

Norfolk County Council

Traffic Signals Developer Design Guide



Norfolk County Council

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Contents	Page
1. Introduction & General Requirements	1
1.1 General	1
1.2 Preamble	2
2. General Traffic Signals Requirements in Norfolk	3
2.1 General	3
2.2 Remote Monitoring	3
2.3 Urban Traffic Control (UTC)	3
2.4 Microprocessor Optimised Vehicle Actuation (MOVA)	4
2.5 TRO's and Third-Party Approvals	4
3. Approval Process	5
3.1 General	5
3.2 Design Standards Required in Norfolk	8
3.3 Detailed Design Submission Requirements	9
3.4 Scheme Drawings	10
3.5 Factory Acceptance Test (FAT)	12
3.6 Supervision during construction	13
3.7 Site Acceptance Test (SAT)	13
3.8 Control Strategy Validation	14
4. Approved contractors	16
4.1 Traffic Signals Contractor	16
5. Health and Safety	17
5.1 General	17
6. Electrical Installation and Power Supply	19
6.1 IEE Regulations	19
6.2 Electricity Supply	19
6.3 Distribution Network Operator	19
7. Traffic Signals Equipment Requirements	20
7.1 General	20
7.2 Controller and configuration.	20
7.3 Equipment monitoring	21
7.4 Traffic signal poles	22
7.5 Signal heads	22
7.6 Push button units and nearside pedestrian/cycle/equestrian signals	22
7.7 Use of audible indicators at pedestrian crossings	23
7.8 Pole mounted detectors	23
7.9 Magnetometer detection equipment	23

7.10	Carriageway loops	23
7.11	UTC control	24
7.12	MOVA control	24
8.	Communication connections	25
8.1	General	25
8.2	Communications at Existing Installations	25
8.3	Private Communication Circuits	25
8.4	4G and ADSL	25
8.5	Router specification	25
9.	Civil works requirements	26
9.1	Poles and pole retention sockets	26
9.2	Electricity feeder pillar	26
9.3	Ducting system	26
9.4	Inspection chambers	27
9.5	Tactile paving and dropped kerbs	28
9.6	Detection loops and slot cutting	28
9.7	Road markings	28
9.8	Road studs	29
9.9	Guard railing	29
9.10	Skid resistance on the approach to crossings	29
10.	Traffic safety and management	30
10.1	General	30
11.	List of relevant standard detail drawings	31
12.	Related documents	32

1. Introduction & General Requirements

1.1 General

- 1.1.1 This document describes and sets out the minimum requirements for all matters relating to the supply, installation and commissioning of traffic signals installations on Norfolk County Council's road network. The Document will apply to all new installations and modifications to existing installations unless stated otherwise by the Traffic Signals Team.
- 1.1.2 This document is not intended as a full specification and use of this document in no way relieves the Promoter of their responsibilities to provide a safe design compliant with the regulations, codes of practice and national recommendations in force at the time. However, if any aspect of this document is not adhered to without the prior written permission from Norfolk County Council, then the Highway Authority has the right to refuse acceptance of all or any aspect of the installation.
- 1.1.3 Any anticipated departure from either nationally accepted or locally derived standards or recommendations stated in this document by the promoter or their contractor(s) for equipment, standards, practices or procedures for the scheme(s)/installation(s), shall only be investigated by the Highway Authority with a minimum of 28 days prior written notification before such departure approval is required. The reasons given for such a departure will then be duly considered and then if accepted or refused the promoter will be notified in writing within the 28-day period stated; with reasons or restrictions given in the approval/refusal. If during this 28-day period further information is required by the Highway Authority to come to a decision then this will be requested by electronic mail to the promoter, providing an email address is provided.
- 1.1.4 Each site will vary in its requirements and any proposals put forward will be subject to scrutiny in both engineering terms and in the form of safety and technical audits carried out by the Traffic Signals Team, Highways Design Team, Highways Development Control and the Road Safety Team.
- 1.1.5 Given the variable nature and requirements of individual installations, it is strongly recommended that any organisation(s) contemplating the design and installation of Traffic Signals installations in Norfolk contact the Traffic Signals Team at the earliest opportunity. This will help to avoid any abortive work.
- 1.1.6 It is strongly recommended that organisations wishing to design and install traffic signals within Norfolk employ the services of a specialist traffic signals designer, competent in the design, specification, installation and commissioning of traffic signals equipment and associated systems and are fully conversant with this document.

- 1.1.7 Before any personnel are used on the design and configuration of any such facility the promoter must ensure that they are satisfied that the minimum requirements expected for them to be totally competent in the tasks and duties they are to undertake are met.
- 1.1.8 If requested, the promoter will make available to the Highway Authority the CV's including all training records of all personnel involved in the detailed design and configuration of the installation(s).
- 1.1.9 It is a requirement of the Local Authority that organisations wishing to install traffic signals within Norfolk employ the services of the Local Authority's Traffic Signals term contractor, Dynniq Ltd, for supply and installation of all equipment.
- 1.1.10 Any street lighting affected by the traffic signals design must be assessed separately by the Electrical Services Team.

1.2 Preamble

- 1.2.1 Traffic signals include road junction signals, road shuttle signals, Puffin pedestrian crossings, Toucan cycle/pedestrian crossings, Pegasus equestrian/pedestrian crossings and wig-wag signals for emergency access.
- 1.2.2 Associated traffic control and monitoring equipment shall comprise such items that have a controlling effect on the highway. Such systems can include UTC, SCOOT, MOVA and remote monitoring systems.
- 1.2.3 This document should be read in conjunction with other applicable Highway guidance for development publications available on Norfolk County Councils website:
- Safe, Sustainable Development
 - Highways and Transport: Post-planning processes
 - Part 1: Guidance on Highways and Transport Planning Conditions
 - Part 2: How to Deliver Associated Highways and Transport Measures
- 1.2.4 **This document is predominantly intended for use during the design phase for traffic signals schemes, but it should be noted that construction cannot start until a Section 278 Agreement is in place.**

2. General Traffic Signals Requirements in Norfolk

2.1 General

- 2.1.1 The design, specification, installation and maintenance of a traffic signals installation is governed by numerous national regulations, codes of practice, advice notes and recommendations. The Promoter and the Specialist Traffic Signals Designer shall be fully conversant with the above documents and unless a Norfolk standard applies then the most current version of these documents must be strictly adhered to at all stages of the project.
- 2.1.2 In addition to the above, the Highway Authority may, at its discretion, impose additional requirements on the Promoter, relevant to the installation under consideration.
- 2.1.3 Where there is doubt about the level of compliance with national guidance, that is required in Norfolk, the Promoter and the Specialist Traffic Signals Designer shall contact the Traffic Signals Team at an early stage in the design process.
- 2.1.4 Traffic signals equipment shall be supplied by Dynniq Ltd in new, unused condition, complete with all ancillary parts necessary to allow site acceptance testing (SAT) of the equipment.
- 2.1.5 Traffic signals equipment shall be supplied with the most up to date versions of software and firmware.
- 2.1.6 If fewer than ten units of the type and make of any item of signals equipment proposed are already commissioned within Norfolk, then an additional unit of the same specification shall be provided for spares (at no cost to the Authority) for the exclusive use of the Authority.
- 2.1.7 Where new traffic signals equipment is proposed not already in use within the authority then training will be required. This training will need to be provided for Highways Services staff and the term maintenance contractor's staff. This training will be required prior to any factory acceptance testing.
- 2.1.8 Where new traffic signals equipment is proposed not already in use within the authority then the Promoter shall be responsible for providing UMSUG (ELEXON) equipment codes as necessary to enable inclusion within NCC's UMS agreement.

2.2 Remote Monitoring

- 2.2.1 All traffic signals installations in Norfolk shall be remotely monitored.
- 2.2.2 Further details regarding remote monitoring requirements are given in Section 7.3.

2.3 Urban Traffic Control (UTC)

2.3.1 Where a new installation is located within an existing UTC/SCOOT region or in a location deemed to be suitable for UTC/SCOOT control, the necessary equipment and configuration may be required, as advised by the Traffic Signals Team.

2.3.2 Further details regarding these requirements are given in Section 7.11.

2.4 Microprocessor Optimised Vehicle Actuation (MOVA)

2.4.1 At isolated junctions or as fallback mode in UTC regions, new or substantially modified traffic signals installations may be required to operate under MOVA control, as advised by the Traffic Signals Team.

2.4.2 Further details regarding these requirements are given in Section 7.12.

2.5 TRO's and Third-Party Approvals

2.5.1 Where an installation requires Traffic Regulation Orders or temporary traffic regulation orders to be made or amended, the Promoter will be required to fund the making of the order, advertising, consultation legal expenses and highway works incurred by the Highway Authority.

2.5.2 Where an installation, or elements of an installation, require third party approval, the Promoter shall be responsible for obtaining such approvals as may be necessary, allowing plenty of time in obtaining the approval prior to requiring it. Evidence of this approval will be forwarded to the Highway Authority.

3. Approval Process

3.1 General

3.1.1 To ensure that the requirements of the Highway Authority are fully met and that the Promoters proposals are both safe and appropriate for the location, a staged approval process shall be undertaken. This staged process also ensures that design flaws and/or installation errors are identified at an early stage and are not carried through to the finished scheme.

3.1.2 An outline of the Approval Process is given in the table below.

PROCESS STAGE	PROMOTER/PRINCIPAL CONTRACTOR INPUT	HIGHWAY AUTHORITY'S INPUT/OUTPUT
Feasibility Study	<ul style="list-style-type: none"> • Submit Transport Assessment Report • Submit CV's and Training records of all personnel involved with the design and configuration of the proposed installations if requested • Submit general signals layout drawing which includes a signals phasing / staging diagram • Submit full LinSig or Micro-Simulation modelling as required • Accident data • 85%ile speed data (24 hours 7 days) 	<ul style="list-style-type: none"> • Check Feasibility information submitted • Prepare Stage 1 Safety/Technical Audit report • Send Report to Highways Project Engineer for onward transmission to the Promoter
Revised Feasibility Study (Where stage 1 Safety/Technical Audit Report identifies potential problems)	<ul style="list-style-type: none"> • Submit Exception Response to the Stage 1 Safety/Technical Audit • Revise Feasibility Study as necessary 	<ul style="list-style-type: none"> • Check Feasibility information submitted • Prepare revised Stage 1 Safety/Technical Audit report • Send Revised Report to Highways Project Engineer for onward transmission to the Promoter
IT IS RECOMMENDED THAT DETAILED DESIGN SHOULD ONLY COMMENCE WHEN THE FEASIBILITY STAGE IS APPROVED IN PRINCIPLE.		
Detailed Design	<ul style="list-style-type: none"> • A complete package of information as set out in Section 3.3 - 'Detailed Design Submission Requirements' 	<ul style="list-style-type: none"> • Check All Detailed Design Information • Prepare Stage 2 Safety/ Technical Audit report • Send Report to Highways Project Engineer for onward transmission to the Promoter

PROCESS STAGE	PROMOTER/PRINCIPAL CONTRACTOR INPUT	HIGHWAY AUTHORITY'S INPUT/OUTPUT
<p>Revised Detailed Design</p> <p>(Where stage 2 Safety/Technical Audit Report identifies anomalies or potential problems) (This process may need to be repeated until submission is signed off by NCC Traffic Signals Team)</p>	<ul style="list-style-type: none"> Submit Exception Report to the Stage 2 Safety/Technical Audit Revise Detailed Design package a necessary to comply with the Stage 2 Safety/Technical Audit and exception response 	<ul style="list-style-type: none"> Check All Detailed Design Information Prepare revised Stage 2 Safety/Technical Audit report Send Revised Report to Highways Project Engineer for onward transmission to the Developer
<p>IT IS A REQUIREMENT THAT CONSTRUCTION DOES NOT COMMENCE UNTIL THE DETAILED DESIGN PACKAGE IS FULLY COMPLIANT WITH THE STAGE 2 AUDIT (AND EXCEPTION RESPONSE) AND A SECTION 278 AGREEMENT IS IN PLACE</p>		
<p>Factory Acceptance Test (FAT)</p>	<ul style="list-style-type: none"> Arrange and conduct FAT. Minimum of 4 weeks' notice required. A Traffic Signals Engineer & the Promoters Specialist Traffic Signals Designer must be in attendance for this test. See also Section 3.5 	<ul style="list-style-type: none"> Observe/assist with FAT and countersign FAT Certificate certifying that the Configuration and Controller are fit to use on the highway
<p>Construction/ Signals Equipment Installation</p>	<ul style="list-style-type: none"> All Traffic Control Equipment shall be installed and tested by Dynniq Ltd 	<ul style="list-style-type: none"> Site Supervision/Inspections as detailed in Section 3.6. Any construction/installation issues found will be reported to the supervision team or to the Promoter/Principal Contractor for rectification, as required
<p>Power Supply Installation</p>	<ul style="list-style-type: none"> It is the responsibility of the Promoter/Principal Contractor to order, programme, oversee and pay for installation of the power supply to the Traffic Control Equipment. Further details are contained in Section 6 - 'Electrical Installation and Power Supply' 	<ul style="list-style-type: none"> The installed signals equipment is added to NCC's unmetered supply agreement inventory database
<p>Communications Installation</p>	<ul style="list-style-type: none"> The responsibilities for provision of communications to the installation(s) are complex and are described in Section 8 - 'Communication Connections' 	<ul style="list-style-type: none"> As described in Section 8 and supplying the Promoter with advice and knowledge of communications as required

PROCESS STAGE	PROMOTER/PRINCIPAL CONTRACTOR INPUT	HIGHWAY AUTHORITY'S INPUT/OUTPUT
Pre-Site Acceptance Test (SAT) Testing (Otherwise known as Pre-Testing)	<ul style="list-style-type: none"> Ensure the following information ACAD drawing, LinSig files, MOVA dataset, MOVA licence number, all configuration files are provided at least 5 working days prior to the SAT Ensure that Dynniq Ltd fully tests the installation at least 24 hours prior to the Traffic Signals Engineer attending the SAT Ensure that all civil works relevant to the installations functionality are completed to the required standards prior to the SAT 	<ul style="list-style-type: none"> The Traffic Signals Engineer will not commence the SAT process without the required certificates and documents
THE SITE ACCEPTANCE TEST MAY ONLY TAKE PLACE WHEN THE PRE-TESTING IS FULLY COMPLETED.		
Configuration of In-station Equipment	<ul style="list-style-type: none"> Supply the necessary information to enable in-station configuration 	<ul style="list-style-type: none"> Configuration of in-station monitoring and control equipment.
Site Acceptance Test (SAT) (Otherwise known as Commissioning)	<ul style="list-style-type: none"> Arrange and conduct SAT. Traffic Signals Engineer to be given a minimum of 4 weeks' notice. Arrange for all snags spotted during the SAT to be corrected. Arrange and co-ordinate another SAT if required by mutual agreement. 	<ul style="list-style-type: none"> The Traffic Signals Engineer will cancel the SAT after 1 hour if it is found that all the works are not satisfactorily completed. Prepare a list of snags found during the SAT and ensure that the Promoter/Principal Contractor addresses snags during SAT where practicable or within an approved timeframe. Observe SAT and counter sign Site Acceptance Test Certificate if the installation passes the detailed functionality, operational and civil checks and is deemed safe to remain on.
Stage 3 Post Opening Safety Audit	<ul style="list-style-type: none"> Respond to Stage 3 Safety Audit Report 	<ul style="list-style-type: none"> Attend Stage 3 (post opening) Safety Audit and contribute to the preparation of the Audit Report

- 3.1.3 The traffic signals design approval process applies to the design and installation of the traffic signals installation only and does not imply approval of any other aspects of the layout.
- 3.1.4 When a design and specification is given approval by the Highway Authority, that approval is valid for 24 months from the date the approval is given. This shall always apply unless extended in writing by the Traffic Signals Team.

3.2 Design Standards Required in Norfolk

- 3.2.1 If there is no specific Norfolk standard set out in this document, then National standards shall always apply.
- 3.2.2 Due to the complexity of traffic signals installations it is important to submit the proposed controller specification with the first detailed design submission. This will give the Traffic Signals Team the opportunity to check the proposal and assist the Specialist Traffic Signals Designer with the submission of an acceptable standard of controller configuration.
- 3.2.3 There are a number of abnormal load routes agreed in Norfolk on which there are minimum requirements laid down for available road widths. An early approach to the Highway Authority is recommended to obtain details of the location of these routes as we have details of the restrictions imposed.
- 3.2.4 The Promoter should make contact with the Highway Authority to obtain the list and restriction on the Traffic Sensitive Routes that exist in the county that may impact on works on the proposed scheme.
- 3.2.5 In order to progress an audit of any submission we require as a minimum the scheme to be drawn (on a detailed up to date topographical survey of the area) at a scale of no smaller than 1/200. This should include as a minimum but not be limited to: proposed pole locations, traffic signal heads, pedestrian heads, push buttons, detectors, loops, traffic and pedestrian phases, controller position, maintenance bay location, tactile paving, any pedestrian guardrail, associated white lining, proposed staging, road studs and feeder pillar.
- 3.2.6 If pedestrian islands are to be incorporated into the design, then they must be of sufficient width and length to incorporate any proposed guardrail without impeding the pedestrian waiting or walking area. The guardrail must not extend beyond the location of the pedestrian push button poles, nor must it be left so short that a user could get between the railing and the pole.
- 3.2.7 85%ile speed data readings or MOVA cruise speed readings should be provided where necessary to support the extent of vehicular detection required at any proposed installation.
- 3.2.8 When a scheme is commissioned temporary signs to Dia.No.7014 (with appropriate variant) of the TSRGD are to be displayed on site for 3 months post switch on.

3.3 Detailed Design Submission Requirements

- 3.3.1 To enable the Highway Authority to fully assess the operational and safety implications of a proposed new traffic signals installation, the Promoter shall submit detailed plans, specifications and standard drawings showing the installation proposals.
- 3.3.2 The detailed information listed in the following sections shall be submitted in accordance with the approval process given in 3.1.2.
- 3.3.3 Detailed Scheme Plan(s) at no smaller than 1:200 scale shall be submitted by the Promoter, showing the following information as a minimum:
- Topographical survey of the existing site
 - Scheme layout including kerb-lines, traffic islands, footways, highway verge, embankment, cycle tracks, highway drainage etc.
 - Controller & feeder pillar locations
 - All signals equipment symbols shall be to the industry standard
 - Pole location (annotated with pole number, pole type(s) to be detailed in key)
 - Signal head location and orientation (symbol denoting aspect type, type(s) to be detailed in key)
 - Pedestrian and/or cycle signal location and orientation (symbol denoting type, type(s) to be detailed in key)
 - Pedestrian pushbutton(s) location and orientation, including audible/tactile device where appropriate (symbol denoting type, type(s) to be detailed in key)
 - Detector location (symbol denoting type, function and detector number, type(s) to be detailed in key)
 - Extent of guardrails and 'Visirail' type
 - Tactile paving, dropped kerb location and corduroy paving
 - Inspection chamber locations (annotated with type, type(s) to be detailed in key)
 - Duct runs (annotated with number of ducts, type(s) to be detailed in key)
 - Phase and Staging Diagram
 - White lining and signing
 - Extent of improvement to surface skid resistance (where appropriate)
 - A hard standing area for the parking of a maintenance vehicle
- 3.3.4 Standard details shall be submitted by the Promoter in addition to the main detailed traffic signals scheme drawing, detailing construction specifications, setting out and installation information. Standard NCC details listed in Section 11 should be used wherever possible.
- 3.3.5 MCH1827B controller specification forms or a pedestrian crossing timing sheet shall be submitted by the Promoter as appropriate. Additional controller configuration requirements are set out in Section 7.2.

- 3.3.6 For MOVA installations, the MOVA data set and a link plan shall be submitted by the Promoter.

3.4 Scheme Drawings

- 3.4.1 All scheme drawings at a scale of no smaller than 1:200 shall be provided in AutoCAD format and at a scale of 1 drawing unit to 1.000m. Please contact the Traffic Signals Team for our current version of AutoCAD.

- 3.4.2 The AutoCAD drawing(s) shall contain the following layers as a minimum requirement:-

LAYER NAME	COLOUR (as seen on paper)
Base/Topo	(Grey)
Signals	(Magenta)
Ducts	(Green)
Loops	(Red)
Kerbs	(Black)
Border	(Black)
Lines	(Cyan)
TactPave	(Red)

- 3.4.3 Traffic Signals symbols shall follow those shown in Chapter 6 of the Traffic Signs Manual.
- 3.4.4 The Norfolk County Council installation alphanumeric site reference number and system code number (SCN) shall be printed within the title block of the scheme drawing. The Promoter must contact Norfolk's ITS team to obtain site reference and system code numbers.
- 3.4.5 A north point shall always be clearly shown, together with all associated road and street names and road numbers where available.
- 3.4.6 Tactile paving for all pedestrian crossings shall be shown using an outline together with any studded pedestrian crossing areas and shall conform to national guidance.
- 3.4.7 Zigzag carriageway markings shall conform to the latest version of "The Zebra, Pelican and Puffin Pedestrian Crossing Regulations and General Directions". As per TSRGD Schedule 14 Part 2 Item 51 Diagram 1001.3 Variant 2. A centre zigzag should be reversed to be a mirror image of the nearside.
- 3.4.8 The markings may be increased between 8 - 18 marks if a site is deemed to have potential safety risks. Markings may be also be decreased to a regulation minimum of two marks from the standards at the discretion of the Engineer. Where site conditions dictate such as at a road junction, markings for the nearside, centre and offside may be of different lengths and placed as an odd number if necessary.

3.4.9 The labelling of loop configurations shall follow an accepted style of "phase-type-lane". For example:-

- XYZ1 will indicate that the three loops (system 'D') of a phase are connected to one channel of detection in lane 1. aX1 and aYZ1 imply that the approach (system 'D') is split to two separate channels of detection.
- aSL1 for stop line loops.
- aQ1 for queue loops.
- aCC1 for call/ cancel loops these are not usually lane associated but a number will be used for each call cancel loop for that phase.
- MOVA loops will indicate the phase followed by the MOVA detector type and number. aLN1, aX2, aSL3, aSNK4.
- SD0, SD1 are SCOOT loops to be used for each controller.

This labelling shall correlate with the controller specification forms detector notation.

3.4.10 The naming of MOVA detectors shall be sequential by approach, phase and lane. All MOVA detectors are to be cabled independently to reduce crosstalk and to aid the testing and investigation of detector problems.

3.4.11 The labelling of above ground detection follows the same style but with a difference of "phase-type-pole number". For example:-

- bMVDP2 is phase B Microwave vehicle detector on pole 2.
- bOCP2 for an on-crossing detector on pole 2.
- bKSP2 for a kerbside detector on Pole 2.

This labelling shall correlate with the controller specification forms detector notation.

3.4.12 Pole numbering shall start from the pole closest to the controller and increment clockwise around the traffic signals design.

3.4.13 Stop line markings shall normally be 200 mm wide. If the stop line is to the alternative dimension of 300 mm wide (high speed, rural, or exceptional circumstances) then the drawing shall identify this accordingly.

3.4.14 Any subsequent alteration, amendment, modification, or addition to the drawing shall carry a revision letter and be clearly dated.

3.4.15 A dashed line shall indicate all 100mm diameter ducting with the legend "xNo." adjacent to or forming part of the line to show multiple ducts. 50mm ducting is only to be used for under kerb ducts (for loop tails) to the associated chamber and shall be shown as a continuous line.

3.4.16 Where the installation uses parallel stage streaming, stream legends shall be placed appropriately within the drawing.

- 3.4.17 Where the colour layering of the scheme drawing is set with the original CAD issue this colour selection shall be closely adhered to for any addition, alteration, amendment, modification to the drawing.
- 3.4.18 Once a traffic signals design is fully signed off by the Traffic Signals Team, Adobe pdf copies of the drawing(s) will be required for inclusion in the Section 278 Agreement documentation.
- 3.4.19 Following construction of the scheme, the Contractor shall supply a printed copy together with an AutoCAD digital file and Adobe pdf file in an electronic format acceptable to the Traffic Signals Team, of an as built scheme drawing marked in the issued column "Original as built".
- 3.4.20 The completed as built scheme drawing shall include as a minimum:-
- A plan up to the highway boundary including any relevant private accesses.
 - The stage diagrams and a cyclic order diagram where the sequence is not standard.
 - A MOVA link/lane relationship diagram where appropriate.
 - The location of the controller, feeder pillar, telecommunications, white lining, signal poles, signal heads, PE cell, PDU's, chambers, duct runs and detection all with identification labels.

3.5 Factory Acceptance Test (FAT)

- 3.5.1 The Promoter or Specialist Traffic Signals Designer shall be responsible for facilitating and conducting the FAT, in full consultation with a Traffic Signals Engineer from Norfolk County Council. Norfolk's normal FAT shall be conducted at the Dynniq Configuration Engineer's premises. The Norfolk Traffic Signals Engineer and the Specialist Traffic Signals Designer must be present. Dynniq shall provide all necessary test equipment in a suitable environment set aside for the purpose. Additional tests may be required at the discretion of the Engineer. The Norfolk Traffic Signals Engineer will sign off the FAT document once completely satisfied with the operation of the configuration.
- 3.5.2 All specified junction controller(s) functions given within this document and within the MCH1827B specification are to be demonstrated to the satisfaction of the Traffic Signals Engineer.
- 3.5.3 The Promoter shall ensure that all equipment and configuration(s) to be tested are operating correctly, prior to requesting Norfolk's Traffic Signals Engineer to be present at the FAT. Where Norfolk's Traffic Signals Engineer is requested to attend a FAT and it is established that insufficient prior testing has occurred, then the Promoter will be liable to reimburse the Highway Authority for all reasonable costs associated with the Traffic Signals Engineer's presence at that test.

- 3.5.4 Dynniq and the Specialist Traffic Signals Designer shall ensure that Norfolk's Traffic Signals Engineer is supplied with a FAT certificate, a green conflict test certificate and an electronic copy of each controller(s) configuration(s). These documents shall be handed over to the Traffic Signals Engineer at least one week before the date of the Site Acceptance Test (SAT).
- 3.5.5 Dynniq shall perform its controller(s) tests and green conflict tests in the depot and on the actual controller(s) to be supplied, not just on the emulator software. The green conflict tests shall be carried out on the junction controller(s) prior to installation, using a relevant test unit that complies with the current IEE Regulations.
- 3.5.6 The Traffic Signals Engineer shall be consulted on the date of the FAT and be given at least four weeks' notice of the date for the FAT.
- 3.5.7 Factory Acceptance Tests for Puffin and Toucan controllers do not normally require the presence of the Traffic Signals Engineer unless under MOVA control.
- 3.5.8 No traffic signal controller shall be allowed onto the site without a current and valid FAT certificate being in place. Under no circumstances will the FAT be conducted with the controller in situ.

3.6 Supervision during construction

- 3.6.1 For all schemes the Principal Contractor shall meet with Norfolk's Traffic Signals Engineer and Dynniq at the start of the scheme. At this meeting the Contractors will be made fully aware of the requirements of the Traffic Signals Engineer.
- 3.6.2 Where on-site conditions require a change to the approved installation layout the Promoter shall first check with the Traffic Signals Team that the change to the design is permitted. If the change is agreed in principle, a member of the Traffic Signals Team will attend site within a suitable time period, to approve an acceptable solution.
- 3.6.3 The Traffic Signals Engineer may inspect the signal installation(s) during construction and shall be afforded full access to all works associated with the signal installation(s) including ducting, chamber, pole retention socket and cabinet works. The Principal Contractor shall arrange for site inductions to be carried out (or provide an escort for the Traffic Signals Engineer).
- 3.6.4 Any issues/snags identified during site inspections will be passed via the Highways Project Engineer for onward transmission to the Principal Contractor. The Principal Contractor shall then arrange for the snags to be rectified. This may cause delay to the programmed SAT depending on the severity of the snag(s) identified.

3.7 Site Acceptance Test (SAT)

- 3.7.1 The Promoter shall ensure that all equipment installed is fully tested and operating correctly at least 24 hours prior to Norfolk's Traffic Signals Engineer being present at a site acceptance test. This includes all communication equipment for any remote monitoring and UTC operation. Where the Traffic Signals Engineer is requested to attend a SAT and it is established that insufficient prior testing has occurred, then the Promoter will be liable to reimburse the Highway Authority for all reasonable costs associated with the Traffic Signals Engineer's presence at that test.
- 3.7.2 The Promoter shall organise a SAT at each new traffic signals installation. Dynniq's Engineer, Norfolk's Traffic Signals Engineer and the Specialist Traffic Signals Designer shall be present at this test. The SAT shall be conducted by the Specialist Traffic Signals Designer, who will ask for a sequence of tests to be demonstrated by Dynniq's Engineer. Norfolk's Traffic Signals Engineer will observe the entire SAT and will have the final say on acceptance of the testing. On successful completion of the SAT, Dynniq's Engineer shall provide the completed original copy of the Site Acceptance Test certificate to the Traffic Signals Engineer, signed by Dynniq's Engineer and the Traffic Signals Engineer.
- 3.7.3 The SAT shall be conducted when all elements of the installation(s) are considered by Norfolk's Traffic Signals Engineer and Dynniq (Norfolk County Council's Term Maintenance Contractor) to be complete. This includes all associated civil works (ducting, chambers, tactile paving etc), road markings, in-station connections and configurations.
- 3.7.4 The SAT will NOT be carried out on Fridays or Weekends. The normal days to carry out SAT's are Monday – Thursday (excluding Bank Holidays).
- 3.7.5 For health and safety reasons and as far as reasonably practicable SAT's shall ONLY be carried out during daylight hours. If a SAT is started in daylight hours but may not finish before dusk then the SAT may, at the instruction of either the Dynniq Engineer or Norfolk's Traffic Signals Engineer, be adjourned until such time as completion of the SAT during daylight hours is possible. A SAT will NOT be started during either the hours of darkness or if the weather is deemed to be unsuitable.
- 3.7.6 The Promoter's Principal Contractor or its sub-contractors shall not leave the junction open to traffic, under the control of the installation, until a Final Site Acceptance Test Certificate has been issued.
- 3.7.7 A copy of the Earth Loop Impedance test schedule shall be supplied to the Traffic Signals Engineer before the SAT commences.

3.8 Control Strategy Validation

- 3.8.1 The Specialist Traffic Signals Designer will be required to validate and monitor the necessary parameters associated with any control strategies deployed (typically SCOOT or MOVA) during typical peak periods appropriate for the individual site (typically weekday AM and PM), to be agreed with NCCs Traffic Signals Team. Norfolk County Council reserves the right to observe any validation work at the promoters cost.

4. Approved contractors

4.1 Traffic Signals Contractor

- 4.1.1 Norfolk County Council's term contractor for both the installation of new schemes and maintenance is Dynniq Ltd and any promoter will be obliged to employ Dynniq Ltd for their scheme installation to ensure compatibility of equipment and systems.
- 4.1.2 The Promoter shall be responsible for placing all orders and for the payment of all accounts in respect of the Specialist Traffic Signals Installation Sub-Contractor, Dynniq Ltd.

5. Health and Safety

5.1 General

- 5.1.1 Traffic signals installation works always fall under the current version of the Construction Design and Management Regulations. The Promoter, the Specialist Traffic Signals Designer, the Principal Contractor and all Sub-Contractors shall adhere to the requirements of these Regulations.
- 5.1.2 The Promoter, Specialist Traffic Signals Designer and/or the Principal Contractor shall ensure that all systems are designed so that they can be constructed and maintained safely. Any particular safety issues that require special attention shall be highlighted, and risk assessments and method statements prepared. This is of particular relevance with regards the proximity and access to and from the maintenance bay areas and access to non-standard height poles. These shall be incorporated into the Construction Phase Health and Safety Plan. The Promoter, Specialist Traffic Signals Designer and/or the Principal Contractor and all Sub-Contractors shall comply with the Norfolk County Council bylaws, all regulations, instructions and notices.
- 5.1.3 All personnel working on the Highway Authorities traffic control systems shall be Sector 8 accredited to the relevant level for the works they are undertaking.
- 5.1.4 All personnel working on the Highway Authorities traffic control systems shall wear the appropriate personal protective equipment or as required by the principal contractor.
- 5.1.5 The Promoter, Specialist Traffic Signals Designer and/or the Principal Contractor shall be fully aware of and comply with the requirements of all relevant Health and Safety legislation.
- 5.1.6 Controller cabinet door(s) shall be closed and secured whenever unattended. Unattended is defined as not in the immediate vicinity of the controller or any live exposed conductor. It will not be acceptable to be a distance away making it impossible to take avoiding action should any person attempt to interfere with any live equipment. If for whatever reason this is not possible, the Contractor shall position suitably signed temporary safety barriers around the controller or any live conductor.
- 5.1.7 An area adjacent to the Controller(s) shall be provided for parked vehicles (minimum long wheel based transit) to allow future maintenance of the traffic control system. If there is only verge then this will need to be strengthened using a system of reinforced grass protection.

- 5.1.8 If not located in an existing footway, a hard standing area shall be provided around the controller service area, and needs to be a minimum of 0.5m surrounding the controller and feeder pillar with a minimum of 2m² in front of the controller to afford easy access to all equipment even when service doors are fully opened. The whole area needs to be completely contained within the limits of the adoptable public highway.
- 5.1.9 A hard standing area (min 3m x 1.5m) shall be provided surrounding all traffic signal poles sufficient to facilitate safe use of 'A' frame ladders for installation and maintenance of the traffic signals equipment.
- 5.1.10 Non-standard height and folding traffic signal poles shall be provided with a hard standing area as above in 5.1.9 and in addition shall include hard standing area to accommodate the pole in its horizontal maintenance position.

6. Electrical Installation and Power Supply

6.1 IEE Regulations

- 6.1.1 Traffic Signals equipment shall comply with BS EN 12368:2015 and the current IEE Wiring Regulations Eighteenth Edition (BS7671:2018).
- 6.1.2 The above documents are amended or updated from time to time. The versions that are currently in force shall be used for Traffic Control work.
- 6.1.3 The completed installation shall be electrically tested in accordance with IEE regulations and an Electrical Completion Certificate shall be issued to the Highway Authority prior to the commencement of an SAT. Under No circumstances will the Highway Authority accept an installation for SAT that does not have this signed certificate.

6.2 Electricity Supply

- 6.2.1 The Principal Contractor shall install an electricity supply feeder pillar (Haldo 66) adjacent to each controller for the termination of the electricity supply.
- 6.2.2 The Promoter/Principal Contractor shall arrange for the provision of a permanent, unmetered, 240v 50Hz AC single phase 25A electricity supply for each controller.
- 6.2.3 The supply must be a direct independent connection to the electricity distribution network, NOT in series with a street lighting column, illuminated sign, internally illuminated bollard, etc.
- 6.2.4 The electricity supply will be provided and terminated by the local power distribution company within the feeder pillar.
- 6.2.5 The Haldo 66 feeder pillar shall be galvanised, complete with root and shall have a wooden back board fitted.
- 6.2.6 Dynniq shall connect the controller power supply to the main power supply in the external feeder pillar. The connection cable between the consumer side cut-out and the controller shall conform to the current issue of BS7671 and shall be double insulated with a minimum conductor CSA as required by the system load and in accordance with standard detail NCD-1400-01B.
- 6.2.7 Dynniq are to ensure that the electricity distribution company has installed the correctly rated BS88 HRC (High Rupturing Capacity) cartridge fuse into the main cut out when connecting the power supply.

6.3 Distribution Network Operator

- 6.3.1 Within the County of Norfolk the Distribution Network Operator (DNO) is UK Power Networks (Operations) Ltd.

7. Traffic Signals Equipment Requirements

7.1 General

7.1.1 All new traffic signals equipment will be supplied by Dynniq Ltd and shall be of new unused condition, complete with all ancillary parts required to allow SAT of the installation. The equipment shall be of the latest specification pertinent to that piece of equipment.

7.1.2 All new traffic signals equipment shall have, as a minimum, a one-year unconditional manufacturer's warranty for all parts and labour.

7.1.3 Traffic signals equipment shall comply with:

- The current TOPAS specifications relating to traffic signals and associated equipment
- The current TOPAS standards relating to traffic signals and associated equipment
- The current DfT advice notes relating to traffic signals and associated equipment.

Where no specification exists for a piece of equipment, the proposer shall consult with the Traffic Signals Team as to the suitability of the equipment before use.

7.1.4 Lamp columns shall not be used to accommodate signal heads.

7.1.5 All staff employed in the installation, testing and SAT shall be suitably trained and competent and conversant with the requirements of BS 7671 and the Electricity at Work Regulations 1989. All such staff shall carry the appropriate valid Sector 8 scheme card that is pertinent to the work they are carrying out.

7.2 Controller and configuration.

7.2.1 Dynniq PTC-1 or PTC-1 Lite controllers shall be used dependent upon the number of phases required.

7.2.2 Traffic signal controllers shall be configured in accordance with the MCH1827B specification and configuration forms shall be issued at the appropriate approval stage.

7.2.3 Vehicle red lamp monitoring shall be provided at signal junctions, two vehicle red fails on the same phase to inhibit pedestrian phases and light wait lamps. This also applies to all pedestrian phases where multiple streams are used where pedestrian routes involve pedestrians crossing onto centre islands.

7.2.4 At signalised junctions incorporating a remote pedestrian facility, if the remote facility extinguishes due to two red lamps failing the junction shall remain on.

- 7.2.5 Vehicle red lamp monitoring shall be provided at signal crossings, two vehicle red fails on the same phase to switch signal lamps off.
- 7.2.6 At staggered mid-block crossings if two red lamps fail on one crossing side then both crossing sides of the installation will extinguish.
- 7.2.7 A standard 5 seconds period for the green man (invitation to cross) shall be used at all nearside installations, unless the promoter demonstrates a good reason as to why this should not be appropriate and is agreed with the Traffic Signals Team.
- 7.2.8 Tactile cones shall rotate for only 5 seconds at start of green man signal.
- 7.2.9 Norfolk standard DFM groups are as follows: -
- Inductive loops: 30m Active 18hrs inactive (fail active)
 - SCOOT loops: 30m Active 18 hrs inactive (fail inactive)
 - MVD's: 30m Active 18hrs inactive (fail active)
 - Magnetometers: 30m Active 18hrs Inactive (fail active)
 - Push buttons: 15m Active 120 hrs inactive (min) (fail inactive)*
 - Kerbsides: 90m Active 120hrs Inactive
 - On Crossings: 30m Active 18hrs Inactive – 2.0s ext. Inverted (fail inactive)

*This Inactive time may be adjusted to suit the specific site conditions.

7.3 Equipment monitoring

- 7.3.1 The Highway Authority currently operates a Siemens UTC system that requires UTMC OTU's to be connected via either IP mesh network, 4G or ADSL to facilitate the necessary IP communications.
- 7.3.2 At non-UTC sites remote monitoring is implemented by the use of SeNd Technology Ltd Mobi.Control devices utilising 4G communications.
- 7.3.3 Due to the complexity of communications options, the Specialist Traffic Signals Designer should contact the Traffic Signals Team for guidance.
- 7.3.4 All monitoring and communications systems at installations must have the latest hardware, software and firmware to communicate with existing Norfolk ITS systems.
- 7.3.5 All monitoring and communications systems shall be fitted and fully functional, 1 week prior to conducting the Site Acceptance Test (SAT).
- 7.3.6 It shall be the Promoter's responsibility to install the approved communication systems, which must be brought into commission prior to the SAT of the signals installation and must be terminated inside the approved street cabinet.

- 7.3.7 All relevant communication and configuration details need to be supplied to Norfolk ITS at least 1 week prior to the planned SAT, including IP addresses, usernames and passwords as applicable.

7.4 Traffic signal poles

- 7.4.1 Dynniq shall supply all traffic signal poles in accordance with Norfolk County Council's requirements.
- 7.4.2 The standard colour of poles and the controller will be black unless otherwise required by the Traffic Signals Team.
- 7.4.3 Self adhesive white numbers 75mm in height shall be stuck on each signal pole as shown on the drawings, set as high as possible on small poles and level with the bottom bracket on other poles, in view from the controller.
- 7.4.4 Norfolk discourages the use of extension brackets; however they may be used with approval of the Traffic Signals Team. No brackets will be accepted if they have been altered or are damaged in any way. The length required shall be approved by the Traffic Signals Team.

7.5 Signal heads

- 7.5.1 Dynniq shall supply all traffic signal heads in accordance with Norfolk County Council's requirements.
- 7.5.2 Primary visors or hoods shall be provided on closely associated secondary signal heads at junctions and the traffic heads of mid-block crossings. The scheme drawing will identify this requirement.

7.6 Push button units and nearside pedestrian/cycle/equestrian signals

- 7.6.1 Combined push buttons and nearside signals are to be used as standard.
- 7.6.2 Pushbutton height to be 1.0 to 1.1 metres.
- 7.6.3 If a separate nearside signal unit is required, its height is to be 1.4 to 1.5 metres to middle of unit.
- 7.6.4 Narrow field of view nearside signals may be used where specified by the designer to overcome sight through issues.
- 7.6.5 High level nearside signal repeaters are acceptable where a higher volume of pedestrian users is expected.
- 7.6.6 High level nearside signal (repeaters) used in conjunction with a combined nearside signal/pushbutton unit to be set to 2.0 to 2.1 metres to the middle of unit.

7.6.7 Nearside signal and pushbutton units to be set at 25 degrees from outer kerbs, 15 degrees from oncoming traffic on central poles on refuge 'D' islands, and unit faces to be 90 degrees from island kerbs (e.g. staggered crossings).

7.6.8 All pushbutton units are to be fitted with tactile rotating cones.

7.7 Use of audible indicators at pedestrian crossings

7.7.1 Audible indication will be used for the minimum green of the pedestrian phase. The sound may be extended depending on the configuration of the pedestrian phase.

7.7.2 In some situations adjacent to residential properties the audible indication will be silenced during the night. The times when audible signals will not usually be used are between 22:00 hrs to 07:00 hrs, seven days a week.

7.7.3 Where independently operating pedestrian crossings are in close proximity to each other audible indication will not be used. A distance of 50m should be used as a guide; however, this is at the discretion of the Engineer as propagation of sound depends upon the local environment.

7.8 Pole mounted detectors

7.8.1 All new pedestrian crossing facilities at mid-block crossings and included in junctions shall incorporate near side pedestrian technology. These crossings are to be capable of demand dependant extensions facilitated through the use of on-crossing detection. The requirement of unlatching demands facilitated through the use of kerb-side detectors is not always a requirement in Norfolk and clarification from the Traffic Signals Team is essential.

7.8.2 Sufficient on-crossing detectors must be provided to ensure full coverage of the proposed crossing length between the road studs.

7.8.3 If kerb-side detectors are used, they must provide full coverage of the proposed crossing width.

7.9 Magnetometer detection equipment

7.9.1 Magnetometer detection equipment shall only be used as a last resort following discussions with the Traffic Signals Team.

7.10 Carriageway loops

7.10.1 All slot cutting and loop installation work shall be carried out by approved sub-contractors of Dynniq Ltd.

7.10.2 Any loop configuration, cut into the carriageway, must be a minimum of 0.5m from any existing ironworks (covers, frames, drain gullies, etc.) in any direction.

7.10.3 Loop tails shall be jointed to feeder cables using reusable joint enclosures located in an adjacent inspection chamber. 50mm orange traffic signals duct shall be installed under kerbs from the adjacent inspection chamber to the carriageway edge for loop tails to be cut into. In some situations, a carriageway loop box may be required that connects to the 50mm duct.

7.10.4 Single pair feeder cable is to be installed between each MOVA loop and controller.

7.11 UTC control

7.11.1 The Highway Authority operates a Siemens, SCOOT Controlled, UTC system. All new installations that are required to be under UTC control shall be fitted with a compatible UTMC Outstation Transmission Unit (OTU).

7.11.2 Changes to the In-station hardware, software, or database, necessitated by the new installation, shall only be undertaken by the Highway Authority or its agents. All reasonable costs for this shall be borne by the Promoter.

7.11.3 The OTU communications are IP based and as such require the provision of a suitable communications link. Where possible this will be via existing or new private communications links. If this is impractical then a suitable 4G or ADSL connection will be used.

7.11.4 The provision of suitable communications will need to be approved by the Traffic Signals Team at an early stage. The cost of its installation shall be borne by the scheme promoter.

7.11.5 When designing and writing configurations, Norfolk's standard UTC control and reply words shall be used. Please contact the Traffic Signals Team for further advice.

7.12 MOVA control

7.12.1 Where MOVA control is required, Dynniq will supply a MOVA outstation with the latest version of MOVA and relevant licence.

7.12.2 MOVA documentation required to be reviewed include the following:

- MOVA link/lane diagram depicting lanes, lines and detectors
- MOVA report file, .MDS and .MOVA files all derived using TRL MOVA tools programme

7.12.3 All MOVA controlled junctions are to be configured to enable MOVA and UTC as modes of control and the controller specification shall include details of all UTC related bits to enable the dual functionality.

7.12.4 Remote monitoring for MOVA controlled junctions shall be implemented via the IP mesh network, 4G or ADSL to the existing Siemens UTC in-station.

8. Communication connections

8.1 General

- 8.1.1 The Promoter/Principal Contractor shall pay all costs associated with the supply of communication facilities for the installation.
- 8.1.2 The Principal Contractor is responsible for all civils works relating to the installation of the communication facilities.
- 8.1.3 The Promoter shall ensure that the communication facilities are connected/ installed and shown to be working at least 1 week prior to SAT. This testing will involve the Traffic Signals Engineer, so the contractor shall liaise with the Traffic Signals team giving a minimum of 15 working days' notice of the testing date.
- 8.1.4 Any necessary LAN IP addresses for Signals equipment will be provided on request by the Norfolk ITS Team.

8.2 Communications at Existing Installations

- 8.2.1 For all existing traffic signals sites please contact the Norfolk ITS Team for clarification.

8.3 Private Communication Circuits

- 8.3.1 Norfolk County Council owns private communication networks within Norfolk.
- 8.3.2 Where feasible, Norfolk County Council may require the Promoter to connect the installation to the existing private communications network, via a new additional extension. The Promoter will be responsible for all associated costs.
- 8.3.3 Norfolk's Traffic Signals contractor, Dynniq, will carry out all connections between the Traffic Signals equipment and the private communications network.
- 8.3.4 The Principal Contractor is responsible for any civils works relating to the connection to Norfolk's communications network.

8.4 4G and ADSL

- 8.4.1 If it is not possible to utilise Norfolk's existing private communications network for new installations, guidance regarding the appropriate choice between 4G and ADSL should be sought from the Traffic Signals Team.

8.5 Router specification

- 8.5.1 Any necessary router shall be supplied by Dynniq and be of a type already approved by Norfolk County Council.

9. Civil works requirements

9.1 Poles and pole retention sockets

9.1.1 All poles shall be installed in retention sockets manufactured by NAL Ltd. The standard retention socket is RS115 with a 'duck foot' cable entry and is Norfolk's only acceptable means to support signal poles and to ease the subsequent cabling of the installation and maintenance.

9.1.2 The required depths of NAL retention sockets to be used are:

- 600mm overall height sockets for 2.1m pole
- 600mm overall height sockets for 3.8m pole
- 750mm overall height sockets for 4.1m swan neck or 6m tall poles

9.1.3 The positions of poles and therefore the retention sockets are indicated on the drawing and should be set out on site accordingly. Where there is any doubt about signal pole/retention socket positions or the installation of any inspection chambers, the Traffic Signals Team shall be called to attend site to agree any changes (01603 222804).

9.1.4 Traffic signal poles at crossing points to be installed at 500mm (+/- 50mm) from face of kerb and 500mm (+/- 50mm) from edge of tactile paving as measured to the centre of the pole. For Toucan crossings the distance from the kerb face shall be increased to 700mm where sufficient footway space allows.

9.1.5 Traffic signal poles on 'D' islands with crossing facilities shall be installed at 350mm from face of the kerb at crossing points and centred on the island.

9.1.6 No part of signal heads shall be closer than 450mm to a line perpendicular to the edge of carriageway.

9.1.7 An absolute minimum footway width 1.0 metre must be maintained at any pole position.

9.2 Electricity feeder pillar

9.2.1 The necessary feeder pillar will be issued to the civils contractor by Dynniq.

9.2.2 The feeder pillar shall be installed by the civils contractor adjacent to the controller as detailed in the scheme drawings.

9.2.3 A link duct 50mm orange smooth bore shall be installed between the feeder pillar and the controller base for the traffic signals contractor to use for the power supply cable from feeder pillar to controller.

9.3 Ducting system

- 9.3.1 Ducts shall be made from polyethylene, with a smooth internal face. The ducts shall be coloured orange and inscribed with lettering, minimum 5mm high at 1m centres "TRAFFIC SIGNALS".
- 9.3.2 The duct runs shall be in straight lines between chambers. No preformed bends shall be used. Where necessary, ducts shall be joined by means of custom made polyethylene connectors and or spigots.
- 9.3.3 The ends of all ducts shall be incorporated into inspection chambers, signal pole retention sockets or the controller root, with the exception of 50mm under-kerb ducts for loop tails.
- 9.3.4 Each duct shall be fitted with a pigmented and stranded polypropylene draw rope of minimum 5KN breaking load and having a design life of not less than 20 years, the ends of which shall be secured to prevent it being pulled back into duct.
- 9.3.5 The spacing of chambers along duct runs shall normally be 30m maximum, but never exceed 50m.
- 9.3.6 Ducts shown on the drawings for traffic signal cables shall not be used to carry any other type of service.
- 9.3.7 The minimum cover for ducts laid in the carriageway shall be 750mm. The ducts shall be bedded in accordance with detail Type B in HCD I2.
- 9.3.8 The minimum cover for ducts laid in the footway/verge shall be 450mm the ducts shall be bedded in accordance with detail Type L in HCD F2.
- 9.3.9 Where it may be necessary to lay ducts with less than standard cover, the Traffic Signals Team shall be consulted on requirements.
- 9.3.10 If written permission for any deviations from this document is not obtained as detailed above, then the installation will not be accepted at the Handover Inspection.
- 9.3.11 Mains power supply cables shall not be housed within the traffic signal ducting.

9.4 Inspection chambers

- 9.4.1 Inspection chambers shall be a twin-wall design and assembled from stackable sections in accordance with Norfolk's standard detail NCD-0500-16.
- 9.4.2 Inspection chamber sections must have the ability to be adjusted in height during installation by being cut laterally without loss of strength to allow for transitional gradient installations.

- 9.4.3 Inspection chamber sizes must be appropriate for the number of ducts/cables accessing the chamber. The size will also be dependent on the ease of access to ducts depending on depth. All chamber sizes will need approval by the Traffic Signals Team.
- 9.4.4 Composite covers must be EN124 with a C250 (25 tonne) loading.
- 9.4.5 Composite covers must be supplied with lockable Steel frames which are hot dipped Galvanised to BS EN ISO 1461:2009.
- 9.4.6 Frames must be supplied with a fixing mechanism which enables them to be secured to the Access chamber.
- 9.4.7 Loop chambers to be installed for each set of loops. The minimum size of a loop chamber is 300mm x 300mm but is dependent on the number of cables needed to be installed back to the controller.
- 9.4.8 Under-kerb 50mm orange traffic signal ducts will be required from the loop chamber to the carriageway or carriageway loop box.

9.5 Tactile paving and dropped kerbs

- 9.5.1 Tactile paving and dropped kerbs for all pedestrian crossings shall be constructed to our standard drawing number NCD-1100-21.
- 9.5.2 The setting out and alignment of the tactile paving and dropped kerbs shall be for the whole crossing and not for a single side at a time.

9.6 Detection loops and slot cutting

- 9.6.1 All slot cutting and loop installation work shall be carried out by approved sub-contractors of Dynniq Ltd.
- 9.6.2 Slot cutting through channel blocks or kerbs will not be permitted.
- 9.6.3 Slot cutting can only commence once sufficient stop lines and lane markings have been laid in the correct location. If for any reason slot cutting takes place prior to the laying of road markings, and are subsequently found to be incorrect, the loops shall be recut (without cost to the authority) in the correct position.

9.7 Road markings

- 9.7.1 Unless otherwise directed by the Highway Authority all markings shall conform to the requirements of The Traffic Signs Regulations and General Directions and subsequent amending regulations.
- 9.7.2 Vehicle stop lines at signal controlled crossing points shall be laid at 3m from crossing studs prior to SAT.

9.7.3 Vehicle stop lines where there are no signalled pedestrian facilities shall be laid at 2m from crossing studs prior to SAT.

9.7.4 For Advanced cycle Stop Lines (ASL), the cycle stop line shall be laid at 1m from the primary traffic signal pole and the vehicle stop line shall be laid at 4m to 5m from the cycle stop line (usually 4m), prior to SAT.

9.8 Road studs

9.8.1 The Principal Contractor shall be responsible for the correct setting out of all studs.

9.8.2 Only road studs manufactured of Stainless Steel will be accepted. They shall be square, silver in colour and between 95mm and 110mm square.

9.8.3 Surface mounted studs are not acceptable.

9.8.4 The 'pitch' of studs used to delineate pedestrian crossing(s) shall be 0.50m subject to the tolerances permitted by the appropriate regulations. The minimum distance from any kerb to the first stud or mark shall be 0.5m and the maximum distance from any kerb to the first stud or mark shall be 0.7m.

9.9 Guard railing

9.9.1 Any guardrail specified for new installations will be 'Visirail' and the appropriate V2 V4 V8 type detailed.

9.9.2 No part of any guardrail shall be closer than 400mm to a line perpendicular to the edge of carriageway.

9.10 Skid resistance on the approach to crossings

9.10.1 The scheme design shall ensure that skid resistance on the approaches to pedestrian crossings meet the requirements of Norfolk County Council's 'Skid Resistance on Approach to Pedestrian Crossings v2'.

10. Traffic safety and management

10.1 General

10.1.1 Prior to the SAT of new installations, temporary signs shall be provided and erected on each approach and maintained in position for a minimum of 3 months. The signs shall be in accordance with the Traffic Signs Regulations & General Directions 2016 (TSRGD), Diagram 7014 using the most appropriate variant.

11. List of relevant standard detail drawings

NCD-0400-01	'Visirail' Type pedestrian Guardrail
NCD-0500-16	Twin Wall UPVC Inspection Chamber
NCD-0500-17	Traffic Signal Pole Foundation
NCD-0500-18	Traffic Signal Controller Foundation
NCD-1100-08	Tactile Paving ('L' Layout)
NCD-1100-09	Grass Block Paving
NCD-1100-21	Pedestrian and Cycle Crossing Points
NCD-1200-15	Pedestrian Crossing Stud
NCD-1400-01B	Electricity Feeder Pillar for Traffic Signals

12. Related documents

Skid Resistance on Approach to Pedestrian Crossings v2

UTC Bit Pattern Requirements Revision 1

Mobi.Control Setup Requirements Revision 1