



Management System Document – Guidance Note

Design and Installation of Low Level Cycle Signals

Document reference: SQA-0651 - Issue: Draft

1 Purpose

- 1.1 The purpose of this document is to provide guidance for the design and installation of Low Level Cycle Signals (LLCS) at traffic signal installations within the Greater London area.

2 Definition

- 2.1 A Low Level Cycle Signal (LLCS) is a signal head consisting of 100mm \pm 10% diameter red, amber and green cycle aspects to advise and control pedal cycles on the highway.
- 2.2 Low Level Cycle Signals conform to TSRGD 2015 Diagram XXXX.XX and have a similar meaning in law to conventional traffic signals.

3 Criteria

- 3.1 An LLCS may be utilised as follows: -
- 3.1.1 As a repeater, underneath TSRGD Diagram 3000 or 3000.2, to mimic the operation of vehicle signals mounted at a higher level and to provide a signal at cyclists' eye level;
- 3.1.2 As an early release, where the LLCS gains right of way before its associated vehicle signal;
- 3.1.3 As a primary signal, to control traffic exclusively made up of cyclists.

4 General Design Considerations

- 4.1 The Highway Act 1835 covered pedal cycles and therefore the design considerations outlined in SQA-0643 Section 3 apply unless otherwise stated.
- 4.2 A Low Level Cycle Signal (LLCS) must not be installed at a Pelican or near-side Toucan facility.
- 4.3 A primary LLCS may only be used in conjunction with a stopline.
- 4.4 The controller minimum cycle green period is 5 seconds.
- 4.6 A minimum horizontal clearance of 450mm must be provided between the edge of the carriageway and a LLCS (TD 50/04 Chapter 4). Where the LLCS is adjacent to a facility where the only vehicles are pedal cycles the minimum horizontal clearance may be reduced to 250mm.

- 4.7 LLCS must be installed with a minimum vertical clearance of 1200mm above a footway / cycle track (TSRGD 2015 Diagram XXXX.XX).
- 4.8 The mounting height of the LLCS amber aspect must not exceed 2000mm above a footway / cycle track (TSRGD 2015 Diagram XXXX.XX).
- 4.9 The recommended mounting height of the amber signal of a 3 aspect LLCS unit is 1500mm above a footway / cycle track.
- 4.10 A primary LLCS should be aligned at a 45° to the ASL or stop line. To avoid see through problems and other site specific conditions, a shallower angle may be considered for segregated tracks.
- 4.11 Where a secondary LLCS is installed, it shall be aligned to a point in the middle of the carriageway / cycle lane and 2m upstream of the stop line. A secondary LLCS shall be within a 30° offset of the middle of the lane.
- 4.12 The minimum distance between the LLCS primary signal pole and an ASL or cycle stop line shall be 1.2 metres.
- 4.13 Where a prohibited or exclusive vehicle movement is in operation a 100mm ±10% diameter regulatory box sign conforming to TSRGD 2015 Diagram 606, 612 or 613 shall be mounted under the green cycle aspect.
- 4.14 Only one box sign may be fitted to an LLCS signal and must be mounted underneath the green cycle aspect in a 4-in-line configuration.
- 4.15 If an LLCS is used in conjunction with a high level signal, the LLCS box sign must replicate information displayed by the high level regulatory box sign.
- 4.16 A cycle movement exemption shall be omitted from the LLCS.
- 4.17 The Designer should check with the Highway Authority that a TRO exists or is proposed for any box sign associated with the LLCS.
- 4.18 If no other high level equipment is present, it is recommended the LLCS is mounted upon a 3m wide based pole.
- 4.19 The individual aspects of an LLCS (including box sign) shall be monitored and failure of an aspect shall be logged as a lamp fault within the controller fault log.
- 4.20 Diagrams of LLCS installation options with their dimensions and clearances are given in Appendix A.

5 Red Lamp Monitoring Considerations

- 5.1 Where the LLCS is used as a repeater the red cycle aspect should not be configured as part of the red lamp monitoring of the crossing or junction.
- 5.2 When the LLCS is used to control cyclists separately from other road users: -
 - 5.2.1 Where one red LLCS aspect is installed on any approach, red lamp monitoring shall be configured such that its failure shall inhibit any pedestrian phases that conflict with the cycle phase.
 - 5.2.2 Where two red LLCS aspects are installed on any approach, red lamp monitoring shall be configured such that failure of both red LLCS aspects shall inhibit any pedestrian phases that conflict with the cycle phase.

6 Use as Repeaters (see Appendix B for typical layouts)

- 6.1 LLCS are classed as Repeaters when utilised to mimic the sequence of an associated high level traffic signal. The LLCS must follow the sequence of its corresponding high level traffic signal exactly. When used in this context, the LLCS provides additional information at cyclists' eye level but confer no other advantages.
- 6.2 LLCS can be used as Repeaters of high level traffic signals at signalised junctions and crossings where:-
 - 6.2.1 the high level signal is of the type shown in TSRGD Diagram 3000 or 3000.2 **and either;**
 - 6.2.2 there are no signalised pedestrian facilities **or;**
 - 6.2.3 the pedestrian signals are of the type shown in TSRGD Diagram 4002.1 (with or without PCaTS) or 4003.5.
- 6.3 It is recommended that if LLCS are used as Repeaters, the highway layout includes an ASL or reservoir (unless the Repeater is used with TSRGD Diagram 3000.2).
- 6.4 LLCS shall not be installed as Repeaters where the associated high level signal includes an indicative green arrow or a filter.
- 6.5 LLCS may be installed as Repeaters where the associated high level traffic green aspect is a green arrow supported by a regulatory box sign.

7 Low Level Cycle Signals for Segregated Cycle Tracks (see Appendix C for typical layouts)

7.1 LLCS may be used as an alternative to a high level signal conforming to TSRGD diagram 3000.2 for the control of vehicular traffic consisting solely of pedal cycles.

7.2 Segregated Cycle Tracks

7.2.1 Each lane of the cycle track shall have a clear vision of at least one LLCS associated with its particular movement. For cyclists the Stopping Sight Distance value (SSD) is defined as the distance for a rider to perceive, react and stop safely in adverse conditions. Table 1 contains desirable SSD values.

TYPE OF CYCLE ROUTE	MINIMUM STOPPING SIGHT DISTANCE (METRES)
Commuter Route	25
Local Access Route	15

Table 1 – Desirable Stopping Sight Distances (LTN 2/08)

7.2.2 Commuter route values should be used for all Cycle Superhighway and TLRN cycle tracks.

7.2.3 Site specific factors (e.g. gradient, surface quality) may increase the SSD and should be taken into account.

7.2.4 The historical highway layout may mean it is not possible to achieve the full SSD. Where the approach does not meet the SSD, the Designer shall identify the available stopping sight distance and propose the most appropriate signals layout, to maximise the available visibility distance.

7.3 Parallel Cycle Crossings

7.3.1 When pedestrian and cycle routes meet to cross a road, a parallel crossing may be appropriate.

7.3.2 Further advice on the use of Parallel Cycle crossings can be found in SQA-643 *Design for Signalised Junctions* Chapter 5.2.

- 8 Low Level Cycle Signals for Early Release (non segregated traffic/cycle facilities)** *(see Appendix D for typical layouts)*
- 8.1 An LLCS can be used to implement a cycle early release facility whereby cyclists are permitted to establish themselves within a junction ahead of motorised traffic.
- 8.2 The cycle early release facility can be either an ASL or a Cycle reservoir. Cycle reservoir comprises of two separately signalled stoplines with high level vehicle signals at the first stopline and LLCS at the second stopline. In the future cyclists will be allowed to cross the first vehicle stopline line when a high level traffic signal is displaying a red signal. (This is not permitted under TSRGD2002 and requires legislative amendment before it can be installed on street)
- 8.3 The depth of the ASL can be upto 7.5m. Currently, a 7.5m ASL has been given DfT authorisation only on the TLRN and roads designated as Cycle Superhighways; use of ASLs above 5m depth on other road types require DfT authorisation.
- 8.4 The recommended depth of the Cycle reservoir is 7.5m.
- 8.5 Secondary high level signals should be sited such that they may be viewed clearly by cyclists, to observe when general traffic has been given right of way.
- 8.6 On a single lane approach or where a 2 Stage Right Turn is present, the LLCS should be installed on the nearside signal pole only.
- 8.7 ASL cycle logo and stopline shall match TSRGD 2015 Diagram 1001.2A.
- 8.8 Cycle reservoir markings shall match TSRGD 2015 Table 69 Item 47.
- 8.9 To enable unimpeded access into ASL or Cycle reservoir a mandatory cycle lead in lane of minimum width of 1.5 metres should be considered. Alternatively cyclists may approach via a segregated facility that is re-integrated into the carriageway on the approach to the junction.
- 8.10 Diagram 1 illustrates the signal sequence for a two stage junction. Phase A is the traffic phase; phase B is the LLCS; and phase C is an opposing traffic phase.



Diagram 1 – Sequence for Early Release

8.11 The minimum early release for cyclists is 3 seconds and the recommended early release period for cyclists is 4 seconds. Early release period longer than 5 seconds requires sign-off by the TI Design Manager, Chief Engineer or Head of the Department.

9 Low Level Cycle Signals for Early Release with segregation on the approach (see Appendix E for typical layout)

9.1 This is an alternative highway layout using physical segregation and a separately controlled entry point. The sequence is similar to a bus gate with cyclists given operational priority into the empty reservoir.

9.2 The two sets of signals shall be linked and configured as one junction (stream) in the controller.

9.3 Due to see through issues, the recommended minimum separation between the two stoplines is 15 metres.

9.4 Reservoir early release LLCS offers cyclists additional priority over other traffic.

9.5 The offset between signals is site specific with Early Release value as per paragraph 8.11.

9.6 Diagram 2 illustrates the signal sequence for the three stoplines. Phases A and B are at the gate; phase A is traffic and phase B is the segregated LLCS facility. Phases C, D and E are at the reservoir; phase C is traffic; phase D is the LLCS; and phase E is an opposing traffic movement.

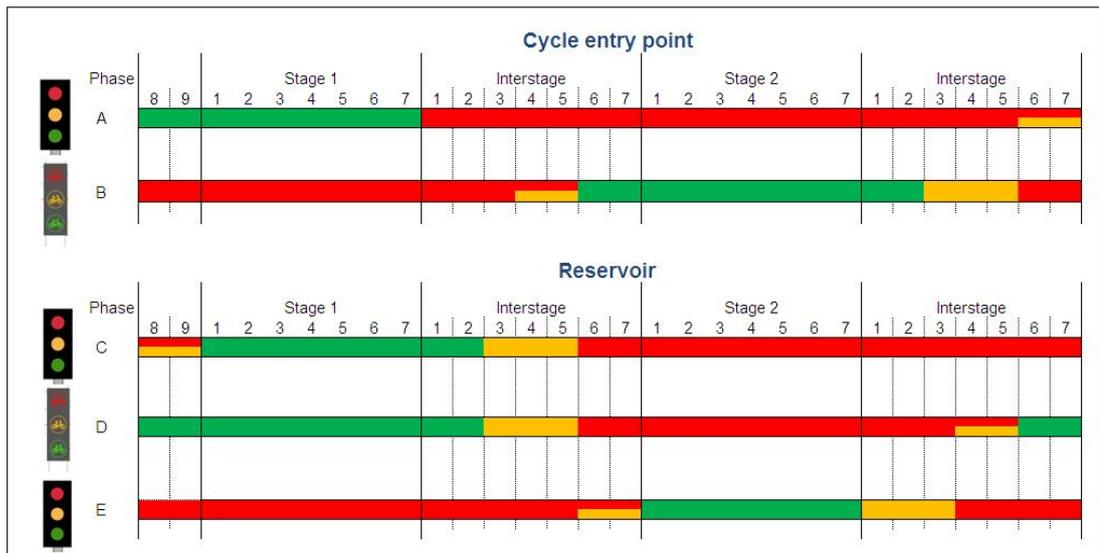


Diagram 2 – Sequence for early release with segregation on the approach

10 2 Stage Right Turn Facility with Early Release (see Appendix F for typical layouts)

- 10.1 2 Stage Right Turn (2SRT) facility relies on the waiting cyclist to either receive the next or subsequent green signal. A simple method of control is required where the maximum number of operational stages should not exceed four.
- 10.2 Contingency and alternative staging sequence affects 2SRT compliance and should be avoided. Please seek guidance from TI Assurance team when incorporating additional stages.
- 10.3 2SRT static signs must be included in the design. The location and sign face detail shall be shown on the PROposed traffic signals layout.
- 10.4 2SRT waiting area shall be designed to take into account turning vehicles swept paths and patronage. Islands offer physical protection and should be considered by the Scheme Designer. LTN2/08 specifies typical bicycle as 1800 mm long and 650 mm wide.
- 10.5 Intergreen calculations must take into account cyclists waiting in the 2SRT area. The current approach without the 2SRT pocket considers the extra distance travelled between conflicting traffic stoplines to the probable collision point D, see Diagram 3. From TAL1/06 Part 4, the extra distance travelled is the difference between points AD and BD. When considering cyclists position, the 2SRT markings should be used to measure the extra distance travelled, the difference between points AD and CD.

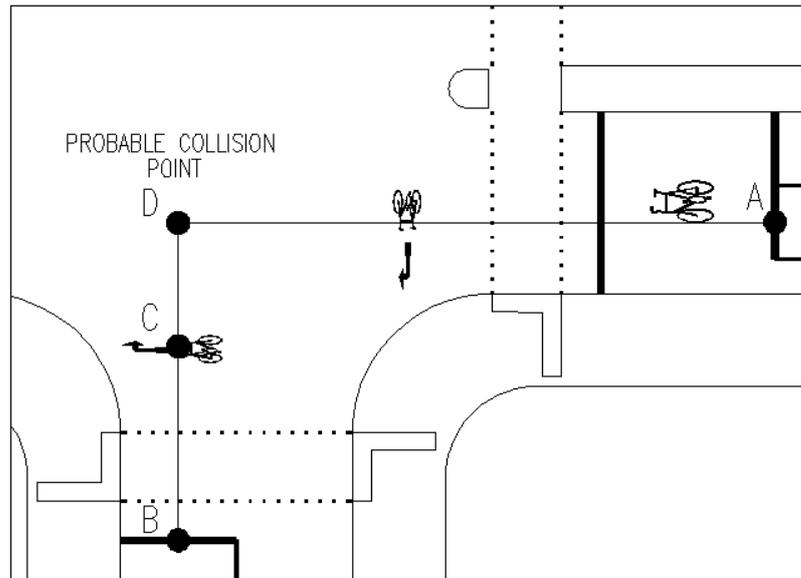


Diagram 3 – Example of 2SRT conflict point

- 10.6 Scheme Designer shall consider the cyclists route and turning circle when designing the 2SRT waiting area. LTN2/08 specifies the minimum turning radius of 1.65m for a conventional bicycle, dynamic cyclist width of 1.0 metre and a minimum 0.5 metre clearance to kerb over 50mm. Taking the three values into account, the recommended minimum cycle turning radius should be 2.65m. Diagram 4 illustrates probable route and a minimum radius consideration.

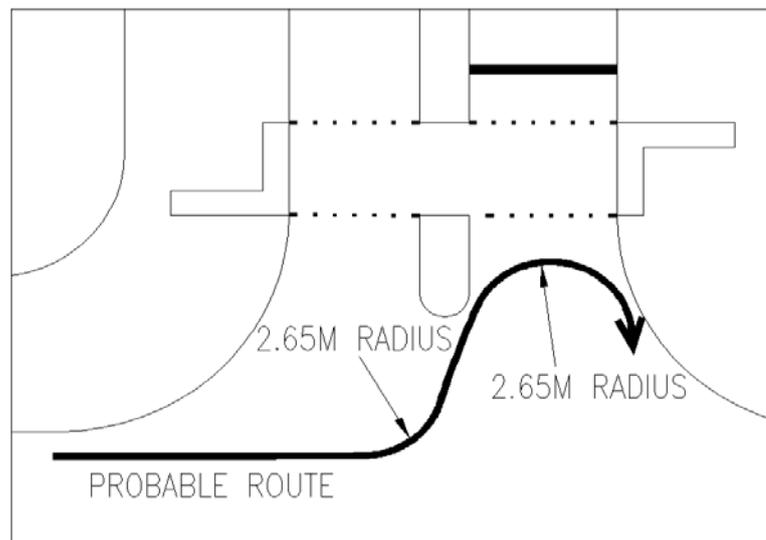


Diagram 4 – Turning radius consideration

- 10.7 Left turn filter signals are not permitted. Please seek guidance from TI Assurance team when considering ahead filter or indicative arrow operation.
- 10.8 Cyclists using the 2SRT facility shall have a clear view of the farsided secondary.

- 10.9 If an LLCS early release signal is fitted, the 2SRT early release signal shall be installed on a farsided secondary featuring a 200mm green cycle aspect mounted either to the left or in a 4-in-line configuration.
- 10.10 The 2SRT early release signal must start at the same time as the early release green LLCS aspect and terminate once the associated traffic phase gains right of way.
- 10.11 Diagram 5 illustrates the signal sequence for a two stage junction. Phase A is the traffic phase; phase B is the 2SRT 200mm cycle green; phase C is the LLCS; and phase D is an opposing traffic phase.



Diagram 5 – Sequence for 2SRT

- 10.12 2SRT early release duration shall match early release period defined in paragraph 8.11.

11 References

Construction (Design and Management) Regulations 2007 (CDM 2007)
Design Manual for Roads and Bridges (DMRB)
Disabled Persons Act 1981
Greater London Authority Act 1999
Inclusive Mobility: A Guide to Best Practice on Access to Pedestrian and Transport Infrastructure (DfT 2002)
London Cycling Design Standards
LTN 1/86 Cyclists at Road Crossings and Junctions
LTN 1/98 The Installation of Traffic Signals and Associated Equipment
LTN 2/95 The Design of Pedestrian Crossings
LTN 2/08 Cycle Infrastructure Design
Signing the Way (DfT Traffic Signs Policy Paper October 2011)
TA 68/96 The Assessment and Design of Pedestrian Crossings
TA 90/05 The Geometric Design of Pedestrian, Cycle and Equestrian Routes
TA 91/05 Provision for Non-Motorised Users
TA 12/07 Traffic Signals on High Speed Roads
TAL 1/06 General Principles of Traffic Control by Light Signals
TAL 1/12 The Traffic Signs (Amendment) (No.2) Regulations and General Directions 2011
TD 50/04 The Geometric Layout of Signal-Controlled Junctions and Signalised Roundabouts
The Traffic Signs Regulations and General Directions 1994 (TSRGD 1994)
The Traffic Signs Regulations and General Directions 2002 (TSRGD 2002)
TfL Signal Design Memorandum – No.002 ASL to Stud Distances on Cycle Routes
TfL Signal Design Memorandum – No.003 Monitoring of Box Signs
References (continued)
TfL Streetscape Guidance 2009: A Guide to Better London Streets
TR2206 Issue A: Specification for Road Traffic Signals
TR2500 Issue A: Specification for Traffic Signal Controller
TR2505 Issue A: Performance Specification for Above Ground Vehicle Detector Systems for use at Permanent Traffic Signal Installations
TR2508 Issue A: Performance Specification for Tactile Equipment for use at Pedestrian Crossings
TR2509 Issue A: Performance Specification for Audible Equipment for use at Pedestrian Crossings
TR2513A Performance Specification for Wig Wag Signal Control Equipment
TR2523 Issue A: Traffic Control Equipment and Interfacing Specification
Traffic Signs Manual Chapter 3, Regulatory Signs
Traffic Signs Manual Chapter 5, Road Markings

12 Structure

The documents listed below form a set of guidance and procedures for the design of traffic signals and signal junctions in London.

SQA-0640	Policy, Standards and Guidance to Procedures for the Design of Traffic Signals
SQA-0641	High Level Process for the Design of Traffic Signals
SQA-0642	Client Requirements
SQA-0643	Design for Signalised Junctions
SQA-0644	Design for Stand Alone Crossings
SQA-0645	Traffic Signal Timings
SQA-0646	Safety Auditing of Signal Schemes
SQA-0647	Justification for Traffic Signals
SQA-0648	Documentation for the Design File
SQA-0651	Design for Low Level Cycle Signals

11 Document Control

Issue	Date	Change Summary	Author	Checker	Approver
1	July 14	Draft	F Lockett/ J Pulker/ P Czachowski		

Appendix A – Low Level Cycle Signal head arrangements, mounting heights and minimum clearances

3-ASPECT LOW LEVEL CYCLE SIGNAL

3-ASPECT LOW LEVEL CYCLE SIGNAL WITH REGULATORY SIGN UNIT

3-ASPECT LOW LEVEL CYCLE SIGNAL WITH HIGH LEVEL 200MM SIGNAL

3-ASPECT LOW LEVEL CYCLE SIGNAL WITH REGULATORY SIGN UNIT AND HIGH LEVEL 200MM SIGNAL

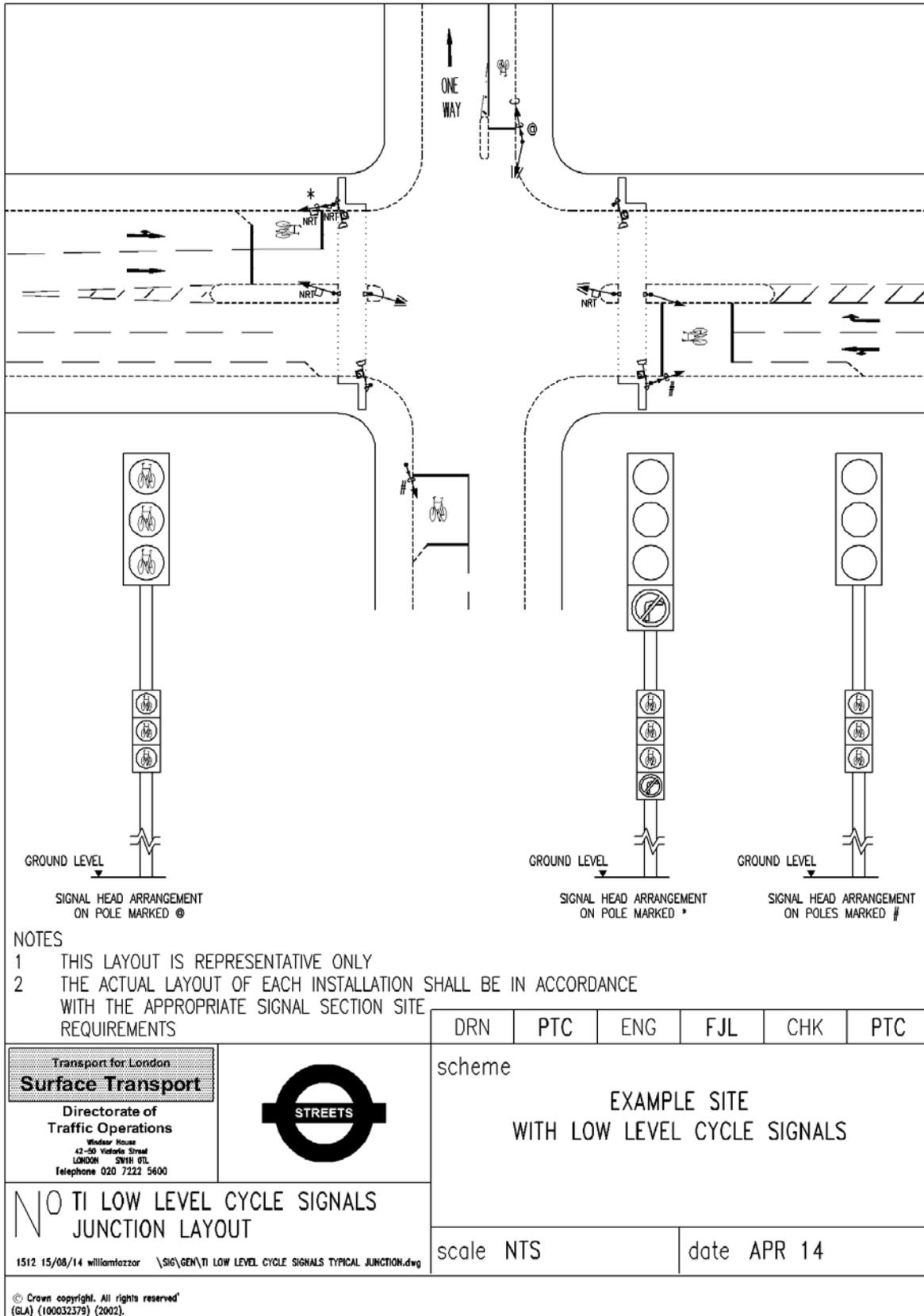
3-ASPECT LOW LEVEL CYCLE SIGNAL AND HIGH LEVEL 200MM SIGNAL WITH REGULATORY SIGN UNIT AND SIDE MOUNTED CYCLE EXCEPTION

NOTES
1 ALL DIMENSIONS ARE IN MILLIMETRES

DRN	PTC	ENG	FJL	CHK	PTC
scheme					
LOW LEVEL CYCLE SIGNALS MOUNTING HEIGHT AND MINIMUM CLEARANCE DIMENSIONS					
NO SIG/GEN/SIGCYC DIM1			scale NTS		date APR 14
1615 15/08/14 williamtozzar \SIG\GEN\SIGCYC DIM 1					

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Appendix B – Example Layout using LLCS as a Repeater



Appendix C – Example Layouts using LLCS for Segregated Cycle Only Facilities

SINGLE LANE

WIDE APPROACH

SEPARATELY SIGNALLED MOVEMENTS

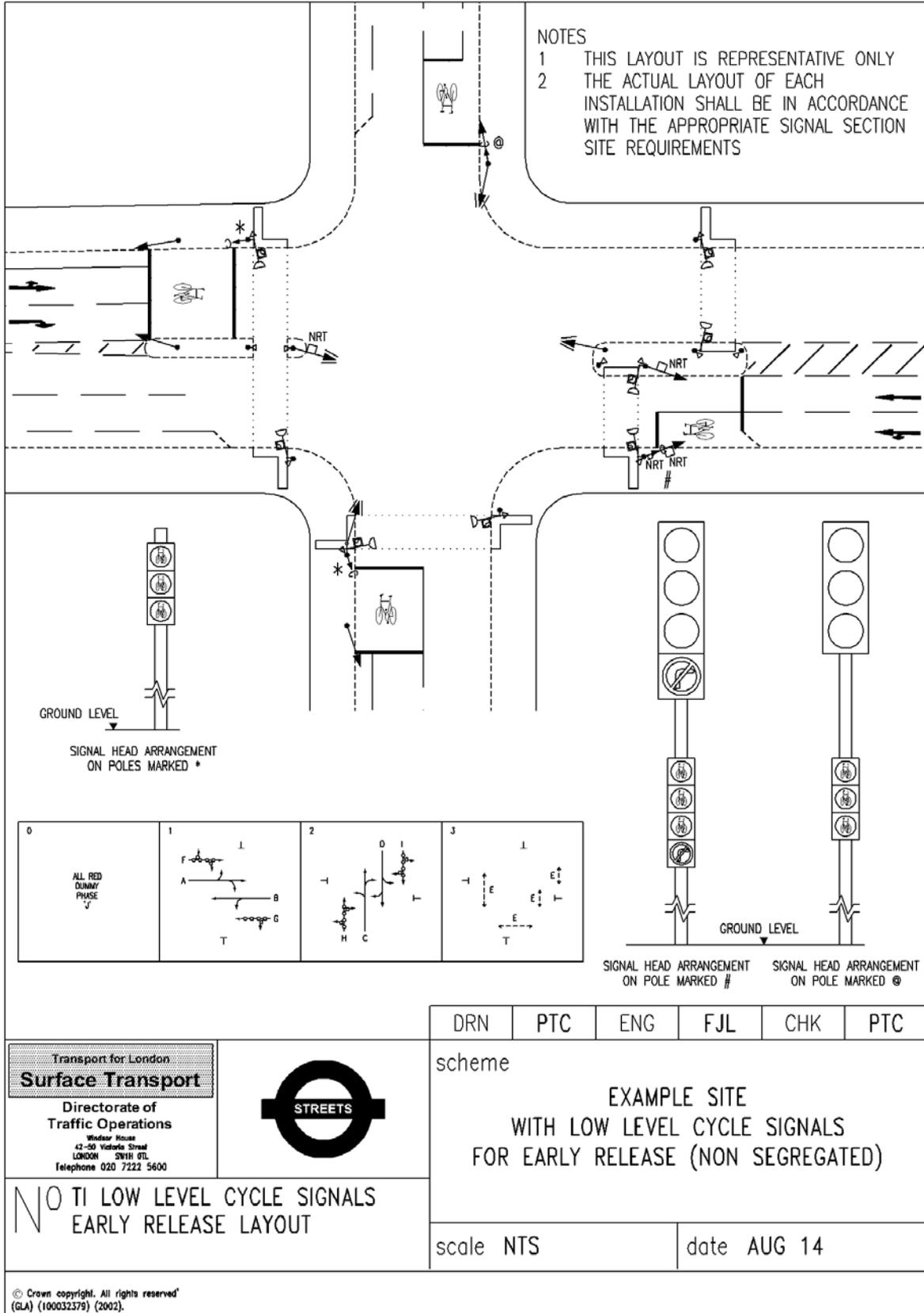
SEPARATELY SIGNALLED (SHARED STOPLINE)

NOTES

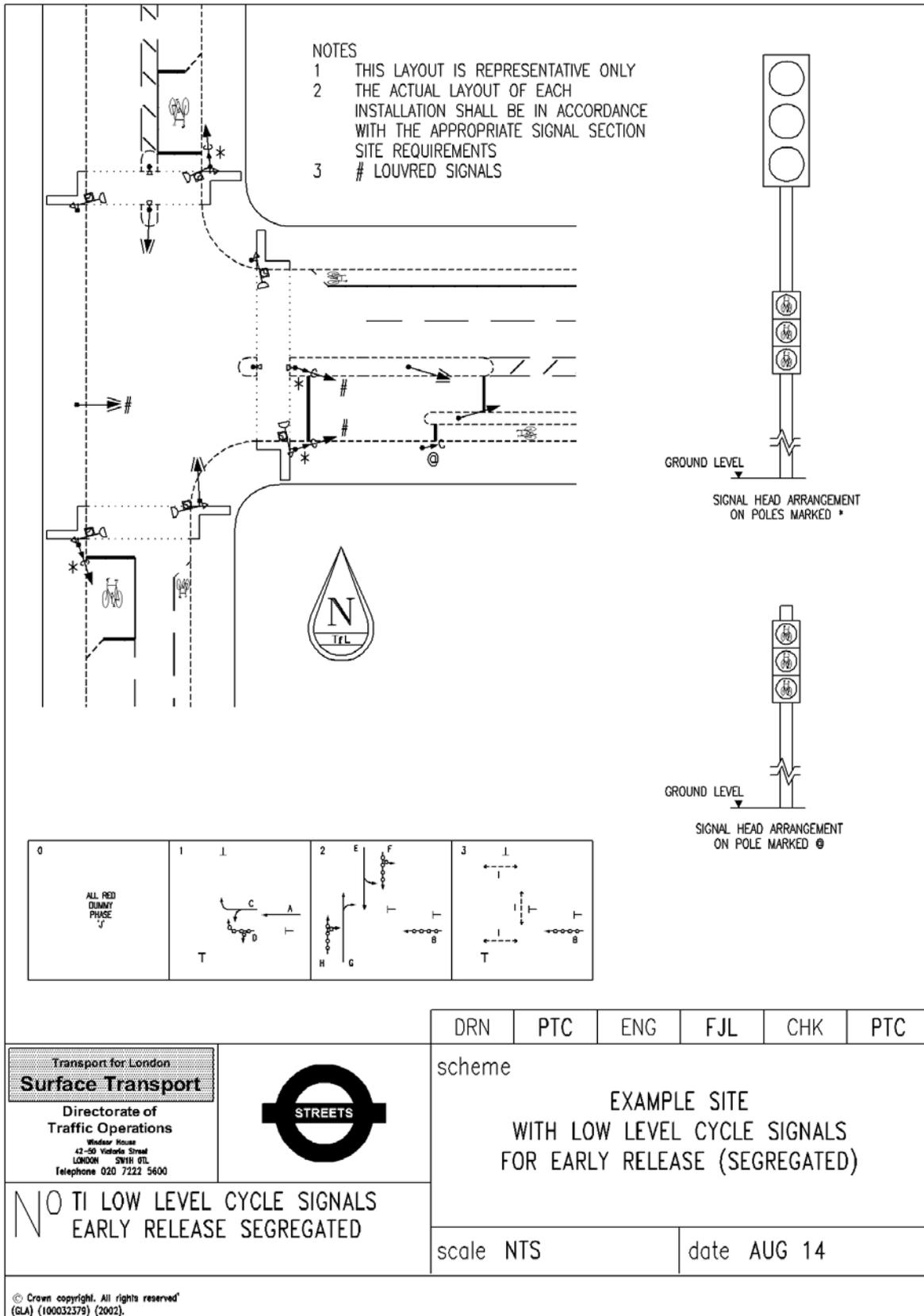
- 1 THESE LAYOUTS ARE REPRESENTATIVE ONLY
- 2 THE ACTUAL LAYOUT OF EACH INSTALLATION SHALL BE IN ACCORDANCE WITH THE APPROPRIATE SIGNAL SECTION SITE REQUIREMENTS

	DRN	PTC	ENG	FJL	CHK	PTC
<p>Transport for London Surface Transport Directorate of Traffic Operations Windsor House 42-50 Victoria Street LONDON SW1H 0TL Telephone 020 7222 5600</p>	<p>STREETS</p>					
<p>NO GEN/SIG/SIGCYC 1</p>	<p>scheme</p> <p>EXAMPLE LLCS CYCLE TRACK LAYOUTS</p> <p>TRAFFIC SIGNALS LAYOUT</p>					
<p>1622 15/08/14 williamtazzar //SIG/GEN/SIGCYC 1</p>	<p>scale NTS</p>			<p>date APR 14</p>		
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Appendix D – Example Layout using LLCS for Early Release (non segregated traffic/cycle facilities)



Appendix E – Example Layout using LLCS for Early Release with segregated cycle facilities (cycle gate) on eastern approach



Appendix F – Example Layout of 2 Stage Right Turn Facility

