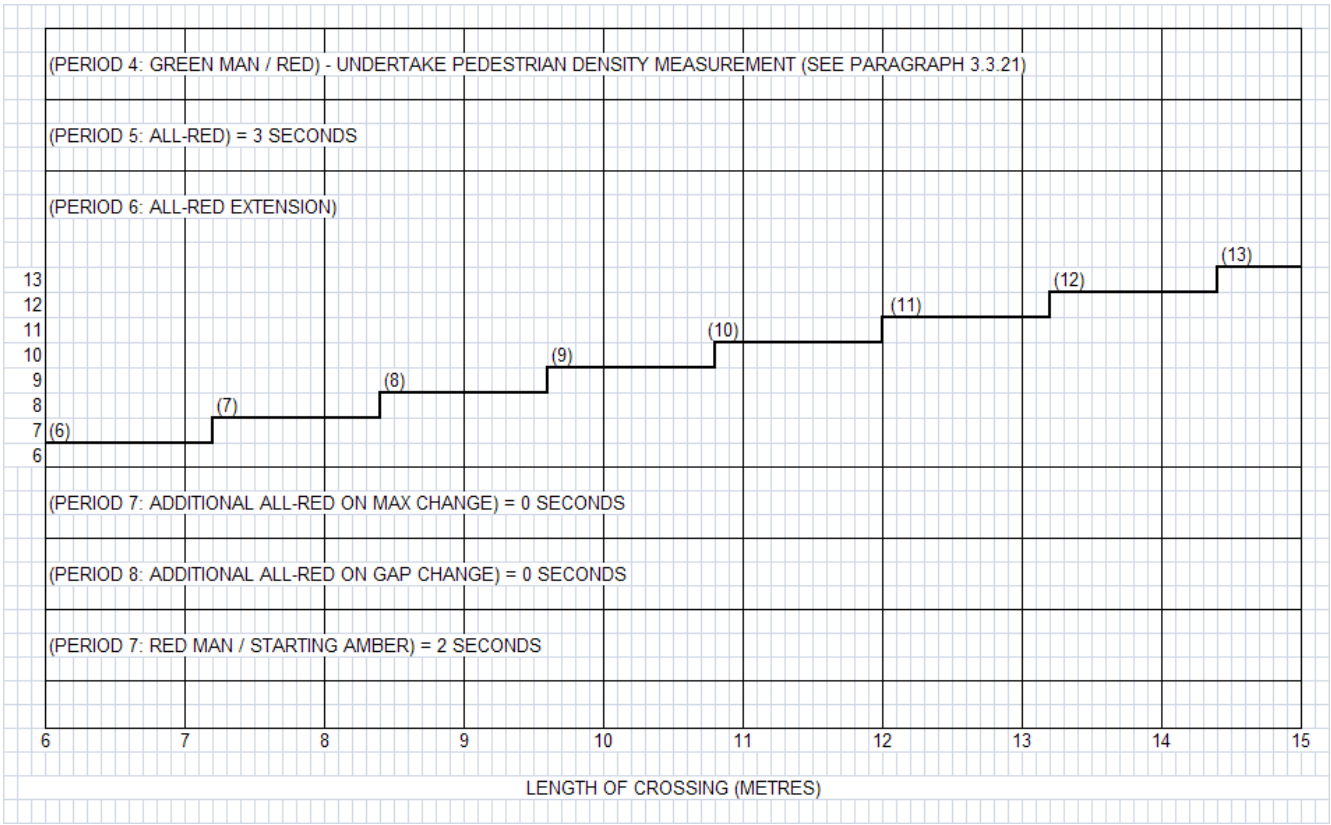
Full and Simple System 'D' VA loops	at 12m, 25m & 39m FSL	Minimum extension 1.6 seconds
Single VA loops (Only to be used at existing sites with this VA loop configuration)	At 40m FSL	Minimum extension 4.0 seconds
MVD		Minimum extension 0.2 seconds (Extensions in the range of 0.2 seconds to 0.4 seconds are recommended but this does not preclude the use of a longer extension time if appropriate for site conditions. Note that the MVD internally adds a 0.5 second extension to the output pulse.)
Speed Assessment (SA)	Simple System 'D' and a loop at 151m FSL	Extension as provided by controllers to DfT Specification MCE 0125 (Delay Period + 5 seconds)

APPENDIX Gi

PUFFIN OR NEARSIDE TIMINGS - GREATER LONDON AREA (INCLUDING NEARSIDE TOUCANS AND EQUESTRIANS)

PERIOD TIMINGS

Period 1	Red Man - Green	20 seconds (FVP) 20 seconds max, 7 seconds min (VA)
ALT Period 1 (where dual VP required)		7 - 20 seconds
Period 2	Red Man - Amber	3 seconds - mandatory
Period 3	Red Man - Red	2 seconds - gap change 2 seconds - max change 2 second - fixed time 3 seconds - SDE change 2 second - computer change

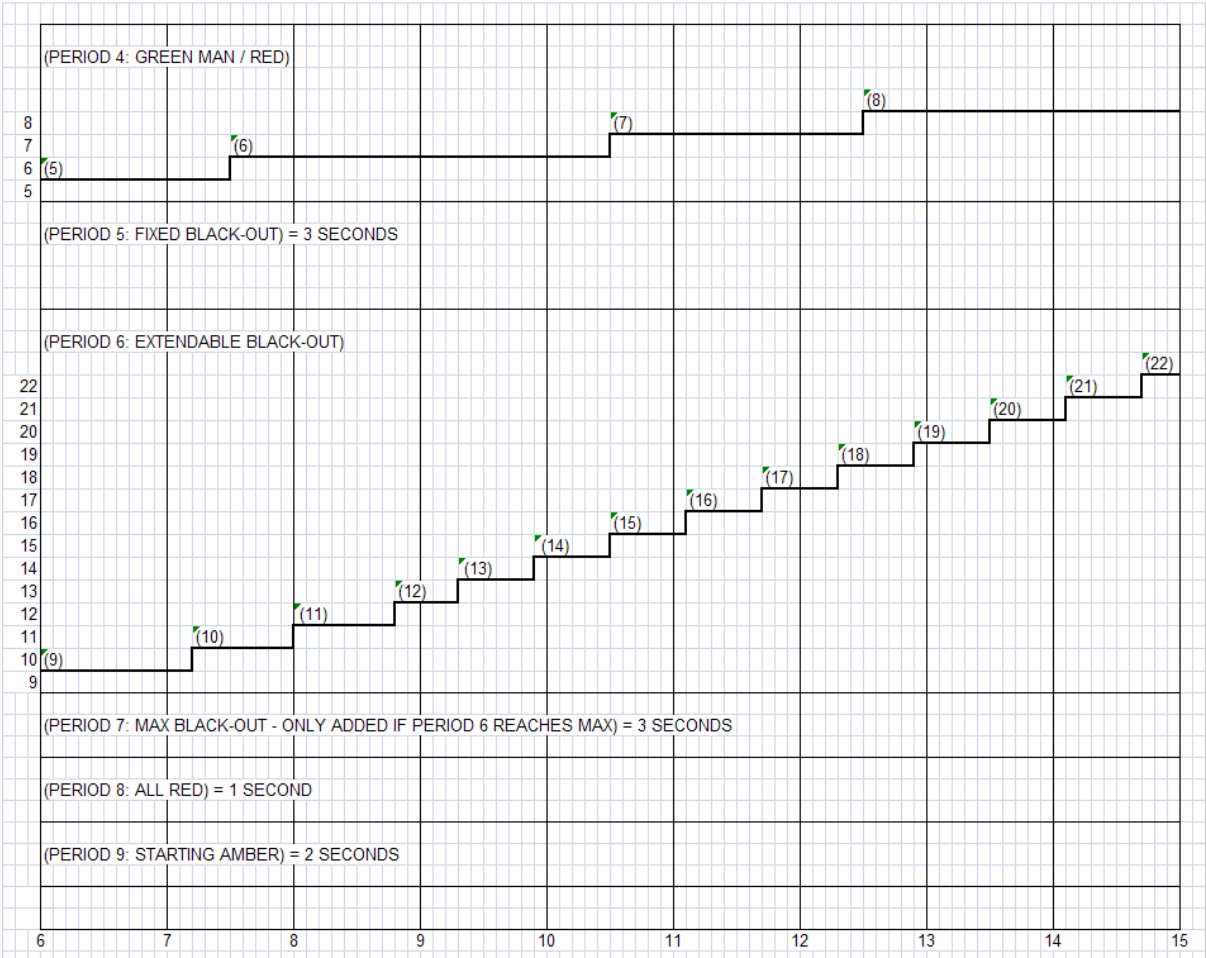


APPENDIX Gii

TOUCAN TIMINGS (FAR SIDED)

PERIOD TIMINGS

Period 1	Red Man - Green	20 seconds (FVP) 20 seconds max, 7 seconds min (VA)
ALT Period 1 (where dual VP required)		7 - 20 seconds
Period 2	Red Man - Amber	3 seconds - mandatory
Period 3	Red Man - Red	2 seconds - gap change 2 seconds - max change 2 second - fixed time 3 seconds - SDE change 2 second - computer change



APPENDIX Hi

CALCULATION OF FAR-SIDED PEDESTRIAN CLEARANCE TIMINGS AT JUNCTIONS (AND Ped-X)

Road Width (metres)	Clearance		Starting Amber	Total clearance
	Blackout	All red		
Standard				
up to 7.2	3	3	2	8
7.2 - 8.4	4	3	2	9
8.4 - 9.6	4	4	2	10
9.6 – 10.8	5	4	2	11
10.8 – 12.0	5	5	2	12
12.0 – 13.2	6	5	2	13
13.2 – 14.4	6	6	2	14
14.4 – 15.6	7	6	2	15
15.6 – 16.8	7	7	2	16
16.8 – 18.0	8	7	2	17
18.0 – 19.2	8	8	2	18
19.2 – 20.4	9	8	2	19
Countdown				
Upto 7.2	3	3	2	8
7.2 – 8.4	4	3	2	9
8.4 – 9.6	5	3	2	10
9.6 - 10.8	6	3	2	11
10.8 – 12.0	7	3	2	12
12.0 – 13.2	8	3	2	13
13.2 – 14.4	9	3	2	14
14.4 – 15.6	10	3	2	15
15.6 – 16.8	11	3	2	16
16.8 – 18.0	12	3	2	17
18.0 – 19.2	13	3	2	18
19.2 – 20.4	14	3	2	19

.

APPENDIX Hii

CALCULATION VEHICULAR CLEARANCE TIMINGS AT JUNCTIONS

The intergreen period can be approximated by considering the relative transit times to the probable collision points.

Ahead movements

Distance	0-9	10-18	19-27	28-37	38-46	47-55	56-64	65-73
Intergreen	5	6	7	8	9	10	11	12

Turning movements

Distance	0-9	10-13	14-20	21-27	28-34	35-40	41-45	46-50
Intergreen	5	6	7	8	9	10	11	12

Where the following stage is a pedestrian stage the distance “X” should be determined from the position of the furthest studs of the pedestrian crossing.

APPENDIX I

Directorate of Traffic Operations

Traffic Infrastructure

STAGE 1 DESIGN/SAFETY CHECK (Predesign, on site)

1 of 3

Site Ref: \ *Project Engineer:*

Address:

Project:

Drawing No: *Date:*

ITEM No.	DESCRIPTION	SITE CHECK	COMMENTS & RESPONSE	Checking Engineer
1	VISIBILITY Check vertical and horizontal alignment to ensure signals, primary and secondary, are visible. Would taller pole, mast arm, additional heads (inc. central refuge) or advance warning signs help? N.B. Mast arms require crash protection on roads with speed limit 40 mph or more.			
2	Are there problems with seeing signal heads? Are backing boards required? (Should be used on sites with a speed limit over 30 mph.) Are fibre optic green arrows required?			
3	Check signals can be seen from distances appropriate to the speed of vehicles. May need mast arm, taller pole or advance signing. (Advance warning signs required on roads with speed limit of 40 mph or more; when signals are proposed for derestricted roads, consideration should be given to the imposition of a suitable speed limit.)			
4	Are any signal heads likely to be obscured by trees, lamp columns, signs, buses in a lay-by, bridge abutments, etc.?			
5	Will any signal heads be visible by conflicting flows? Fit louvres or hoods.			
6	Will there be any "see through" problems, including pedestrian aspects? Fit louvres or screens.			
7	Does any section of guard-rail need to be of the "see through" type, including any on the central reserve which may obscure visibility for right turning vehicles?			
8	Are islands / refuges large enough to accommodate waiting pedestrians including those with pushchairs / prams / wheelchairs? (Recommended minimum width - 2.0m for refuge; 3.0m for staggered facility)			

Directorate of Traffic Operations

Traffic Infrastructure

STAGE 1 DESIGN/SAFETY CHECK (Predesign, on site)

2 of 3

Site Ref: \ *Project Engineer:*

Address:

Project:

Drawing No: *Date:*

ITEM No.	DESCRIPTION	SITE CHECK	COMMENTS & RESPONSE	Checking Engineer
9	Is there sufficient footway width to accommodate waiting pedestrians including those with pushchairs / prams / wheelchairs?			
	PEDESTRIANS			
10	Will pedestrians, including children, be obscured by trees, bollards, signs, pillar boxes, etc? If guardrail is to be installed is '"see through" type guard-rail needed?			
11	Will controller position obscure or obstruct pedestrians?			
12	Will vehicle signal aspects be immediately visible to vehicles entering the road near a crossing?			
13	At pedestrian crossing points check road widths for appropriate design, straight over or staggered layout.			
14	Is there sufficient footway width for cyclists / pedestrians at Toucans? (recommeded minimum 2.8m)			
15	If there are no pedestrian facilities, would closely associated secondary signals cause problems for pedestrians?			
	RIGHT TURNING TRAFFIC			
16	If port to port markings are to be used, is forward visibility O.K.?			
17	Could closely associated secondary signals be provided and would the stop line need to be set back?			
18	Could right turns be banned? If right turn overlap at cross roads, recommend to highway authority that opposing right turn should be banned.			

Directorate of Traffic Operations

Traffic Infrastructure

STAGE 1 DESIGN/SAFETY CHECK (Predesign, on site)

3 of 3

Site Ref: \ *Project Engineer:*

Address:

Project:

Drawing No: *Date:*

ITEM No.	DESCRIPTION	SITE CHECK	COMMENTS & RESPONSE	Checking Engineer
19	Check right turn lane will be adequate for stacking turning traffic, i.e. no turning traffic queuing in fast lane.			
20	GENERAL Check that the signal poles and heads will have adequate clearances from the carriageway and will not unduly obstruct the footway.			
21	Are private accesses affected by the signals?			
22	Is anti-skid surfacing required? Anti-skid surfacing has to be applied to TLRN roads, approaches to Pelican & Puffin crossings and stand alone Toucans. If anti-skid surfacing is required, is existing surface suitable?			
23	Has the promoting authority provided a risk assessment for the parking of a vehicle during maintenance activity? Has the authority shown that a place is available or can be provided, if necessary?			
24	Are there any problems that can be foreseen with the construction, maintenance and decommissioning of the proposed work?			
25	Will there be a maintenance agreement in place for all the equipment associated with or connected to this installation? If not, how is maintenance to be managed?			
24	ADDITIONAL COMMENTS AND RESPONSE			

Signed _____

(Project engineer)

APPENDIX J

Directorate of Traffic Operations

Traffic Infrastructure

STAGE 2 DESIGN/SAFETY CHECK (Scheme Drawing Check) 1 of 5

Site Ref: \ *Project Engineer:*

Address:

Project:

Drawing No:

Safety Check Carried Out By: *Date:*

ITEM No.	DESCRIPTION	AUDIT CHECK	COMMENTS & RESPONSE
	VISIBILITY		
1	Check horizontal alignment to ensure signals, primary and secondary, are visible. Would taller pole, mast arm, additional heads (inc. central refuge) or advance warning signs help?		
2	Is proposed planting/landscaping (if shown) satisfactory with regard to visibility of signals, pedestrians and sight lines?		
3	Are any signal heads obscured by trees, lamp columns, signs, buses in a lay-by, bridge abutments, etc.?		
4	Are there any "see through" problems? Fit louvres or screens. Are any signal heads visible by conflicting flows? Fit louvres or hoods.		
5	If guardrail is to be installed does any section of guard-rail need to be of the'"see through" type, including any on the central reserve which may obsure visibility for right turning vehicles?		
	PEDESTRIANS		
6	Are dropped kerbs provided where appropriate?		
7	Are pedestrian crossing routes clearly defined?		
8	Are crossing widths wide enough? Minimum 2.4m. (For Toucans recommended minimum width 4.0m.)		
9	Are islands / refuges large enough to accommodate waiting pedestrians including those with pushchairs / prams / wheelchairs? (Recommended minimum width - 2.0m for refuge; 3.0m for staggered facility)		

Directorate of Traffic Operations

Traffic Infrastructure

STAGE 2 DESIGN/SAFETY CHECK (Scheme Drawing Check) 2 of 5

Site Ref: \ *Project Engineer:*

Address:

Project:

Drawing No:

Safety Check Carried Out By: *Date:*

ITEM No.	DESCRIPTION	AUDIT CHECK	COMMENTS & RESPONSE
10	Is there sufficient footway width to accommodate waiting pedestrians including those with pushchairs / prams / wheelchairs?		
11	Is there sufficient footway width for cyclists / pedestrians at Toucans? (Recommended minimum 2.8m)		
12	If there is no guard-rail, is it needed and, if so, should it be "see through" type?		
13	At pedestrian crossing points check road widths for appropriate design, straight over or staggered layout.		
14	If staggered facility, is it staggered correctly where possible?		
15	If staggered facility check that 'U' turners and right turners clearing in the intergreen and left turners do not conflict with pedestrians.		
16	Are pedestrian push buttons appropriately sited, are any additional push buttons required or are any other special facilities for the disabled required? e.g. audibles, tactiles or bleep & sweep.		
17	Is tactile paving required?		
18	Are there any "see through" problems with pedestrian aspects? Fit louvres. (Recommended stagger between crossings - 4.0m)		

Directorate of Traffic Operations

Traffic Infrastructure

STAGE 2 DESIGN/SAFETY CHECK (Scheme Drawing Check) 3 of 5

Site Ref: \ *Project Engineer:*

Address:

Project:

Drawing No:

Safety Check Carried Out By: *Date:*

ITEM No.	DESCRIPTION	AUDIT CHECK	COMMENTS & RESPONSE
19	Are signal aspects immediately visible to vehicles entering the road near a crossing?		
20	At Pelicans, are the zig-zag markings of the appropriate length or do they need extending / shortening?		
21	Does controller posititon obscure or obstruct pedestrians?		
22	RIGHT TURNING TRAFFIC If port to port markings are used, is forward visibility O.K.?		
23	Could closely associated secondary signals be provided and would the stop line need to be set back?		
24	If early cut off provided (not recommended on high speed roads > 40 mph), could alternative method be used, i.e. separately signalled right turns and could they be physically separated?		
25	If early cut off is to be provided, opposing flow should have closely associated secondary signal. Also, could opposing right turn be banned?		
26	If separately signalled right turns cannot be channelised, could a split phase be provided?		
27	Check right turn lane is adequate for stacking turning traffic, i.e. no turning traffic queuing in fast lane.		

Directorate of Traffic Operations

Traffic Infrastructure

STAGE 2 DESIGN/SAFETY CHECK (Scheme Drawing Check) 4 of 5

Site Ref: \ *Project Engineer:*

Address:

Project:

Drawing No:

Safety Check Carried Out By: *Date:*

ITEM No.	DESCRIPTION	AUDIT CHECK	COMMENTS & RESPONSE
	GENERAL		
28	Check that signal sequences prevent conflicts and provide safe clearances between phases and stages.		
29	Check that signal equipment does not unduly obstruct the footway.		
30	If islands / channelisation provided, do they guide traffic adequately and are any regulatory signs required?		
31	Check speed assessment equipment is fitted where appropriate or that the intergreens have been increased appropriately.		
32	Where necessary, is signal equipment located properly, i.e. behind any safety fencing? Mast arms require crash protection on roads with speed limit of 40mph or more.		
33	Is anti-skid surfacing required? Anti-skid surfacing has to be applied to TfLRN roads, approaches to Pelican & Puffin crossings and stand alone Toucans. If anti-skid required, is existing surface suitable?		
34	Are lane widths adequate, does inside lane need to accommodate cyclists?		
35	Check that carriageway markings are correct and clearly define routes and priorities.		
36	Are private accesses affected by the signals?		

Directorate of Traffic Operations

Traffic Infrastructure

STAGE 2 DESIGN/SAFETY CHECK (Scheme Drawing Check) 5 of 5

Site Ref: \ *Project Engineer:*

Address:

Project:

Drawing No:

Safety Check Carried Out By: *Date:*

ITEM No.	DESCRIPTION	AUDIT CHECK	COMMENTS & RESPONSE
37	Are swept paths O.K.?		
38	Are there any deviations from signal standards and, if so, are the reasons acceptable?		
39	If the promoting authority's risk assessment has shown one to be necessary and no other close position is available, has a hardstanding area been shown near the controller for a maintenance engineer's vehicle?		
40	Are there any problems that can be foreseen with the construction, maintenance and decommissioning of the proposed work?		
41	Is there a maintenance agreement in place for all the equipment associated with or connected to this installation? If not, how is maintenance to be managed?		
42	ADDITIONAL COMMENTS AND RESPONSE		

NOTE: This safety check has been carried out without any knowledge of landscaping, other street furniture, signing, horizontal/vertical alignments, condition of road surface with regard to skid resistance, existing road markings and the new/existing road surface.

Checked by _____ (Engineer)

Project Engineer_____

APPENDIX K

Directorate of Traffic Operations

Traffic Infrastructure

STAGE 3 DESIGN/SAFETY CHECK (On Site, as Installed) 1 of 3

Site Ref: \ *Project Engineer:*

Address:

Project:

Drawing No:

Safety Check Carried Out By: *Date:*

ITEM No.	DESCRIPTION	SITE CHECK	COMMENTS & RESPONSE
1	Check vertical and horizontal alignment to ensure signals, primary and secondary, are visible. Would taller pole, mast arm, additional heads (inc. central refuge) or advance warning signs help?		
2	Check signals can be seen from distances appropriate to the speed of vehicles. May need mast arm, taller pole or advance signing. (Advance warning signs required on roads with speed limit of 40 mph or more; when signals are installed on derestricted roads, consideration should have been given to the imposition of a suitable speed limit.)		
3	Is landscaping satisfactory with regard to visibility of signals, pedestrians and sight lines (allowing for growth).		
4	Are any signal heads likely to be obscured by trees, lamp columns, signs, buses in a lay-by, bridge abutments, etc.?		
5	Is signing and signal equipment located properly, i.e. behind any safety fencing? If speed limit is 40 mph or more, mast arms must have crash protection.		
6	Does controller position obscure or obstruct pedestrians?		
7	Check that the signal poles and heads have adequate clearances from the carriageway and do not unduly obstruct the footway.		
8	Does any section of guard-rail need to be of the "see through" type, including any on the central reserve which may obscure visibility for right turning vehicles?		

Directorate of Traffic Operations
Traffic Infrastructure

STAGE 3 DESIGN/SAFETY CHECK (On Site, as Installed) 2 of 3

Site Ref: \ *Project Engineer:*

Address:

Project:

Drawing No:

Safety Check Carried Out By: *Date:*

ITEM No.	DESCRIPTION	SITE CHECK	COMMENTS & RESPONSE
9	Are there any "see through" problems, including pedestrian aspects? Fit louvres or screens.		
10	Are any signal heads visible by conflicting flows? Fit louvres or hoods.		
11	Are signal aspects immediately visible to vehicles entering the road near a crossing?		
12	Check whether or not signals should be dimmed at night (not on TfLRN Roads) and whether signals can be clearly seen at night.		
13	If staggered facility check if 'U' turners and right turners clearing in the intergreen and left turners do not conflict with pedestrians.		
14	If port to port markings are used, is forward visibility O.K.?		
15	At Pelicans, are zig-zag markings adequate for any site specific problems?		
16	At Pelicans, is the overlap appropriate in this case (to help prevent intimidation of pedestrians)?		

Directorate of Traffic Operations

Traffic Infrastructure

STAGE 3 DESIGN/SAFETY CHECK (On Site, as Installed) 3 of 3

Site Ref: \ *Project Engineer:*

Address:

Project:

Drawing No:

Safety Check Carried Out By: *Date:*

ITEM No.	DESCRIPTION	SITE CHECK	COMMENTS & RESPONSE
17	Does the skid resistance of the road surface on the approaches appear to be adequate? If not, has the highway authority's attention been drawn to the fact? Anti-skid surfacing has to be applied to TfLRN roads, approaches to Pelican & Puffin crossings and stand alone Toucans.		
18	Check that signal timings, intergreens, minimum green timings, etc. are in accordance with recommended standards.		
19	Is the operation of the signals safe?		
20	Check for any design changes which may have occurred during implementation of the scheme.		
21	Are there any problems that can be foreseen with the maintenance and decommissioning of the works?		
22	If the promoting authority's risk assessment has shown one to be necessary and no other close position is available, has a hardstanding area been provided near the controller for a maintenance engineer's vehicle?		
23	ADDITIONAL COMMENTS		

Signed _____ (Project engineer)

APPENDIX L

Justification for Traffic Signals

1 INTRODUCTION

In 2002, The Management Liaison Committee, which is now The Traffic Control Liaison Committee, suggested that to gain some uniformity amongst the London boroughs and to reduce the continuing increase in system maintenance costs, an objective justification should be introduced to assist the London boroughs in justifying new signal installations.

The following information should be provided by the scheme client to TD Traffic Infrastructure for all new schemes.

2 JUNCTIONS

For a new junction, the justification is based on three criteria:

a) That the proposed site has an accident rate equal to or greater than the average signal junction on the roads in the boroughs area – Inner London or Outer London (see Appendix (i)) and it achieves a positive First Year Rate of Return (FYRR – taking into account positive and negative scheme impacts); **and**

b) That the traffic flows meet the relevant criteria (see Appendix (ii)); **or**

c) That the turning traffic flows or pedestrian flows meet those shown in Appendix (iii).

d) For a new development, where modelling evidence provides sufficient information.

3 PELICANS / TOUCANS / PUFFINS

It is proposed that for new installations the site should meet the following criteria:

3.1 **Either**

a) That the proposed site has an accident rate equal to or greater than the average pelican installation on roads in the boroughs area – Inner London or Outer London (see Appendix (i)) and it achieves a positive First Year Rate of Return (FYRR – taking into account positive and negative scheme impacts); **and**

b) That it meets the PV^2 criteria (see Appendix (iv)).

3.2 **Or**

a) That the proposed site has an accident rate equal to or greater than the average pelican installation on roads in the boroughs area – Inner London or Outer London (see Appendix (i)) and it achieves a positive First Year Rate of Return (FYRR – taking into account positive and negative scheme impacts); **and**

b) That it meets **0.8** of the PV^2 criteria (see Appendix (iv)); **and**

c) That it meets **one or more** of the following additional criteria:

i) The 85th percentile speed of vehicles exceeds the speed limit of the road and other options are thought unsuitable.

ii) There are normally a greater than average proportion of elderly pedestrians, disabled pedestrians or school children.

iii) Vehicle flows are such that pedestrians have difficulty in asserting precedence.

iv) There is a specific need for a crossing for cyclists.

v) Pedestrians could be confused by traffic management measures such as a contra-flow bus lane.

vi) There is a need to link with adjacent controlled crossings or junctions.

vii) Pedestrian flows are high and delays to vehicular traffic would otherwise be excessive.

viii) Long delays to buses on a route are being experienced.

ix) Improving access where there is substantial community severance, such as linking two parts of a school or enabling access to a retail park.

4 However, whilst this criteria should be adhered to whenever possible, there may be times when exceptional circumstances mean that the proposal is assessed on a site by site basis, e.g. if a footbridge or subway is removed there will not be any relevant “before” accident data etc.

Appendix (i)

Annual accident rates on all roads for justification of new traffic signal installations

Borough	Accident rates for junctions	Accident rates for Pelicans/Toucans /Puffins
City of London	2.50	0.55
Westminster	2.32	0.74
Camden	2.39	0.71
Islington	2.90	0.53
Hackney	2.45	0.72
Tower Hamlets	1.93	0.57
Greenwich	1.74	0.34
Lewisham	2.67	1.46
Southwark	2.03	0.60
Lambeth	2.94	0.74
Wandsworth	2.10	0.82
Hammersmith & Fulham	2.79	1.16
Kensington & Chelsea	2.59	0.83
Inner London Avg	**2.41**	**0.75**
Waltham Forest	1.77	0.32
Redbridge	1.96	0.19
Havering	2.31	0.44
Barking	2.43	0.36
Newham	2.01	0.56
Bexley	1.54	0.36
Bromley	1.77	0.34
Croydon	1.93	0.59
Sutton	1.63	0.37
Merton	1.47	0.32
Kingston	1.12	0.29
Richmond	1.43	0.25
Hounslow	2.01	0.42
Hillingdon	2.24	0.50
Ealing	2.09	0.52
Brent	1.76	0.80
Harrow	1.79	0.61
Barnet	2.64	0.49
Haringey	2.52	0.52
Enfield	2.92	0.61
Outer London Avg	**1.97**	**0.44**

Figures obtained from London Road Safety Unit - Levels of Collision Risk in Greater London issue 11 December 2006.

Appendix (ii)

Traffic flow justification for signalled junctions

The numerical criteria for the justification of traffic signals have not been updated since The Department of the Environment, Circular Roads 5/73 and Technical Memorandum H1/73. The following figures are therefore based on these figures, but increased by 11.5%, in line with the increase in traffic flow on the major roads in London between 1974 – 1995 as shown in the Department of the Environment Transport and the Regions London Traffic Monitoring Report: 1997 Edition.

The following figures are based on the average of the flows during the four busiest hours of any weekday:

1. For reduction in traffic conflicts and delays

   Total entering intersection 565

   Contribution from side roads 170

2. Interruption for side road traffic (where side road traffic experiences unreasonable delay in trying to break into a continuous stream of traffic on a major road).

   Total entering intersection 1356

   Contribution from side road 112

Appendix (iii)

Turning traffic & pedestrian flow justification for signalled junctions

These numerical criteria are based on the figures contained in The Department of the Environment Circular Roads 5/73.

The volume of turning traffic exceeds 700 vph **or** the flow of pedestrians crossing any arm of the junction is greater than 300 per hour. These figures are to be the average of the flows during the four busiest hours of any day of the week.

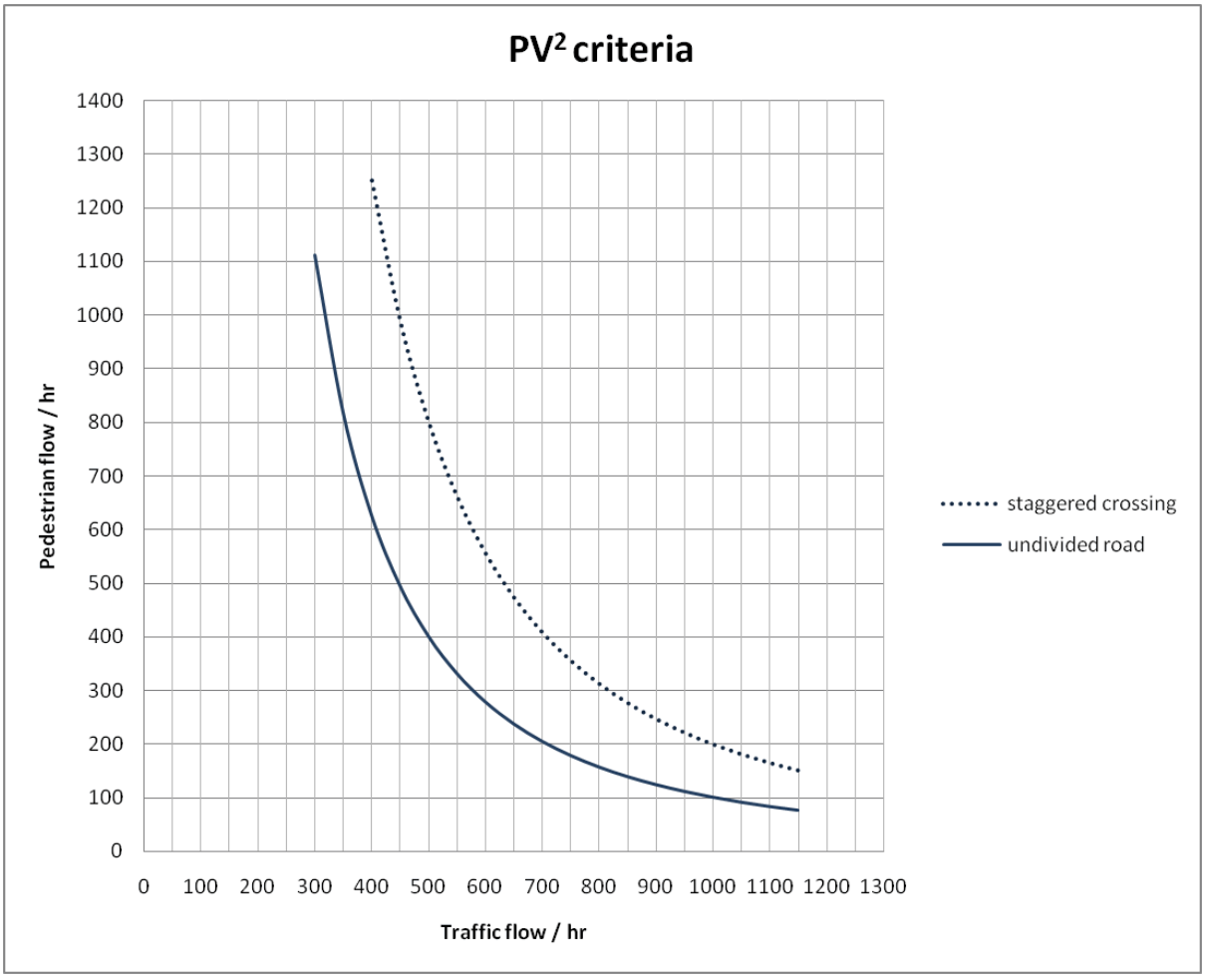
Appendix (iv)

PV² Criteria

P = the pedestrian flow (pedestrians / hour) across a 100m length of road centred on the proposed crossing site.

V = the number of vehicles in both directions (vehicles / hour).

The PV² value should be the average over the four busiest hours of the day and a crossing is normally justified where the calculated value of PV² is equal to or greater than 1 x 10^8 on an undivided road or 2 x 10^8 on a carriageway incorporating a staggered crossing.



REFERENCES

APPENDIX M

DEPARTMENT FOR TRANSPORT ADVICE NOTES AND STANDARDS

	Title
DMRB	Design Manual for Roads and Bridges
TA 84/06	Code of Practice for Traffic Control and Information Systems for All-Purpose Roads
TA 8/80	Carriageway Markings. Markings for Right Turn Movements at Cross Road Junctions
TA 12/81	Traffic Signals on High Speed Roads
TA 19/81	Reflectorisation of Traffic Signs (partially superseded)
TA 22/81	Vehicle Speed Measurement on All Purpose Roads
TA 20/84	Layout of Major/Minor Junctions
TA 54/87	Signing and Illumination of Road Humps: Two-way, 2 lane Single Carriageway Roads
TA 56/87	Hazardous Cattle Crossings - use of Flashing Amber Lights
TA 60/90	The use of Variable Message Signs on All-purpose and Motorway Trunk Roads
TA 58/92	Traffic Signs and Road Markings for Lane Gains and Lane Drops on All-purpose Dual Carriageway and Motorway Trunk Roads
TA 2/93	20 mph Speed Limit Zone Signs
TA 61/94	Currency of the Traffic Signs Manual
TA 62/94	Night Mobile Lane Closures on Trunk Roads and Trunk Road Motorways
TA 64/94	Narrow Lanes and Tidal Flow Operation at Roadworks on Motorways and Dual Carriageways with full width Hard Shoulders
TD 6/79	Transverse Yellow Bar Markings at Roundabouts
TD 7/80	Type Approval of Traffic Control Equipment
TD 18/85	Criteria for the use of Gantries for Traffic Signs and Matrix Signals on All-purpose and Motorway Trunk Roads
TD 24/86	All-purpose Trunk Roads and Trunk Road Motorways: Maintenance of Traffic Signals
TD 25/86	All-purpose Trunk Roads and Trunk Road Motorways: Maintenance of Traffic Signs

TD 26/86 Trunk Roads and Trunk Road Motorways: Maintenance of Road Markings

TD 29/87 Lane Closures - Vehicle Mounted Signs

TD 33/90 The use of Variable Message signs on All-purpose and Motorway Trunk Roads

TD 35/91 All-purpose Trunk Roads - MOVA System of Traffic Control at Signals

TD 38/94 Night Mobile Lane Closures on Trunk roads with Hard Shoulders

TD 50/04 The Geometric Layout of Signal Controlled Junctions and Signalised Roundabouts

LTN 1/98 The Installation of Traffic Signals and Associated Equipment

The majority of these Advice Notes and Standards form part of Volume 8 (Traffic Signs and Lighting) of the Design Manual for Roads and Bridges (DMRB) and are available from HM Stationery Office or at:

www.standardsforhighways.co.uk/dmrb/index.htm

DfT Traffic Advisory Leaflet 4/91. Audible and Tactile Signals at Pelican Crossings

DfT Traffic Advisory Leaflet 5/91. Audible and Tactile Signals at Signal Controlled Junctions

DfT Traffic Advisory Leaflet 8/93. Advanced Stop Lines for Cyclists

DfT Traffic Advisory Leaflet 10/93. 'Toucan' An unsegregated crossing for pedestrians and cyclists

DfT Traffic Advisory Leaflet 5/96. Further Development of Advanced Stop Lines

DfT Traffic Advisory Leaflet 3/97 The MOVA Traffic Control System

DfT Traffic Advisory Leaflet 4/97 Rising Bollards

DfT Traffic Advisory Leaflet 4/98 Toucan Crossing Development

DfT Traffic Advisory Leaflet 16/99 The Use of Above Ground Vehicle Detectors

DfT Traffic Advisory Leaflet 1/01 Puffin Pedestrian Crossings

DfT Traffic Advisory Leaflet 1/02 The Installation of Puffin Pedestrian Crossings

DfT Traffic Advisory Leaflet 2/03 Signal-control at Junctions on High-speed Roads

DfT Traffic Advisory Leaflet 3/03 Equestrian Crossings

DfT Traffic Advisory Leaflet 5/05 Pedestrian Facilities at Signal-Controlled Junctions

DfT Traffic Advisory Leaflet 1/06 General Principles of Traffic Control by Light Signals

Traffic Advisory Leaflets can be found at:
www.dft.gov.uk/pgr/roads/tpm/tal/

TFL GUIDANCE AND STANDARDS

TfL - Doc.No: U/S000/TS/603 – Puffin Design Guide

TfL - TTS 14 - Drawing Standards for Proposed Drawings

TfL - Modelling Guidelines – Traffic Schemes in London Urban Networks

TfL Guidance Note No. GN/TO/008 – Site Installation Commentary

TfL Guidance Note No. GN/TO/001 – Bus Priority in UTC

TfL Userguide GU/2706/TO/382 – Selective Vehicle Detection in London Underground Ltd.

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Guidance on the Installation of Signals on Lamp Columns

MISCELLANEOUS

DfT Specification TR 2206 Specification for Road Traffic Signals

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DfT (1998) “Guidance on the Use of Tactile Paving Surfaces”

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DfT Specification MCE 0108. Siting of Inductive Loops for Vehicle Detecting Equipments at Permanent Road Traffic Signal Installations

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The Traffic Signs Manual. Chapter 4, Warning Signs (HMSO)

The Traffic Signs Manual. Chapter 5, Road Markings (HMSO)

TRL MOVA Traffic Control Manual, Application Guide 44

TRL MOVA Data Set up Guide, Application Guide 45

TRL OSCADY 5 User Guide, Applications Guide 40

TRL Report RR 67. The Prediction of Saturation Flows for Road Junctions controlled by Traffic Signals

TRL Application Guide 35, TRANSYT 11 User Guide

Traffic Signals, Webster, F.V., and B.M. Cobbe. Ministry of Transport, Road Research Laboratory, Road Research Technical Paper No. 56. London, 1966 (H.M. Stationery Office)

LINSIG for Windows On-line Manual. JCT Consultancy Ltd

Inclusive Mobility – A guide to best practice on access to pedestrian and transport infrastructure.

(available from **www.mobility-unit.dft.gov.uk/inclusive/index.htm**)