LINCOLNSHIRE COUNTY COUNCIL

TRAFFIC SIGNALS DESIGN GUIDE




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1 DESIGN GUIDE OBJECTIVES

Introduction

The purpose of this document is to promote consistently high standards of safety and workmanship for the installation of new traffic signal equipment in Lincolnshire.

This guide covers the design, installation and commissioning of traffic control systems and will apply to all new installations as well as modifications to existing junctions and crossings.

This document states the procedures and design standards that are operated by Lincolnshire County Council. In addition, it covers the most commonly encountered design and construction related decisions when installing traffic signal equipment in Lincolnshire.

This document is provided to assist all those involved in planning, designing and building new traffic signal installations to be maintained and/or financed by Lincolnshire County Council.

Traffic signal equipment includes the following types of installation:

- Traffic signal controlled junction
- Puffin pedestrian crossing
- Toucan pedestrian crossing (pedestrians and cycles)
- Pegasus crossing (pedestrians and horses)

Traffic Signals in Lincolnshire

The successful design, construction and operation of traffic signal installations require a high level of project management, co-ordination and attention to detail.

The installation work is of a highly specialist nature and the work on site is only part of the project delivery process.

Traffic signals in Lincolnshire are all linked into management and communication systems that are operated to maximise efficiency and safety of operations and to constantly monitor installations for faults.

As part of the improvement of traffic signal control technology, advances are made and new alternative traffic control solutions become available. The County Council relies heavily on its own specialist trained staff and those of the traffic signal companies to recommend and provide appropriate traffic signal solutions on the highway network. Every effort will be made to keep this guide up to date.

Guidelines and Standards

Traffic signal design will be carried out in accordance with National Standards with particular reference to the Highways Agency document TA 101.

This document provides guidance on the Lincolnshire County Council requirements when national design guides and national standards allow a range of design solutions.

The requirements contained in this document do not contradict national design guidance and standards and are provided to assist the design decision process.

Procurement

All traffic signal installations in Lincolnshire are designed in-house and procured through the Lincolnshire County Council traffic signal term contract. This is to ensure that traffic signal equipment is compatible with Lincolnshire County Council traffic signal control systems and can be maintained by the term contractor.

The County Council provides an engineering design, tender and site supervision service for the civil engineering elements of traffic signals installation projects.

The specification contained in the latest version of the County Council's Model Contract document (Framework for Highway Works) must be used when procuring the civil engineering elements of a proposed traffic signal installation.

2 HEALTH AND SAFETY

Competency in Design, Construction and Maintenance

All personnel working on Lincolnshire County Council traffic signal systems shall be accredited to the appropriate level of Sector 8 and shall be fully aware of and comply with all relevant Health and Safety legislation.

Safety Audits

All traffic signal projects that require alteration to line or level of the highway are subject to a Safety Audit. The Safety Audit procedure is described in the Lincolnshire County Council Highways and Transportation Guidance Note HAT 62-2-19.

Safety in the Design and Construction Process

Traffic signal installations are designed and implemented in full compliance with the Construction Design and Management Regulations. All installations shall be designed to ensure they can be constructed and maintained safely as required by the regulations.

The following are important safety issues that shall be checked during the design process:

- Checking potential vehicle/pedestrian conflicts and clearance timings
- Assessment of traffic approach speeds and appropriate measures to be taken
- Approach visibility of signal heads
- Inter visibility at the installation and potential of signal see through
- Maintenance considerations (e.g. height of equipment, proximity to traffic and other hazards, maintenance vehicle parking area, controller location and access)
- Passively safe street furniture
- Consideration of vulnerable road users

Traffic Signal Maintenance

As required by Health and Safety regulations, traffic signals are operated and maintained subject to a safe system of work. This requires that health and safety issues are addressed in planning and executing maintenance work. Risk assessments are prepared and adhered to at all times.

3 DESIGN CRITERIA

Traffic signal design work for installations in Lincolnshire must only be carried out by personnel for whom competence in traffic signal design can be demonstrated (e.g. appropriate professional qualification).

The general principles to be followed in the design process are outlined in Highways Agency Document TD 101. These principles include:

- All electrical work must comply with The Electricity at Work Legislation and the IET Wiring regulations
- Compliance with the Traffic Signs Regulations and General Directions and the DfT Traffic Signs Manual
- Investigation and approval of scheme justification in terms of benefits (e.g. safety, accessibility, journey time/congestion reduction, reduced maintenance costs)
- Site assessment and compatibility with adjacent installations
- Control and detection strategy
- Reserve capacity assessment
- Assessment of maintenance and inspection requirements
- Use of TOPAS accredited equipment
- Consideration of vulnerable road users
- Interaction with public transport
- Remote monitoring and control facilities
- Requirement for passive safety equipment

The Designer shall refer to the DfT document TAL 1/06 General Principles of Traffic Control by Light Signals (or superseding documentation) and all documents referred to in this DfT advisory leaflet. This document is not necessarily exhaustive and any additional design considerations specific to the proposed installation must be checked by the designer as part of the design process.

The Designer shall refer to and abide by all the Lincolnshire County Council requirements stated in this document. Any departures from these standards shall have the Approval of the Principal Engineer (Traffic Signals) and shall be recorded as part of the design process in accordance with the Lincolnshire County Council departure from standards policy.

4 TRAFFIC SIGNAL DESIGN PRINCIPLES

The Principal Engineer (Traffic Signals) shall be consulted at an early stage on highway design proposals that could require the use of traffic signal control.

The use of traffic signal control shall be determined as a result of a comprehensive options appraisal that determines the best method of traffic control within agreed safety and capacity criteria.

Traffic signal designs are carried out in accordance with a relevant Quality Management System (e.g. the Lincolnshire CC Highways Quality System).

A design brief shall be agreed with the Principal Engineer (Traffic Signals) and shall address what type of facility is to be constructed (e.g. traffic signal junction, pedestrian/cycle facility) and what options are required to be included in the scheme (e.g. type of pedestrian facility, signal management strategy, vehicle detection systems, bus priority facilities etc.).

Investigations shall be carried out to ensure that the proposals are safe and will function without unacceptable delays to all users. The safe operation of installations is the highest priority, though the efficient movement of traffic is also a key consideration.

Risk assessments and safety audits will be carried out on all projects for new traffic signal installations.

Design calculations shall be based on up to date traffic count data.

The determination of land requirements and the method of traffic control shall not be finalised until the proposals have been modelled to fully consider the impact on the Highway Network and the layout has the approval of the Principal Engineer (Traffic Signals).

The approval of the Principal Engineer (Traffic Signals) at the following milestones in the design process:

a) Initial design/feasibility:

- Preliminary design drawings.
- Vehicle flow details. Both base and design flows shall be submitted.
- Design flows to be used
- Junction analysis calculations from Linsig and where applicable network modelling using Linsig. Inclusive of link diagrams and model data.
- Scheme justification/assessment and analysis of benefits.

b) Detailed design:

- Detailed design drawings
- Detailed installation specification (Contract Documentation)
- Controller specification(s)
- MOVA configuration data

- MOVA Speed results and proposed associated detector placement
- Inter-green calculations
- Puffin or Toucan timing schedule(s)

Drawings submitted for approval by the Principal Engineer (Traffic Signals) shall comply with the requirements of the Lincolnshire County Council Quality System and as a minimum shall contain the following information.

- Site location
- Existing and proposed layout
- Staging & phasing details
- Signal head/pole arrangements
- Cable ducting and chamber details
- Detection details
- Proposed carriageway markings

It is a requirement of the County Council that all proposed traffic signal installations are submitted to the Lincolnshire Road Safety Partnership for safety auditing. When a proposal is submitted for approval, it must be accompanied by a copy of the appropriate Road Safety Audit report(s).

The design engineer's response to any recommendations detailed in the Road Safety Audit report shall accompany the submission accordingly.

5 TRAFFIC SIGNAL MODELLING

The modelling required for a proposed traffic signal installation will depend on the type of installation and its location on the highway network. The scope and detail of the modelling work required must be agreed with the Principal Engineer (Traffic Signals).

In advance of detailed design work, it is beneficial and more efficient to carry out initial investigations to identify the main capacity and operational issues with existing or proposed junction layouts. This will show locations of potential congestion, potential lane blocking and the need for additional lanes or investigation of alternative layouts.

Lincolnshire County Council will only accept modelling outputs from the latest version of Linsig and these must be in the form of electronic files.

When carrying out Linsig modelling the following critical parameters must be agreed with the Principal Engineer (Traffic Signals):

- Design year traffic flows (taking account of predicted traffic growth, additional traffic from known development, possible migration of traffic from other routes and latent demand from vehicle traffic and vulnerable road users).
- PCU value (check that the Linsig default of 5.75m is appropriate at the location).
- Saturation flow (check that the value used is appropriate for the location).
- Assessment of predicted traffic lane usage including correct modelling of lane blocking issues.
- Appropriate lane width (effective lane width usually measured 10m from the stop line).

For some locations the Principal Engineer (Traffic Signals) will determine that further network modelling is required. For example this could require network modelling using the Linsig.

In the larger urban areas of Lincolnshire traffic flows on the network are controlled using SCOOT/UTC. In this situation the modelling of a network needs to reflect as closely as possible how traffic signal timings under SCOOT/UTC control would optimise in response to live traffic flows.

6 SOURCE OF TRAFFIC SIGNAL DATA

The use of up to date and accurate traffic flow data is vital to the assessment of the operation of existing and proposed traffic signal installations.

The main sources of traffic data for use in the design process are:

- Recent site surveys – traffic flows, turning counts
- Accident statistics – last 5 year KSI
- Lincolnshire County Council approved Transport Model outputs
- Relevant SCOOT/UTC data from the Lincolnshire County Council system.
- Origin and Destination surveys

Prior to the commencement of design work, the designer must agree with the Principal Engineer (Traffic Signals) the source of traffic data to be used in the process.

In addition, agreement with the Principal Engineer (Traffic Signals) is required on the following factors relevant to the traffic data to be used in junction/network modelling:

- the appropriate design year
- rate of traffic growth
- future development traffic
- inclusion of relevant future highway network alterations

7 METHOD OF TRAFFIC CONTROL

The method(s) of control for any proposed traffic signal installation shall be determined by the Principal Engineer (Traffic Signals). The method used shall take into account:

- Current standards and requirements
- The current method of control applied to adjacent installations
- Proposed method of control at adjacent installations
- Current and proposed Intelligent Transport System (ITS) initiatives.

The method(s) of control that may be applied to a proposed installation will usually consist of a combination of methods applied in a priority sequence. The priority sequence shall be dependent upon the expected control methodology to be used.

Either all or a selection of the following method(s) may be applied at an installation. The County Council's Principal Engineer (Traffic Signals) will advise accordingly:

- SCOOT / UTC control
- Microprocessor Optimised Vehicle Actuation (MOVA)
- Vehicle Actuation (V/A)
- Fixed Time Operation (FT)
- Local Linking (LL)
- Cable-less Linking Facility (CLF)
- Part Time Operation (PT)
- Manual control

At installations not under SCOOT/UTC control the primary mode will be MOVA operation.

8 TRAFFIC SIGNAL MONITORING AND CONTROL

All traffic signal installations are linked by telecommunications to the Traffic Signal Control room in Lincoln. Electronic monitoring is used throughout all traffic signal installations in Lincolnshire to ensure safe and correct operation.

The traffic signals in the main urban areas of Lincolnshire operate under SCOOT/UTC control provided in the Siemens STRATOS system. This system uses live traffic data to optimise traffic flow across the urban networks. The system is operated by dedicated staff located at the Lincoln Traffic Signal Control room.

Traffic signal remote monitoring equipment is required at all installations not monitored by the Authority's SCOOT/UTC system.

The County Council's Principal Engineer (Traffic Signals) will advise the design engineer as to which form of monitoring and control will be adopted on a project by project basis. The decision will be based upon the current and intended strategic highway objectives of the Authority.

Urban Traffic Management Control (UTMC) and SCOOT Requirements

Lincolnshire County Council operates an Urban Traffic Management Control System and uses the SCOOT traffic control strategy to manage key installations on the highway network within the following areas:

- Boston
- Grantham
- Lincoln and North Hykeham

The current SCOOT/UTC system is the hosted Siemens STRATOS SCOOT/UTC system.

In conjunction with CCTV cameras, the system is used to manage traffic flows on key traffic routes in the main urban areas. It also forms part of the County Council's traffic signal maintenance service enabling traffic signal faults to be quickly identified and for accurate information to be provided to the maintenance term contractor.

It is the intention of the Authority to extend the SCOOT/UTC control strategy to other strategic locations throughout the County if and when required.

At an early point in the design of a proposed traffic signal project, it must be ascertained if Lincolnshire County Council wishes to operate the facility under SCOOT/UTC control. The Principal Engineer (Traffic Signals) shall determine if this method of control is to be provided.

If the proposed traffic signal facility is required to operate under the SCOOT/UTC control strategy, then it is likely that a more detailed analysis of the facility will be

required at the initial design stage (e.g. Linsig network analysis). The Authority will advise accordingly.

Monitored Installations

Remote monitoring equipment shall be compatible with the current monitoring system being operated by the County Council. Currently this is the Siemens STRATOS system and the Metron Remote Site Monitor. Siemens RMS is due to be de-commissioned by April 2020.

Control/Monitoring System Procurement

The design and procurement of the specialist systems equipment, system database updates, initial system set up, system validation, site validation and communication links will be carried out directly by the Lincolnshire County Council Highways Alliance Traffic Signal Engineers.

A purchase order will be required from the client to Lincolnshire County Council to cover the cost of designing, procuring, installing and validating the relevant monitoring and control equipment plus the procurement of a communication link.

The communication link will either be a cable broadband connection or mobile phone broadband connection.

All costs associated with the above works shall be recoverable from the client.

9 TRAFFIC SIGNAL OPERATIONAL REQUIREMENTS

Controller Type

All new traffic signal controllers shall be ELV type.

Only traffic signal controllers supplied via the Lincolnshire County Council Traffic Signal Term Contract may be used on the Lincolnshire Highway Network.

The type of controller to be used at an installation will depend on the facility to be provided and the latest approved type of controller available in the Term Contract.

A NAL controller base fitted with a utility access flap should generally be used unless there are site specific reasons not to.

High risk installations must be fitted with facilities to enable an Uninterrupted Power Supply (UPS) to be utilised, to give the site back-up power whilst the power supply can be restored; these sites should also be equipped with the means to connect a generator to provide electrical power during periods of prolonged loss of supply.

A high risk site will be determined by the Principal Engineer (Traffic Signals) based on an assessment of the installation including traffic flows, pedestrian flows, vehicle speeds and visibility. Details of the feeder pillar, sockets and switching requirements can be obtained from Principal Engineer (Traffic Signals).

Controller Parameters

Default settings to be used are as follows:

- Minimum intergreen to indicative arrows shall be 4 seconds
- All phases shall be set to oppose one another to ensure the start of maximum green timers
- Lowest maximum green time for indicative arrows shall be 12 seconds
- Call/cancel periods should be initially set to 3 seconds/2 seconds. (NB detector location requires careful consideration)
- V/A detector extension periods are normally set by detector type, with System D extensions set to 1.6 secs and MVDs, kerbsides and on-crossing detectors to 0.5 secs.
- DFM active/inactive settings shall normally be 30mins/n/a for push buttons, 60mins/48 hours for vehicle / on crossing detectors and 30mins/72 hours for kerbside detection.
- Where required, timings can be modified to suit specific site requirements with the approval of the Principal Engineer (Traffic Signals).

Method of Calculating Intergreens

Traffic to traffic intergreen calculations shall be carried out in accordance with the methodology described in TAL 1/06 (or superseding documentation).
The pedestrian to traffic intergreen shall be calculated as 2 seconds plus 1 second per 1.2 metres length of walk distance with a minimum intergreen of 5 seconds. This may be reduced by an allowance for vehicle journey time where the designer is satisfied this is appropriate.

These values shall be assessed and modified during the commissioning process. Any revised intergreens shall be included in an amended configuration.

Use of V/A Maximum Green Sets

The following V/A maximum green timings shall be provided for all new controllers based on up to date traffic counts and Linsig optimisations agreed with the Principal Engineer (Traffic Signals):

Max Set A = AM peak
Max Set B = Off peak day
Max Set C = PM peak
Max Set D = Off peak night

The need for additional max sets (e.g. for Saturday or Sunday periods or specific events) should be considered on a site per site basis.

Pedestrian and Cycle Friendly Timings for Puffin and Toucan crossings (Pre-timed Max)

For locations subject to 30 mph or lower speed limits and not under SCOOT/UTC control the Designer shall consider the suitability of using the following strategy:

- The maximum period to vehicles is to be set to start timing from the start of the traffic green stage rather than when the pedestrian demand is made.
- After the expiry of the maximum green to vehicles, the interval from receiving the pedestrian demand and the loss of the green signal to traffic is to be set to 5 seconds.
- The maximum green time to vehicles is dependent on site conditions. At free standing crossings it should normally be set at 30 seconds for installations operating a pre-timed max.

Pedestrian Phase Minimums

As a guide, these are calculated as follows:

Walk Distance < 12.5 metres = 6 seconds
Walk Distance 12.5 metres to 15 metres = 7 seconds

On shorter crossings of low volume, the green man time can be set to 5 seconds. The use of AGD 645 kerbside detection can also be used to provide a variable green man time based on pedestrian volume.

Pedestrian Black Out Periods

A 3 second black out period operates at existing far-sided crossing facilities.

All new near-sided pedestrian and cycles crossing facilities shall only have a black out period on indicator units mounted on the centre island of straight through crossings. The blackout period is set to 3.0 seconds.

The blackout period shall be set to allow pedestrians who start to cross at the end of the green man invitation period sufficient time to pass the centre island indicator before the red man is illuminated.

At installations which are to be modified, a mixture of near-sided and far-sided crossings points will not be permitted.

Puffin and Toucan Clearance Timings

The designer shall configure the consecutive method of operation.

Puffin crossings shall use the following timing parameters quoted in LTN 2/95:

Period 3 = 3 seconds
Period 5 = 3 seconds
Period 6 = 0-30 seconds
Period 7 and 8 = zero

Timings for periods 5 & 6 are to be consecutive.

SCOOT

UTC stages, SCOOT operation and SCOOT loop requirements shall be discussed and agreed with the Engineer responsible for the UTMC system at an early stage in the design process. This information shall be indicated on the design drawings.

Where possible, UTC stage replies shall be based on the phase which indicates the stage green time running. On more complicated configurations dummy phases may be required to return phase or stage replies. This information will be detailed on the Special Conditioning Sheet.

MOVA

Unless agreed otherwise with the Principal Engineer (Traffic Signals), free standing installations not operating under SCOOT shall operate under MOVA control. The installation shall normally be configured to use V/A as fall-back mode. This shall use the MOVA loops and additional stop line or above ground detection as required with appropriately increased extensions and intergreens.

Pole Referencing

All traffic signal poles at an installation shall be referenced with a number starting at "1" and continuing in an unbroken sequence clockwise from the controller (i.e 1, 2, 3 ……n where n = the total number of poles at the installation). These pole references shall be used to identify poles on drawings and cross referenced to the poles on site using black on yellow stickers. These stickers shall be located at the top of poles and be visible from the location of the traffic signal controller. The numbers shall be 75mm in height.

Primary and Secondary Signal Heads

All new signal heads shall be LED type.

Duplicate primary signal heads shall be provided at all new facilities with dual lane approaches. Duplicate primary signal heads shall only be required on single lane approaches if there are specific visibility or safety issues.

Additional high level traffic signal heads (up to 6.0m high and mounted on tall signal poles), shall be provided on high speed approaches and considered at locations with restricted approach visibility, gradients or a high number of vulnerable users and recorded accidents. Due to the difficulty of access and high cost of maintenance the mounting of high level signals on mast arms and above lane gantries shall be avoided if at all possible.

Primary hoods shall be fitted to closely-associated secondary signal heads at locations without push button controlled crossing facilities.

Passively Safe Equipment

All proposed new traffic signal installations shall be the subject of a design risk assessment and passively safe equipment shall be used if this is recommended and if no other alternative measures can be taken. It is expected that the use of passively safe equipment will be used at sites with a high risk or a site history of vehicles leaving the carriageway. It is not expected that passively safe equipment will be required on roads with speed limits of 30mph or less.

Signal Head Backing Boards

The Designer shall consider the requirement to install backing boards and the type to be specified based on a site specific assessment.

Backing boards can be deleted in conservation areas and at other locations in well-lit 20/30 mph zones with good approach visibility and with a low number of vulnerable users and recorded accidents.

Reflective high visibility backing boards should be fitted at high speed installations, at rural installations with no or limited lighting or where they would assist in highlighting a hazard due to restricted approach visibility in the event of a loss of power.

Detection Equipment

Loops – should only be used where other methods are either inappropriate or inhibitive due to cost

Magnetometers – can only be specified by agreement of the Principal Engineer (Traffic Signals)

Above Ground Vehicle Detection – should be the default choice on roads with a speed limit of 30mph or less

Pedestrian detection – the use of kerbside and on-crossing detection should be reviewed on a site per site basis, and not installed by default.

Speed assessment/speed discrimination - MOVA control should be specified on all sites where SA/SDE is required, with intergreen times adjusted accordingly

Above Ground Detection and Stop Line Loops

Where staging and phasing allows, stop line loops and/or above ground detectors are to be used in preference to type D detection on all installations located on low speed roads (85 percentile speed < 35mph) unless site conditions prevent this.

Stop line loops should generally be 2m deep, offset 3.0m from the stop line, 0.4m from the kerb and 0.8m from the centre line. This should be altered to suit the approach on a site specific basis. Stop line detection should be considered on ALL approaches that have an above ground vehicle detector for both operational and maintenance reasons.

Above ground stop line detectors and any new detection solutions should be considered, particularly at locations which would require a road closure or diversion to install detector loops.

Call/Cancel Detection

Call/Cancel detectors should generally be located to detect the second vehicle waiting within the junction.

It may be advisable to install a second call/cancel detector just ahead of the stop line as part of the initial design at new larger junctions with free-flowing turning traffic where prior observations cannot be made.

Nearside Pedestrian/Cycle Signalling and On-crossing Detection

All new pedestrian push button and indicator units shall be LED type.

All new signalised crossing points at junctions, with a width greater than 6.0m, should use on crossing detection unless otherwise approved by the Principal Engineer (Traffic Signals). The decision not to provide this equipment should be noted as a departure from standards and be recorded in the design file accordingly.
The designer should assess the risk of the view of nearside indicators being blocked by high numbers of waiting pedestrians. Where this occurs, an additional high level repeater unit shall be used with either a combined push button and pedestrian indicator unit or separate units at the lower position depending on the pole type and achievable mounting heights.

Care should be taken when siting indicators on angled crossings or central islands to prevent see-through. Narrow field of view lenses should be used where this cannot be avoided.

Kerbside Detection

At junctions with pedestrian/cycle facilities, kerbside detection shall be considered at demand dependant crossings. The decision not to provide this equipment should be approved by the Principal Engineer (Traffic Signals) and the reason recorded in the design file.

Tactile Cones and Audible Indicators

If two push button units are provided at a crossing point, both shall be fitted with tactile cones but only one shall have an audible indicator.

Vulnerable Road Users

At all controlled pedestrian crossing facilities, the requirements for vulnerable users shall be adhered to (as appropriate) in accordance with the following guidance:

- Guidance on the use of tactile paving surfaces, DETR 1998
- The Design of Pedestrian Crossings, LTN 2/95
- Audible and Tactile Signals at Pelican Crossings, TAL 4/91
- Pedestrian Facilities at Signal - Controlled Junctions, TAL 5/05.
- Puffin Pedestrian Crossings, TAL 1/01.
- Installation of Puffin Pedestrian Crossings, TAL 1/02

The main adjustments included in new traffic signal installations are:

- No kerb check at pedestrian crossing points to assist wheel chair users
- Tactile paving at pedestrian crossing points to assist the blind and partially sighted
- Tactile, rotating cones used in pedestrian crossing push button units to assist the deaf or hard of hearing
- Advanced stop lines and low level cycle aspects to assist cyclists
- Remote button devices (e.g. Neatebox)

It will not be appropriate in every circumstance for audible signals to be provided due to the chosen staging arrangement, the existence of uncontrolled crossing points at the installation or the close proximity of other signals installations.

For each junction or crossing facility the Designer shall make an assessment considering the above guidance.

Any departures from the above guidance must be approved by the Principal Engineer (Traffic Signals) and the reasons recorded in the design file.

Bus Priority

The R2P Bus AVL system has an automated link to the Siemens UTMC system and as such can be used to automatically send bus priority requests for late running buses. Although this is primarily aimed at those sites operating under SCOOT, the facility exists to implement this on sites that are running under other forms of control. The Senior Engineer (Operations) should be consulted during the design stage when considering bus priority at any new site, as to the type and format that any priority should take.

Service Connections

All service connections for traffic signal installations will be determined and procured by the Lincolnshire County Council Highway Alliance Traffic Signal Engineers. Costs will be recharged to the works promoter.

A purchase order will be required to Lincolnshire County Council from the client to cover the cost of procuring, installing and validating all service connections.

Type of Communications Connection for SCOOT/UTC

The following types of telecommunications for traffic signal installations are operated by Lincolnshire County Council:

Cable Broadband – preferred option ordered via BT
Mobile Broadband – Where a cabled option is temporarily unobtainable
Wireless communications – should be considered for sites in close proximity that can utilise a single ADSL connection.

All communication links shall be terminated in the controller cabinet / NAL base.

Type of Electrical Supply (metered/unmetered)

The electricity supply will be procured by Lincolnshire County Council and the associated costs shall be recharged to the works promoter.

The electricity supply shall be an unmetered 230v 50Hz AC single phase supply will be provided in a separate supply pillar in accordance with the County Council's typical detail drawings.

ELEXON Codes

All traffic signal equipment installed in Lincolnshire connected to unmetered electricity supplies must have an accurate and up to date ELEXON charge code and related switch regime. An accurate and up to date traffic signal inventory is maintained and is essential for accurate billing of electricity charges by the relevant electricity operator.

10 HIGHWAY ENGINEERING REQUIREMENTS

Street Lighting

As part of the design process Street Lighting illumination levels shall be checked and improved if necessary for all new and modified traffic signal installations. The street lighting requirements shall be determined by the Principal Engineer (Street Lighting).

Critical Dimensions

It is very important for the safe operation of the junction and requirements of vulnerable users that the critical dimensions shown on design and typical detail drawings are adhered to.

The following are critical items that need to be correctly located relative to each other:

- Stop Line
- Primary signal pole(s)
- Flush Dropped kerbs
- Tactile paving
- Crossing studs

Pole Position, Stop line and Crossing Stud Offsets

A minimum of **450mm** clearance between kerb face and traffic signal equipment mounted on poles shall be provided.

The positioning of the traffic signal poles and stop lines is **critical** to the safe functioning of the installation. The following requirements must be adhered to:

- Straight pole = 700mm from kerb
- Cranked pole = 500mm from kerb
- Stub pole = 500 or 700mm from kerb to match the above
- Stop line = 2.5m from pole(s)
- Crossing studs = 0.5m from pole(s)

Where footway, verge and island widths allow, straight poles shall be used. Installations with footways less than 1.8 metres should be avoided. Narrow footways require careful consideration and the option to use cranked poles or poles sited at the back of the footway should be considered along with the use of extension brackets.

Visibility, clearance, maintenance requirements and siting restrictions due to private property must be considered by the designer.

All poles shall be installed using an appropriate NAL socket with integral ducting connections.

In central reservations or locations with maintenance access issues the use of wide based, low access or hinged poles should be considered.

Minimum Crossing and Footpath Widths

The standard width of Puffin crossings shall be 3.0m with an absolute minimum of 2.4m.

The standard width of Toucan crossings shall be 4.0m with an absolute minimum of 3m.

At locations with high pedestrian flows and where site constraints allow, crossings of greater width should be considered.

The minimum footpath width to ensure adequate space for pedestrians and space to locate traffic signal equipment and guard rail is 2.5m. At Toucan crossing facilities this is 3.0m.

The standard minimum island width at staggered pedestrian facilities is 3.0m. At Toucan crossing facilities this is 4.0m. This may be reduced to 3.0m if site constraints exist.

Any deviation from the standard dimensions stated above must be approved by the Principal Engineer (Traffic Signals) and be noted in the design file by the Designer.

Cored Crossing Studs

100mm dia. cored white thermoplastic crossing studs at 500mm centres shall be installed at all new pedestrian and cycle controlled crossing facilities.

Offset Pedestrian/Cycle Crossings Facilities

The offset should be arranged so that pedestrians walk along the island facing oncoming vehicles unless approved by the Principal Engineer (Traffic Signals).

Minimum width between guard rails for pedestrian only crossings is 2m.

Minimum width between guard rails for Toucan crossings is 3m but this may be reduced to 2m if site constraints exist.

Minimum offset between crossings is 3m but this may be reduced to 2m if site constraints exist.

Duct Design

All traffic signal installations shall be provided with a continuous system of ducting provided with draw pits and draw cords connecting all traffic signal equipment.

At junctions a continuous ring of ducting shall be provided to and from the controller. This is to facilitate resilience in the event of future cable damage or cable upgrades.

Ducts shall be smooth bored corrugated, 100mm dia., orange, with draw cord installed and have permanent markings reading “Traffic Signals” on the outside at 1 to 2m intervals.

The number of ducts required is a function of the amount and types of cable to be accommodated and the detection system(s) to be used. This must be determined and agreed with the Traffic Signals Term Contractor as part of the design process.

Signal Equipment on Street Lighting Columns

Traffic signal equipment shall not normally be mounted on street lighting columns unless approved by the Principal Engineer (Traffic Signals) and the Principal Engineer (Street Lighting). Assets should be labelled as "Traffic Signal Equipment".

Road Surfacing at Traffic Signal Installations

It is County Council’s policy to avoid the use of High Friction Surfacing (HFS) treatments and to use appropriate wearing course materials that provide the required level of grip wherever possible.

HFS will not be required in areas where the posted speed limit is less than 40 mph and the existing or proposed surfacing has a PSV value of 68 or above.

The County Council's Code of Practice Highway Works: Standards, Materials and Testing (current edition Version 5.4.1 of January 2019) and in particular Tables 4 and 5, gives guidance on the selection of Polished Stone Values (PSV) and Aggregate Abrasion Value (AAV) for surfacings and surface treatments. The County Council's Materials Laboratory should be approached for advice on this matter.

If HFS treatment is deemed to be necessary, the potential cost and reduced life cycle issues must be considered and accepted by the Highway Authority. Alternatively, road surfacing with a PSV of >68 can be specified and its use recorded in the Design File.

Priority locations where high levels of vehicle grip shall be considered are:-

- Roundabouts
- Traffic signals
- Pedestrian crossings
- Railway level crossings
- Locations where traffic is controlled by flashing red lights
- Accident prevention schemes

- School safety zones
- Where there are additional factors that heighten the level of risk.

Risks to be considered when choosing wearing course materials are:-

- traffic volumes exceeding 750v/lane/day
- compromised approach visibility
- significant gradients
- a high number of vulnerable users
- accident records indicating a site of significant risk

For the locations categorised above, where HFS treatments are required then this shall normally be laid to a minimum distance of 50m from the stop line.

For other surfacing materials the minimum treatment area is the described feature and an installed length of 75m from the stop line. For low speed approaches with a posted speed limit of 30mph and below the minimum distance of HFS may be reduced to 30m and 45m for other surface materials.

On high speed approaches with a posted speed limit of 40 mph and above the requirement for an extension to the 50m minimum HFS length shall be evaluated. In addition to the risk factors included above; the Designer shall consider the effects of queuing traffic when determining the length of the extension. Any such decisions shall be recorded on the Risk Assessment as part of the design process.

Where HFS or replacement surfacing is to be used at controlled crossing locations it shall be laid beyond the stop line to the pedestrian crossing studs. Buff coloured HFS shall not be laid beyond the stop line and only dark grey/black HFS shall be used in this area. At non-staggered crossings the HFS or replacement surfacing shall cover the area between the opposing stop lines.

Guard Rails

The designer should carefully consider the need to use guard rails and only use guard rails if there is a good safety reason to do so.

When guard rail is used the following principles shall apply:

- The type of guard rail used at an installation shall conform to the Lincolnshire County Council Standard Detail Drawings.
- Specialist decorative guard rail shall only be used with the prior approval of the Principal Engineer (Traffic Signals) and the appropriate local Highways Manager.
- The desirable minimum offset (clearance) of guard rail from the kerb face is 450mm. (Absolute minimum offset is 300mm).
- The maximum gap between guard rail and traffic signal poles at a crossing point is 150mm. The last panel should be angled to line up with the signal post if it is at a greater offset from the kerb.
- The guard rail must not project beyond the signal pole into the crossing.

Street Scene Considerations

The designer shall give full consideration to the environment in which the traffic signal installation is to operate and where appropriate minimise the visual impact of traffic signs and traffic signal equipment.

All cabinets and feeder pillars shall be black in colour and treated with anti-graffiti treatments sourced via the County Council's Traffic Signals Term Contractor. All traffic signal poles shall be black in colour with the exception of modifications to existing grey pole installations or for schemes at locations with specific conservation or safety requirements.

The following issues shall be considered in environmentally sensitive areas dependant on location:

- Colour of HFS and crossing surfacing
- Type and colour (contrasting or complimentary with surround) of tactile paving
- Colour and style of street furniture
- Minimising the number of signal poles and levels of traffic signal equipment
- Deletion of the backing boards to signal heads
- Type of controller case (i.e. option to use a small cabinet if available)
- The use of a NAL controller base
- Width of stop line and minimal use of road markings
- The need for traffic islands or widening of footways
- The need for pedestrian guard rail.

All traffic signal schemes shall be compliant with the Streetscene design principles recommended in the latest version of the Lincolnshire County Council document "Streetscene Design Manual".

Temporary Signing of New/Altered Installations

Appropriate temporary signs compliant with the Traffic Sign Regulations shall be used on the approaches to new or altered installations to warn drivers of the new traffic control arrangements. The installation is not to be switched on until these signs have been correctly installed.

The designer should give consideration to the environment in which the traffic signal installation is to operate when designing temporary warning signs.

The maximum time temporary signs are to be in place is 3 months after the commissioning date of the installation, and the date for removal is to be added to the rear of the sign.

11 TRAFFIC SIGNALS DRAWINGS

Standard Drawings

The general construction arrangements for traffic signals installations are shown on the Lincolnshire County Council Standard Details for Highways Works.

https://www.lincolnshire.gov.uk/residents/environment-and-planning/planning-and-development/standard-details-for-highway-works/

Scheme Drawing Standards

Scheme drawing standards for highway works are provided in the Lincolnshire Highways Alliance Quality System.

The LCC Traffic Signal "As Built Drawing" requirements are provided in Appendix B to this guide.

12 ELECTRICAL DESIGN AND CABLE REFERENCING

Cable Design

The design and installation of cabling for a traffic signal installation shall conform to the requirements of the latest version of National and European electrical regulations.

Cable provision for new and modified installations will also conform to the following Lincolnshire County Council operational requirements and as stated in the Lincolnshire Model Contract documents.

Traffic Signal Cable:
Traffic signal cable shall comply with BS6346, shall be steel wire armoured with copper multi-core conductors and with outer PVC insulation coloured orange.

Spare cores:
A minimum of 4 spare cores (or 25% whichever is greater) shall be provided in each cable section. These can be the yellow and/or green cores as long as the exposed section of cable is sleeved in an alternative colour and this is recorded on the electrical test certificate.

Separation of Primary and Secondary Traffic Signal Aspects:
Cable use shall be designed, as far as possible, that in the event of losing a single aspect on a phase (i.e. a single pole knocked down) the installation will be left with at least one aspect (primary or secondary) in use on that phase.

Feeder Cable:
Feeder cable must be armoured and an individual cable should be used per loop when achievable. When this is not practical, detectors brought back on the same feeder must be terminated and connected to the same detector pack to help prevent “cross talk”.

Number of cables in a single post:
A maximum of 5 cables are permitted in a single post including in cranked cables. It is only permitted to use unarmoured cable for “dropper” cable connections to push buttons etc if there is insufficient space for armoured cable.

As Built Cable Schedule:
Three copies of the “As Built” cable schedule are provided by the cable installer to Lincolnshire County Council (one copy laminated for storage in the controller).

Maximum Number of cables connected to the controller:
Generally the maximum number of cables that can be connected to a single controller is 45 depending on the mix of cable sizes. Any cable design in excess of this number of cables will require the use of additional distribution cabinets.

Lincolnshire Standard Core Use:

LV

PURPLE	RED
ORANGE	AMBER
GREY	GREEN
BROWN	RED
WHITE	AMBER
BLUE	GREEN
RED/WHITE	REDMAN
RED/BLUE	GREENMAN
RED	REGULATORY
YELLOW	EARTH
GREEN	EARTH
BROWN/RED	SOLAR LIVE
YELLOW/RED	SOLAR LOAD
GREY/RED	REG NEUTRAL
BLACK/RED	SOLAR NEUTRAL
BLACK	NEUTRAL

ELV

ORANGE	PB+VE
WHITE	0V
BROWN	WAIT+VE
BLUE	WAIT-VE
RED	TACTILE+VE
BLACK	TACTILE-VE
PURPLE	24V+VE
GREY	24V-VE
GREEN	ONXING INPUT
YELLOW	KERBSIDE/VEHICLE INPUT
RED/WHITE	REDMAN+VE
RED/BLUE	GREENMAN+VE
RED/BLACK	REDMAN-VE
RED/YELLOW	GREENMAN-VE
RED/GREY	BUZZER+VE
RED/BROWN	BUZZER-VE

Cable Referencing

Cables shall be referenced in accordance with the County Council's standard system. The referencing system shall be used for the cabling schedule or schematic diagram on the on the drawings (including as built drawings) and for labels that shall be fitted on site to the cable ends and within chambers with a permanent tagging system. This will enable cables to be quickly identified and cross referenced with the drawing on site to assist on-going maintenance and future modification works.

The system shall identify the cable type/use and number/destination (pole) using a minimum of characters for simplicity and ease of installation. Detection cables may serve more than one loop or phase so this information must be covered on the schematic or schedule.

The Cable Referencing System shall comply with the following:

- A separate number shall be used for each cable length between terminations or joints.
- Signal cable to pole no.1 = C1 etc.
- Link cable from pole 1 to pole 2 = C2 etc.
- Push button/pedestrian facilities cable to pole 2 = P2 etc
- Above ground detection on pole 3 = A3 etc.
- D system loops = D1 etc
- Stop line detection = SLA, SLB etc
- All detection loops (except SCOOT loops) shall be labelled according to appropriate phase = AX, AY, AZ etc.
- SCOOT loop to be numbered sequentially on the drawings and indicated on the cable schematic or schedule as SC1, SC2 etc., as actual node and link information may not be known or may change.
- SDE loops = SD1 etc, drawing to use controller specification reference.

13 TRAFFIC REGULATION ORDERS AND LEGAL NOTICES

Puffin and Toucan crossings

This is a mandatory legal requirement to be arranged by the County Council and shall be included in the project management of the installation.

Parking Restrictions

At an early point in the design process the need for on-street parking restrictions must be determined. Parking restrictions are typically used to facilitate vehicle turning movements, provide vehicle access to lanes, reduce lane blocking, improve road safety and improve visibility of signals.

Advertising and Consultation

Applying for parking restrictions and consulting on parking restrictions are often critical activities that dictates when, where and if the traffic signal installation can be implemented. Any objections must be dealt with via the appropriate procedures. Sufficient timescales must be allowed for these requirements in any project programme – this process can take up to 6 months and should be in place before works commence on site.

14 TRAFFIC SIGNAL TESTING AND COMMISSIONING

All new traffic signal installations, major upgrades and changes to controller configurations shall be tested prior to switch on, to ensure the safe and correct operation of the signals and to ensure the signals operate as intended.

The results of the Factory Acceptance Test are recorded on the form shown in Appendix C.

The results of the Site Acceptance Test are recorded on the form shown in Appendix D.

Lincolnshire County Council is responsible for providing and approving the Controller Specification and site works specification.

The Traffic Signals Term Contractor shall arrange and facilitate a factory acceptance test on all new and replacement controller configurations. Lincolnshire County Council requires 7 days' notice of all testing including repeat tests and Lincolnshire County Council staff's approval and presence is required at all factory acceptance tests unless otherwise agreed.

Lincolnshire County Council reserves the right to make minor changes to the configuration data at the time of testing. Any repeat factory acceptance tests required due to initial failures of the test shall be carried out within 7 days.

No controller shall be switched on at the installation after being replaced or modified without a successful Site Acceptance Test and the permission and approval of Lincolnshire County Council. Where a new or revised configuration is involved Lincolnshire County Council shall be on site to check and approve the installation when it is switched on.

15 HANDOVER DOCUMENTATION

Take Over Certificate:

A properly completed and signed take over certificate will be provided on completion of the works. If there are outstanding minor works to complete when the site is commissioned an interim certificate shall be issued and a final certificate issued when the work is completed.

MCH1827b Forms (including all relevant appendices):

- A copy of the as-built, hand-written forms completed in block capitals.
- Issue number, date and page number to be completed on each sheet.
- A full set of forms using the next issue number shall be completed for any new or revised EPROM.
- Site documents to be stored in the controller in a weatherproof pouch issued by the Principal Engineer (Traffic Signals).
- Special or unusual facilities will be explained on the special conditioning sheets.

RAM Data:

- RAM data changes made on site during the commissioning should be recorded on a RAM data cards issued by the Principal Engineer (Traffic Signals).
- Significant changes require a revised EPROM to be installed.
- Superseded or temporary works EPROM forms shall use design issue references and remain on the design file.

Controller Build Specification:

- Two copies of the latest specification. One copy for the installation file in the Traffic Signals filing system. One copy for storage in the controller cabinet on site.
- Superseded or temporary/works specifications should remain on the design file. These can have scheme references and issue numbers.
- Operating dates for temporary or superseded EPROMs should be recorded on the front page of the specification and in the Visit Log Book in case of future court actions.

As Built Drawings:

- Two copies of drawings per site in accordance with Appendix B. One drawing for the Installation file in the Traffic Signals filing system. One drawing for storage in a weatherproof pouch within the controller cabinet on site.
- Operating dates for temporary or superseded layouts should remain on the design file.

APPENDIX A

DESIGN STANDRDS AND REFERENCE DOCUMENTS

Traffic signal operations and equipment shall comply with all common law, current UK/EU legislation, statutory instruments, bylaws, regulations and guidance. Prominent reference documents and standards are:

DMRB	The DfT Design Manual for Roads and Bridges (Chapter 6)
TAL	Traffic Advisory Leaflets
LTN	Local Transport Notes
TD	Technical Directions
SI	Statutory Instruments
MCE0108	Siting of Inductive Loops for Vehicle Detecting at Permanent Road Traffic Signal Installations
MCH1540F	Specification for the Installation of Detector Loops on Motorways and All-Purpose Trunk Roads
TA 101	Highways Agency - Traffic Signal Systems
TR2029D	Inductive Loop Cable for Vehicle Detection Systems
TR2031E	Armoured Feeder Cable for Inductive Loop Systems
TR2206A	Specification for Road Traffic Signals
TOPAS 2500A	Specification for Traffic Signal Controller
TOPAS 2505A	Specification for Above Ground Vehicle Detector Systems for use at Permanent Traffic Signal Installations
TOPAS 2506A	Specification for Above Ground On-Crossing Pedestrian Detection Systems
TOPAS 2507A	Specification for Kerbside Detection Systems for use with Nearside Signals and Demand Units
TOPAS 2508A	Specification for Tactile Equipment for use at Pedestrian Crossings
TOPAS 2511A	Specification for Nearside Signals and Demand Units
TOPAS 2512B	Specification for Below Ground Vehicle Detection Equipment
TOPAS	The Contractor shall provide copies of certificate of TOPAS registration for relevant equipment. http://www.topasgroup.org.uk/

BS 7671:2018	18th Edition IET Regulations: Requirements for Electrical Installations
BS EN 50556:2011	Road Traffic Signal Systems
BS EN 12352:2006	Traffic Control Equipment. Warning and Safety Light Devices
BS EN 12368:2015	Traffic Control Equipment. Signal Heads
BS EN 12675:2017	Traffic Signal Controllers. Functional Safety
BS EN 50293:2012	Electro Magnetic Compatibility
BS EN 61386-24:2010	Conduit Systems buried underground
TSRGD	Traffic Signs Regulations and General Directions 2016
BSI	British Standards Institution requirements
Roads Liaison Group	Management of Electronic Traffic Equipment Code of Practice
Traffic Signs Manual	Chapter 6
	Chapter 8
	Safety at Street Works and Road Works Code of Practice
	New Roads and Street Works Act - 1991
Streetscene Design Manual	Lincolnshire County Council (2016)

APPENDIX B

As Built Drawing Format

1) As-built drawing to be produced by the **actual** designer.

2) One AutoCAD file to contain both drawings: 'Civils Layout' and 'Signals Equipment Layout'.

3) The main scale is 1:200. Inserts at scale 1:500 are used if necessary. If more than two scales are used, insert "As Shown" against primary/secondary scale.

4) The As Built Drawing number (DRG no) format is:

   EXAMPLE: TSL012/-/4501

   TS *siteref*/-/ 4501 for Civils Layout

   4502 for Signals Equipment Layout

   4503 for Civils & Signals Equipment Layout (most crossings)

   Designers can choose to leave drawing number blank on the "as built".

5) The Final revision of the "as-built" to be denoted as revision 'AB'

6) The drawing used by the maintenance team (ref /4504) is for loop drawings and for issue to subcontractors.

7) When the "as-built" drawing has been completed, designers shall move the drawing into the relevant site file in G:\SIGNALS\Traffic Signals Services\DRAWINGS\Holding area\(*division)**(site ref)* and email the maintenance team to confirm the drawing is in the holding area ready to be checked.

8) 'Alternative Scheme Code' to be filled in with construction/design scheme code- this can be used by the designer to record the old drawing number when the drawing number is changed or by for the maintenance team to record the design phase drawing reference number.

9) All proposed/existing layers shall be combined so there's only one layer for ducting, one for chambers, one for road markings etc.

10) Text height, style, case, orientation etc. to be as per LHA quality system drawing standards.

11) Include a small viewport for location plan.

Civil Engineering Layout Drawing

1) Poles, pole numbers and controller to be included.

2) No CP or SP markings required- to be shown in key and pole schedule.

3) Full tactile paving layout.

4) Loops, magnetometers and virtual loops to be shown; latter to be represented as hatched square and labelled as detector number. Detector type to be described in key e.g. AGD318 for MOVA X det.

5) Show HFS, but loops to be overlaid on top of hatching and clearly shown.

6) No staging diagram or magnetometer info required.

7) Loop / detector schedule showing distance from stop line, kerb edge, centre-line, detector type, Phase demanded and extended, extension time.

8) In the key, "as supplied by" text not required for chambers or retention sockets. For example, instead of "STAKKAbox access chamber as supplied by NAL" could put "NAL STAKKAbox access chamber".

9) Chambers don't require labelling but sizes to be shown in the key.

Signals Equipment Layout Drawing

1) Staging and phasing diagram.

2) MOVA link/lane diagram.

3) Pole schedule to include all pole mounted signal equipment.

4) Loops, magnetometers and detector numbers. Magnetometer chambers also to be shown.

5) No tactile paving and no HFS.

6) Show lamp columns only when signal equipment is mounted on them.

7) Remove loop distances (to be shown in loop table). For MOVA sites, distance still to be shown on MOVA det/distance diagram.

8) Cable schedule as per installation docs provided by the Term Contractor.

APPENDIX C

FACTORY ACCEPTANCE TEST CHECK LIST

TRAFFIC SIGNAL CONTROLLER (FAT)

CUSTOMER	
SITE NAME	
SITE REFERENCE	
CONTROLLER TYPE	
CONFIG REFERENCE	
CONFIG VERSION TESTED AT FAT	
CONFIG VERSION APPROVED	

Factory Acceptance Tests

General

Note serial number of controller (if applicable)

Set all detectors to 'off', all computer bits to 'off', select 'normal' on the manual panel
Switch on mains supply, initialise RAM, check time/date and switch signals on.

Check controller starts up in correct stage and that the correct indications are given ☐
Check the starting inter-green time ☐
Check demands have been inserted for all stages and the controller services all phases ☐

Use configuration printout to check the following basic parameters are as specified:-
Minimum green times ☐
Detector Extension times ☐
Maximum Green times ☐
Pedestrian blackout times ☐
Intergreen times ☐
Phase delay times ☐
Starting intergreen time ☐
Timetable entries and event parameters ☐
Handset limit values ☐
All pedestrian sequences ☐
Pelican sequence times ☐
Puffin sequence times ☐
Pedestrian sequence times ☐
Toucan sequence times ☐

Mode Priority:-

Check that the mode priority operates as specified ☐

Manual Mode:-

Check manual disable via handset, if specified ☐
Select each configured manual button & check correct phases appear ☐
Check pedestrian green arrow demand dependant phases as specified ☐
Check all stage to stage movements ☐
Check that non-permitted movements give the correct indication ☐
Check that leaving manual mode inserts demands for all phases ☐
Check operation of all other buttons/switches on the manual panel ☐

FACTORY ACCEPTANCE TESTS- continued

Detector and Push Button Functions:

Check DFM times are as specified ☐
Check Call/Cancel times are as specified ☐
Check for correct active states on each detector input ☐
Check for correct DFM force states on each detector input ☐
Check each detector demands the correct phase ☐
Check each detector extends the correct phase ☐
Check that all inputs perform the correct functions, e.g. latched/unlatched demands, green extensions, light wait indicators, etc ☐
Check SD/SA loop spacing is as specified ☐
Check SD/SA Extension times are as specified ☐
Check SD/SA Extra Intergreen times are as specified ☐
Check SD/SA operation ☐

Vehicle Actuated Mode:

Check the VA logic for each stage change is correct (i.e. stages are only demanded/extended by the appropriate phases) ☐
Check the arterial reversion occurs to the correct stage/phase if no demands/extensions present (if specified) ☐
Check that correct revertive phase demands occur if extension running when maximum green expires (discuss with configuration engineer) ☐
Check stage movement constraints (i.e. permitted, prohibited, alternative moves ☐
Check timetable change points for switched maxes by altering the clock ☐
Check operation of signals with permanent demands on all detectors ensuring that all phases are satisfied ☐
Check demand dependant phases appear correctly ☐
Check call/cancel detector operate correctly ☐
Special stage changes occur correctly ☐

All Red Extensions:

Check all red extension times are as specified ☐
Check all red maximum times are as specified ☐
Check that appropriate detectors extend appropriate stage moves ☐
Check all red extensions are operative or auto-extend to max in the appropriate modes ☐

Fixed Time Mode:

Select fixed time mode and check for correct stage sequence ☐
Check fixed time stage durations, if specified ☐
Check fixed time runs to current phase maximums (if specified) ☐
Check any demand dependant stages/phases ☐
Check that leaving fixed time mode inserts demand for all phases ☐
If fixed time runs to current phase maximums, check timetable changes ☐

FACTORY ACCEPTANCE TESTS- continued

Cableless Linking Facility Mode

Check plan timings/influences are as specified ☐
Check timetable change points for CLF plans by altering the clock ☐
Check that all plans operate, especially demand dependant stages ☐
Check CLF permitted movements by writing a plan with a non-permitted move in it ☐

Instation Testing Junction Site:

Check Router set up correct LAN IP address ☐
Check Router VPN established ☐
Check Chameleon IP addressed ☐
Check Chameleon IOUT file installed ☐
Check MOVA files installed ☐
Check UTMC instation database complete ☐
Check Chameleon under UTMC control lamp lit ☐
Check contractor IP address is same as Router and Chameleon ☐

UTC Mode:

Reset all detectors to 'off' and select 'normal' on the manual panel ☐
Check mode changes when a force bit is activated ☐
Check operation of non-demand dependant force bits ☐
Check operation of demand dependant force bits with both street demands and D-bits and check that any stage demand reply bits are returned correctly ☐
Check that correct G-bit replies are returned for each stage or phase or both ☐
Check that the UTC stage change logic is correct ☐
Check for correct operation with multiple force bits ☐
Check stage to stage movement restrictions (i.e. permitted, prohibited, alternative moves) ☐
Check that no phase minimums can be violated by forcing stages ☐
Check that stages can be forced past the VA maximum green times ☐
Check operation of any other miscellaneous control bits, DX, TS (all modes) ☐
Check that any phase confirm bits are correctly returned ☐
Check reply bits returned for specific controller conditions (LD,DF, RR, CF etc) ☐
Check operation of any other miscellaneous bits (HC, BD, GP etc) ☐

FACTORY ACCEPTANCE TESTS- continued

MOVA Mode:

Check that MOVA licence installed ☐
Open MOVA commissioning screen and observe ☐
Switch all detector test switches to off and select Normal/Revert to auto in manual panel ☐
Check CRB bit is on (this should only be on in Auto/Normal) ☐
Check Detectors all operate and are in correct positions ☐
Check G bits are correct for stage returned ☐
Check extra bits e.g. phase returns, priority, input for pedestrian waits, etc. ☐
Set MOVA to enabled and put in control ☐
Check TO bit, then test force bits ☐
Check appropriate lamp on in manual panel ☐
Check stage to stage movements for allowed/prevented moves ☐
Check for any other specials requested in special conditioning ☐

Part Time Mode:

Check timetable change points by altering the clock ☐
Check that signals switch off in correct stage, once minimums have expired ☐
Check queue detector operation ☐
Check minimum on/off operating timers if specified ☐
Check operation of part-time inhibit switch ☐

Hurry Call Mode:

Check hurry call delay times are as specified ☐
Check hurry call hold times are as specified ☐
Check hurry call prevent times are as specified ☐
Check operation of request detectors ☐
Check operation of cancel detectors ☐
Check that correct stage is called in relation to the detector ☐

Vehicle Priority Mode:

Check priority unit basic requirements are as specified ☐
Check priority extension times are as specified ☐
Check priority maximum times are as specified ☐
Check inhibit times are as specified ☐
Check phase compensation times are as specified ☐
For each priority unit check operation of priority demands/extensions, inhibit periods and compensation periods ☐

Pedestrian Linking:

Check pedestrian link timings are as specified ☐
Check operation of pedestrian link ☐
Check operation of override timer ☐

FACTORY ACCEPTANCE TESTS- continued

Red Lamp Monitoring:

Check that 1 red lamp out extends appropriate intergreens by the specified duration and DFM lamp flashes ☐
Check that 2 reds out inhibit conflicting pedestrian phases or stream ☐
Check that failure of all (or 2) monitored reds on an approach/channel of a pedestrian stream causes shutdown ☐
Check that red lamp failure actions cease when lamps are replaced and fault log reset ☐

Green Conflict Monitoring:

Check all green/green conflicts ☐
Check fault log for correct conflict data ☐
Check dimming operation ☐

Special Conditioning:

Check operation of any special conditioning not covered by any of the preceding tests ☐
Check that configurator has removed on-crossing detector pulse button off the Manual Panel ☐

FACTORY ACCEPTANCE TESTS- continued

Miscellaneous:

Perform any other miscellaneous tests that may be required (define below):-

1. ☐
2. ☐
3. ☐
4. ☐
5. ☐
6. ☐
7. ☐
8. ☐
9. ☐
10. ☐
11. ☐
12. ☐

Factory Acceptance Test Results

SITE NO/SCN No.:	Location:
Date of Simulator Test (FT,UTC and basic data):	☐Passed ☐Failed (as appropriate)
Comments	
Date of Factory Test:	☐Passed ☐Failed (as appropriate)
Comments	
Latest Date for Corrective Action	
Supplementary FAT Required ☐Yes ☐No (as appropriate)	
Traffic Signal Engineer:	Name: Signature:
Signal Company Engineer:	Name: Signature:

APPENDIX D: Site Acceptance Test Check List

Traffic Signals Equipment

Site Acceptance / Takeover Check List (SAT)

Location:

Signal Contractor:

Signal Contractor Engineer:

Controller Type ELV/LV:

Config Reference:

Config Issue No:

Date and Time of Takeover:

1	Electrical Test Certificate	☐
2	Feeder Pillar/Fuse Ratings	☐
3	Street Furniture Check	☐
4	Head/PBU Alignment	☐
5	Temporary "New Signals Ahead" signs erected where applicable	☐
6	Flash Out Test	☐
7	On Crossing Detectors	☐
8	Switch-on Dynamic Risk Assessment, considering the following: Are there any issues with the Traffic Management (TM)? Yes/No Are the agreed resources and measures in place to manage the traffic, pedestrians and the Traffic Management? Yes/No Do all parties agree that the weather conditions, visibility and/or lighting levels are suitable to proceed? Yes/No Do all parties agree that the civil engineering works in and around the installation are complete or at a suitable point to proceed? Yes/No Are traffic and pedestrian flow levels suitable to proceed? Yes/No In your opinion is it safe to proceed with the switch on? Yes/No	☐

9	Start Up Sequence	☐
10	Intergreens Checked/Corrected	☐
11	Audio and Tactile Cone Operation	☐
12	Detection Equipment Layout	☐
13	V/A, MOVA, SDE, SA Operation	☐
14	Kerbside Detectors	☐
15	Photo Cell	☐
16	BT Line	☐
17	Controller Base Seal	☐
18	Red Lamp Failure Test	☐
19	Time of Day/Day/Week settings	☐
20	OMU/OTU Time and Date Settings	☐
21	MOVA Unit Time and Date Setting LIN Number: / LIF Number:	☐
22	Cable Layout Diagram	☐
23	Controller Log Book / Drawing / Cont / Spec / Zip Wallet	☐
24	Cables Labelled in Chambers	☐
25	Poles Numbered	☐

Additional Comments:

OUTSTANDING ITEMS	ACTION BY	DATE COMPLETE
1) Check timings at peak periods within 2 weeks of S.A.T. 2) Check timings at peak periods after months of S.A.T. 3) Others: **Comments:-**		

Takeover/Commissioning accepted

Name (LCC): Signature:

_____

Name (Signals co): Signature:

_____

Date: Time:

Completion of Actions

Name: Signature: _____

Date: Time:

Takeover accepted

Name: Signature: _____

Date: Time: