Version	Date	Prepared	Date	Verified	Date	Approved	Date
01	May 2026	DW	12.05.2026	SW	12.05.2026	MB	03.06.2026

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1.0 General Requirements for traffic signalling systems

1.1 This specification sets out the requirements for the procurement, supply, installation, and commissioning of traffic signal equipment in Gloucestershire. Works shall comply fully with the Department for Transport (DfT) Standards for Highways and Chapter 6 of the Traffic Signs Manual. Where differences arise between the content of this specification and any referenced specifications or documents the contents of this specification shall be adopted.

1.2 This specification shall be read in conjunction with National Highways requirements TC 101 Traffic signalling systems - Version E_1.0.0-1 and the GCC Traffic Signals-TC101 DMRB amendments shown in Appendix F.

1.3 The Contractor shall be responsible for the design of the electrical installation. The Contractor shall complete and return to the Overseeing Organisation details of the cable layout and capacity proposals or confirm any cable design details issued on drawings or works schedules are suitable. The Contractor shall also check and accept duct and chamber designs and capacity. Cable installation as-built record sheet shall be submitted for acceptance at pre-commissioning sign off.

1.4 Civil engineering requirements are provided with respect to the erection of traffic signal street furniture and associated service duct and access chamber systems. These requirements are additional and supplementary to any other engineering requirements detailed in a general works specification and design details.

1.5 For all County Council projects, the Client shall be Gloucestershire County Council. Where this document is nominated or modified to be used for external projects the Client reference shall be amended accordingly. References to GCC shall be Gloucestershire County Council or the County Council Traffic Signals Department. Overseeing Organisation shall be engineering representatives given due authority for administration, supervision and design responsibilities on behalf of the Client. These shall include as advised under specific projects or contracts, Consultants and term Consultants. Where a term Consultant and Contractor are one in the same company, they shall act in accordance with the requirements of the specification, the contract and its conditions independently, to provide compliant services. The Overseeing Organisation shall be nominated and recorded at the commencement of the Contract.

1.6 The Overseeing Organisation shall issue to the Contractor site specific design drawings and schedules, providing information for the installation and location of the traffic signal equipment.

1.7 The Contractor shall be responsible for ensuring that any Sub-Contractor employed under this Contract are identified to the Overseeing Organisation for acceptance, and that all works are fully supervised and checked in accordance with the specification.

1.8 The Contractor shall be deemed to have inspected the site at the time of preparing his quotation or tender and to be satisfied on all matters relating to the requirements of the works specification.

1.9 The Contractor shall note that the GCC Client does not normally allow new traffic signal installations to be commissioned on Fridays, Saturdays, Sundays or Bank Holidays, unless formally agreed in advance works programming.

1.10 All traffic signal equipment shall be set out by the Contractor in accordance with the positions shown on the Contract Drawings with due consideration to the specification. Positions shall be verified on site in conjunction with the Overseeing Organisation / GCC Client prior to the commencement of work. Pole and Cabinet setting out shall consider adequate and appropriate clearance to any adjacent street furniture, comply with minimum clearance standards to edge of carriageway and safe working distances from adjacent Road Restraint Systems.

1.11 The Contractor shall take full responsibility for safe working practices and ensure adherence to site specific rules and health and safety documentation. Procedures issued by the Principal Contractor under CDM are mandatory. In addition, the following guidance, regulations and specifications shall be adhered to:

a) Electricity at Work Regulations 1989
b) Health and Safety at Work Act 1974
c) Management of Health and Safety at Work Regulations 1999
d) The Construction (Design and Management) Regulations 2015
e) COSHH regulations
f) Latest Edition IEE Regulations for Electrical Installations (BS 7671:2018 IET Wiring Regulations 18th Edition)
g) Chapter 8 Traffic Signs Manual.
h) Chapter 6 Traffic Signs Manual.
i) EMC Regulations
j) Design Manual for Roads and Bridges

1.1 Commencement of Works

1.1.1 Works shall only commence following applications granted by the Traffic and Transport Department NRASWA Street Works Coordinator, with all works being subject to appropriate notices and acceptances granted under this system.

1.1.2 Works shall only commence following submission and acceptance by the Overseeing Organisation of the Contractors works programme. The works programme shall be submitted using either MS Project or Excel and shall identify all works activities and key milestones in the procurement, lead-in, site installation and testing / commissioning processes.

1.1.3 Works shall only commence following submission and acceptance of the Contractors developed Health and Safety Plan which shall include site specific information.

1.1.4 Failure to comply with the above requirements will place the Contractor at risk for future tendered schemes.

1.2 Site Decommissioning

1.2.1 Decommissioning of existing sites prior to removal or refurbishment shall be specified in site specific works instructions and drawings. Signals shall only be switched off with the prior permission of the Overseeing Organisation and with site

specific Traffic Management in place, and certification of power isolation and disconnections.

1.2.2 GCC Traffic Signals Team shall be given at least 48hrs notice of the actual switch-off and decommissioning of junctions or crossings to avoid invalid fault reporting and attendance.

1.2.3 Site paperwork, documents and logbook shall be retained and handed to GCC client for all decommissioned installations.

1.3 Traffic management requirements

1.3.1 Traffic Management associated with junction installation and refurbishment works shall generally be supplied and maintained by the Principal Contractor. Traffic Management may be ordered from the Contractor with site specific works information. These works shall be undertaken using suitably qualified staff or approved specialist Contractors.

1.3.2 Traffic management for slot cutting operations shall normally be provided by the Contractor and shall comply with the recommendations of Traffic Signs Manual Chapter 8 as appropriate to the statutory speed limit applicable to the Site. The Contractor shall submit details of his proposals to the Overseeing Organisation for acceptance prior to commencing works.

1.3.3 Traffic management requirements, diversions, lane or road closures to be identified and applied in accordance with Appendix E.

1.4 Site working hours

1.4.1 Operations affecting traffic flow are to be undertaken outside of peak traffic hours (Peak hours being Mon to Fri 07:00 to 09:15 and 15:15 to 18:00). Where slot-cutting is carried out outside normal working hours the work shall include Contractor's supervising staff time in attendance during such operations.

1.5 Asset identification systems

1.5.1 Cable identification shall be provided at each road crossing or controller Access chamber using a pull-tag or equivalent approved system.

1.5.2 All cables in all road crossing access chambers shall be marked with a tag sleeve or pull tight marker system indicating the asset connected i.e.: Pole / Loop reference. Markers may be colour coded to represent the voltage carried or have the voltage carried marked. If pull tight tags are used indelible ink shall be used to reference the tag.

1.5.3 All cable cores at each end of cable terminations shall be referenced and recorded.

1.6 Colour and external finish of traffic signalling systems

1.6.1 Controller and Miscellaneous Cabinets shall be black in colour with anti-graffiti coating.

1.6.2 Poles shall be galvanised prior to the application of **black** plastic coating.

1.6.3 Passive poles shall be manufactured from aluminium, steel or composite materials suitable for external highway environments.

1.6.4 Corrosion protection shall be provided by hot dip galvanising, powder coating, anodising or equivalent

1.6.5 Feeder pillars shall be black powder coated finish.

1.7 Telecommunication service provider (TSP) interface

1.7.1 Communication systems for Remote Monitoring and Urban Traffic Control shall be data SIM as supplied by GCC client.

1.8 Comms Addressing & Router

1.8.1 In order to comply with Traffic and Transport Department UTMC or RMU system networks, ruggedized 4/5G SIM enabled routers shall be supplied. This shall include all network cables Ethernet port/connections and switches for additional equipment and remote laptop connection and interrogation.

1.8.2 Where more than one controller is to be connected utilising the same communications link, ethernet connections using multi-port ethernet amplification systems shall be supplied and connected with either armoured 16c cable or 10pr CAT5e powder filled BT type cable.

1.8.3 The Controller, UTMC / RMU / MOVA systems shall be capable of remote (MEC) or (system) IP addressable interrogation.

1.8.4 The Contractor shall install the router in an appropriate position in the controller racking ensuring that Ethernet switch connections are available for laptop interrogation and the connection of other ancillary apparatus such as CCTV.

1.8.5 The Contractor shall set up the router its connections and terminations including where necessary UTC IP tunnels. Internal settings such as I.P. addressing, shall be carried out in conjunction with the Overseeing Organisation.

1.8.6 The router shall have its own fused auxiliary power supply, suitably rated and marked accordingly.

1.8.7 Where UTC, MOVA and RMS systems are specified the Contractor shall provide integral facilities. Where any conflict arises in supplying suitable I.P. addressing across integral facilities the Contractor shall propose an effective solution at contract award, for acceptance by GCC client. For example, UTC and MOVA integral and RMS external add-on, with either combined or separate router and switches.

1.8.8 The communication system for RMS and UTC shall be wireless with suitable cabinet mounted or pole mounted antenna. Data enabled SIM cards shall normally be supplied by GCC but may be directed to be ordered by the Principal Contractor.

1.9 Verification requirements for traffic signalling systems

1.9.1 The Contractor shall supply a draft configuration in test file format and PDF format 10-working days prior to the FAT to enable a review by the Overseeing Organisation. The Contractor shall supply the final configuration data in electronic format issued by email to the Overseeing Organisation. Hard copies of the controller specification printout, shall be provided in the controller and any remote MEC's ready for SAT.

1.9.2 Configured junction controllers shall be made available for testing at the signal company's local depot or the Overseeing Organisation Offices. The Contractor shall ensure that any controller is made available for factory acceptance testing no later than 4-weeks from the issue of the works specification forms and a minimum of 10-working days prior to site installation, unless agreed otherwise by the Overseeing Organisation. The Contractor shall give the Overseeing Organisation at least 10-working days' notice of the controllers being ready for depot/factory acceptance testing. A copy of the configured specification in PDF and Emulation Format shall be given to the Overseeing Organisation at this time.

1.9.3 The tests shall be undertaken by the Contractor with the Overseeing Organisation and GCC Client present as witness. The Contractor shall demonstrate compliance with the referenced documents of TC101, works specifications and contract drawings. Suitable signal lamp mimics, adequate means of simulating detector inputs and an interface to simulate Urban Traffic Control and or MOVA control shall be provided during the tests.

1.9.4 Safety critical tests including green conflicts and red lamp monitor tests shall be carried out on the actual controller in addition to any software emulation. Safety critical test may be carried out in the supplier's local depot and signed off when complete. Safety critical tests may be repeated as part of Site Acceptance Testing providing site conditions allow.

1.9.5 A certificate shall be issued as evidence of test compliance. The Contractor shall supply to the Overseeing Organisation a copy of the controller configuration upon successful completion of the depot/factory tests in hard copy, PDF and configuration file formats.

1.9.6 Repeat tests shall be offered within 10-working days of any initial test failure. All costs incurred by GCC in attending the retest will be met by the Contractor.

1.9.7 Controller configuration emulation may be tested remotely via Zoom or Teams.

1.9.8 Following configuration of the controller and completion of FAT the Contractor shall deliver and install the controller in its permanent site location provided a permanent 230v mains supply is available for connection. The controller shall be installed in accordance with the agreed programme of works.

1.9.9 Controllers not subject to an FAT will require additional site acceptance testing with respect to lamp monitoring and conflict testing.

1.9.10 All traffic signal components and apparatus shall be fully type approved and shall comply with the referenced documents of TC101.

1.10 Commissioning and site acceptance – junction controllers

1.10.1 Commissioning of traffic signal installations shall only be undertaken when all works, including surfacing, reinstatements, signing, pedestrian guard railing and road marking activities are complete. The traffic signals installation shall be fully complete and pre-tested by the Contractor prior to attendance by the Overseeing Organisation & GCC Client in accordance with Pre-Commissioning Test Schedules. Pre-Commissioning shall be undertaken at least 3-days prior to Site Acceptance.

1.10.2 The Contractor shall demonstrate to the Overseeing Organisation and or GCC Traffic Signals Team, compliant and satisfactory operation of the installation at site acceptance testing in accordance with test schedules contained in this specification or other agreed schedules. On completion of the tests the site acceptance certificate shall be completed by the Contractor and the Overseeing Organisation. A certificate shall be awarded provided the site is deemed to be operating satisfactorily. Any incomplete works or failed tests of a minor nature shall be noted on the interim certificate. A full completion certificate shall only be awarded to the Contractor after expiration of the fault free maintenance period. The maintenance period shall only commence when all works are fully complete and tested. The maintenance period shall typically be 28-days fault free but may be defined as a longer period in works specifications or contracts.

1.10.3 The Overseeing Organisation and GCC Traffic Signals Team, shall be given a minimum of 10-working days advance notice for the site acceptance testing by the Contractor. The Contractor shall allow one clear working day to undertake testing of the installation ensuring all resources are retained for the duration of the test procedure.

1.10.4 Green conflict and red lamp monitoring tests shall be performed on all signal installations. The process for achieving completion shall be agreed with the Overseeing Organistion.

1.11 Commissioning and site acceptance – NMU Controllers

1.11.1 Normally, there is no requirement to factory/depot acceptance test pedestrian controllers unless the site is MOVA controlled, has linking or parallel control features. GCC reserve the right to request and attend FAT under any other circumstances.

1.11.2 All testing by the Overseeing Organisation will be carried out in accordance with the site acceptance test procedures. If not included in design details, timings for the crossing sequence will be provided by the Overseeing Organisation no later than 10-working days before the controllers are required on site.

1.11.3 The controller configuration for crossings with MOVA or any special requirements must be submitted to GCC for checking not less than 10-working days prior to FAT or exceptionally, the controller being delivered to site.

1.11.4 Following configuration of the controller and completion of FAT the Contractor shall deliver and install the controller in its permanent site location provided a permanent 230v mains supply is available for connection. The controller shall be installed in accordance with the agreed programme of works.

1.11.5 Controllers not subject to an FAT will require additional site acceptance testing with respect to lamp monitoring and conflict testing.

1.12 Insulation Resistance Tests

1.12.1 The insulation resistance of each cable and their individual cores shall be tested using impedance test voltages of 500 volts' dc. for a period of one minute.

1.12.2 Before each cable is glanded to its earth point, an insulation resistance test shall be carried out between the earth and armouring, earth and each cable core and each cable core to armouring.

1.12.3 All test results shall record an impedance greater than 20 Megaohms, with the actual reading recorded by the Contractor.

1.13 Loop / Feeder Tests

1.13.1 With the feeder cables jointed to their inductive loops, the total series resistance of each loop/feeder circuit shall be tested. The total series resistance shall be less than 5 ohms, with actual results recorded by the Contractor.

1.14 Earth Fault Loop Impedance Tests

1.14.1 Earth continuity and bonding shall be demonstrated through earth fault loop impedance testing of the controller, supply pillar and each low voltage signal pole on site.

1.15 Documentation requirements for traffic signalling systems

1.15.1 All control equipment supplied together with related hardware shall be offered with one complete set of User Manuals detailing procedures for the installation, operation and maintenance of the equipment.

1.15.2 Duplicate bound copies of the configuration specifications shall be handed over at the time of site acceptance together with final 'installed' record sheets. Any RAM data changes introduced at the time of commissioning shall be noted at this time and included in a RAM data record sheet to be appended to the configuration specification.

1.15.3 A logbook shall be supplied and annotated with the controller maintenance reference number, any MOVA licensing information and IP addressing. The book shall be pro-formed with date, time on / off site, reason for visit, actions taken and signature columns.

1.15.4 The site acceptance certificate shall be signed and handed over to the Overseeing Organisation complete with one full set of keys to access all parts of the control equipment, at the time of site acceptance.

1.15.5 All relevant test certificates compliant with the site acceptance testing shall be submitted to the Overseeing Organisation as identified in the Handover Summary. An As-Built CAD drawing shall be supplied based on the Overseeing Organisation's design drawing detailing relevant site changes and accurately locating equipment, cable and detection details. The drawing shall be issued to

the Overseeing Organisation in electronic format within one-month of acceptance. Interim hard copies of design drawings shall be retained in the controller.

1.15.6 The Contractor shall retain sufficient records to provide replacement EPROMs or Configuration files in the event of EPROMs becoming damaged or requiring modification. A PDF file and an electronic version of the Controller Configuration shall be issued to the Overseeing Organisation following successful FAT.

1.15.7 Equipment training shall be supplied to the Overseeing Organisation if requested during factory / site acceptance testing for any section of equipment relating to the traffic signal control system.

1.16 Handover Pack and Handover Procedure Summary

1.16.1 Handover Pack

- Controller Manuals (available within 10-days from SAT)
- Add-on equipment Manuals (available within 10-days from SAT)
- Controller Specification - hard copy, PDF and Digital Files (available withing 2-working days following FAT)
- Completed test schedules and green conflict test certificate (available within 10-days from SAT)
- Completed electrical tests and certificates (available within 10-days from SAT)
- Remote monitoring / UTC Router and IP address data (available at SAT)
- MOVA dataset and validation report (If included in the Contract). To be supplied by others as necessary. (available within 10-days from activity)
- Bus Priority Details (If included in the Contract). To be supplied by others as necessary. (available within 10-days from activity)
- As built drawings - hard copy, PDF and Digital Files (CAD) (available within 1-month from SAT)
- Health and Safety details in compliance with CDM regulations. (available within 1-month from SAT)
- Passive pole BS EN 12767 test certificates and classification details. Manufacturer’s installation instructions and confirmation that supplied poles match the certified products.
- For installed SIS systems, the Contractor shall provide, the manufacturer’s datasheets and certification, electrical schematics showing SIS integration, operation and maintenance instructions.

1.16.2 Handover Procedures

- Contractor shall submit dates to the Overseeing Organisation for Pre-Commissioning and Site Acceptance Testing (SAT). Pre-commissioning shall be undertaken by Contractor. Pre-commissioning shall be completed by the Contractor a minimum of 3-days before the Site Acceptance Test date. Notice period for SAT to be 10-days. The Pre-Commissioning Test Schedule shall be completed and submitted for acceptance.

- SAT testing shall only be undertaken following a successful Factory Acceptance test, completion of controller conflict testing and accepted pe-commissioning. All associated site works shall be complete or substantially complete before the SAT test is conducted. Arrangements for altering and removing temporary traffic management shall be organised by the Contractor.

- The Overseeing Organisation will check availability of interested parties: Designer and GCC Traffic Signal Client and approve dates.

- The Contractor shall undertake the SAT. The Designer / Overseeing Organisation will check the various tests on an approved form. Test failures shall be noted and if unable to be rectified on the day of the SAT, these shall be rectified within an agreed time frame, the maximum time being the Defects Correction Period under the contract. Test failures which in the view of the Overseeing Organisation make the installation unsafe or ineffective shall constitute a failure of the SAT and the signals will not be switched on.

- Remedial works shall be fully tested and demonstrated to the Overseeing Organisation. A part or full SAT test shall be conducted by agreement depending on the remedial works undertaken.

- Upon successful completion of the SAT (interim or final) a completion certificate shall be issued. The Overseeing Organisation shall notify the GCC Signal Maintenance Team that the signals are to be left on and provide the relevant contract details and status of the installation to enable update of the fault management system. Successful and final completion of the SAT will start the 28-Day fault free maintenance period. During this period the Contractor shall be responsible to undertake attendance and rectification of all fault conditions as determined by the GCC Traffic Signals Team or the Overseeing Organisation. Fault conditions, classifications, attendance and rectification standards shall be as detailed in the works specification or works scope, or in accordance with the current GCC maintenance contract. The 28-day fault free maintenance period shall re-start upon rectification and provision of fault clear notification to the GCC Signals Maintenance Team and the Overseeing Organisation. Every fault attendance shall be annotated in the site logbook and detailed on a fault attendance form to be submitted to the Overseeing Organisation immediately following rectification of the fault. A copy of the form may be added to the GCC Fault Management System if directly available to the Contractor.

- Following successful completion of the 28-Day fault free maintenance period, the installation shall be taken into GCC Traffic Signals Maintenance,

and the fault management system updated to reflect completion and ongoing defects period timing off. The Defects Period or Warranty Period applied under the works contract shall include the traffic signal installation, to enable GCC Traffic Signals to have failed components replaced or repaired under the works contract. The installation completion certificate shall be re-issued and dated as fault free period attained.

- The Overseeing Organisation shall notify GCC Signals Team when the Defects Period is complete. The installation completion certificate shall be re-issued and dated as Defects Period attained.
- Where the Overseeing Organisation is responsible for collating handover details, CDM / H&S details, these shall be collated and transferred to GCC Client. Relevant details shall be updated onto the GCC IMTRAC mapping system.
- Where the Contractor or his Principal Designer is responsible for collating handover details, CDM / H&S details, these shall be collated and transferred to GCC Client. Relevant details shall be updated onto the GCC IMTRAC mapping system.

1.17 Post commissioning data and alterations

1.17.1 Following acceptance of the signals, the Overseeing Organisation may order alterations to the controller EPROM or Configuration file to incorporate minor changes and or post commission RAM data changes. The EPROM or Configuration file shall be supplied with all supporting documentation updated as necessary.

1.17.2 Revisions shall be allowed for under Provisional Item rates provided at the time of site-specific works tender or order.

1.17.3 Should the intersection exhibit faulty / undesirable operation which in the opinion of the Overseeing Organisation cannot be left without immediate attention, the Contractor shall accelerate attendance and support and make all efforts to provide an immediate temporary fix to the problems by utilising download or site EPROM revision facilities.

1.18 Site records for traffic signalling systems

1.18.1 See specification Appendices C & D.

2.0 Traffic Signal Heads

2.1 Lamps

2.1.1 Signal aspect lamps shall be ELV, LED high-intensity, energy-efficient units compliant with the referenced documents of TC101. They shall include IP65 dust/moisture protection, >8000 cd luminance for 200mm heads, and a typical lifespan of 100,000 hours, consuming <8W. Full lamp and red lamp monitoring shall be available for all lamp types.

2.1.2 Only ELV lamps shall be installed at new or substantially upgraded installations.

2.1.3 Regulatory aspects on signal heads shall comply with the referenced documents of TC101. Aspects shall be individually fused with an in-line chassis mounted fuse holder within the head. The fuse shall be rated at no more than 1 Amp and shall be easily accessible. Illumination shall be provided by low energy LED lamps.

2.2 Mounting of signal heads

2.2.1 Signal head mounting brackets shall be long enough to provide a minimum of 125º rotational adjustment. Head arrangements susceptible to rotation shall be secured with supplementary fixing brackets. The use of offset brackets shall be minimised and only used with the acceptance of the Overseeing Organisation.

2.2.2 The Contractor shall be responsible for installing vehicular signal heads on overhead mast arms and tall signal poles (exceeding 4 metres long) including the hiring of lifting equipment and traffic management. The lamp transformers shall be located in the base of the column of the overhead mast arm. The door and column shall be earthed to current edition wiring regulations. Where signal heads are mounted on lighting columns or mast arm shafts, only one hole shall be drilled for cable entry. Heads shall be mounted by using purpose made clamp brackets. Any holes drilled in columns for cable entry shall be de-burred and a rubber grommet used to seal the edge prior to cabling. Where cables are required to be looped from one head to another, protective tubing such as 'kopex' shall be used, securely fixed and glanded at each end entering the head. Cable terminations shall be fixed in weatherproof housings.

2.2.3 It is not standard practice to use street lighting columns for mounting traffic signal heads, however, where lamp columns are approved for use the power supply to the column must be connected to the same mains phase as the traffic signal controller and shall be ELV LED design. Signal heads should only be mounted on lighting columns with prior permission from GCC.

2.2.4 All signal heads shall have a minimum vertical clearance of 2.1m from finished ground level unless overhanging a cycleway in which case a minimum vertical clearance of 2.4m shall be provided. The minimum clearance between any signal head arrangement to the nearest kerb edge shall be 600mm (40mph or greater roads) or 450mm (30mph roads). Installation details which do not comply with these standards shall be immediately identified to the Overseeing Organisation.

2.2.5 The alignment of signal heads shall be carried out in accordance with the Overseeing Organisation’s siting instructions at the time of commissioning. The Contractor shall ensure that all cable and kopex links between signal heads and poles are of sufficient length to allow correct alignment.

2.2.6 The Contractor shall be aware that designs may utilise various techniques to achieve clearance of signal apparatus from the carriageway edge. This may include side mounting equipment on straight poles or rotating straight poles by 45 degrees in the retention socket. Swan neck poles may also be specified. The Contractor shall ensure that adequate rotation of heads for correct alignment can be achieved especially where close-associated offside signals are erected.

2.3 Backing Boards

2.3.1 All traffic signal aspects shall be fitted with either primary or secondary cowls. All backing boards shall have a border of Class-1 retro-reflective (white) pressure sensitive or vacuum applied material in accordance with manufacturer's procedures. Application of pressure sensitive material shall take place on dry surfaces. An ambient temperature of 15ºC minimum is recommended for satisfactory adhesion. The material shall have a 50mm width throughout. Where the continuous border bridges each backing board/signal head a distinct cut edge shall be made to avoid any subsequent stretching/shrinkage of dissimilar surfaces. The finished border shall be of a neat appearance and not made up of short lengths of cuttings.

2.4 Miscellaneous

2.4.1 Where refurbishment works or site-specific details determine that controllers and signal heads from different suppliers may be used, the Contractor shall provide a statement on the performance and compliance of such installations with respect to longevity, maintenance, lamp monitoring and red lamp monitoring. Secondary lamp monitoring systems may only be used with acceptance from GCC.

2.4.2 During installation and up until the time of commission, all signal heads, not in use shall be securely covered using purpose made orange opaque bags. Covers shall be removed at the time of commissioning in accordance with the Overseeing Organisation's instructions. Covers shall be re-applied should the signals not be accepted or the signal switch-on delayed to an alternative date.

2.4.3 Far side pedestrian heads shall only be used with prior agreement from GCC and shall generally be 'side mounted' wherever possible to increase carriageway clearance.

3.0 Nearside light signals demand units & wait indicators

3.1 Nearside displays

3.1.1 Nearside signal heads and wait indicators shall be supplied and installed in accordance with the referenced documents of TC101.

3.1.2 Pedestrian, cyclist and equestrian aspects shall be LED design and fitted with 3M masks or other equivalent means of limiting phantom effects and restricting view angle.

3.2 Demand units & wait indicators

3.2.1 Push button units shall be constructed in durable vandal resistant non-combustible material.

3.2.2 Push button switches, 'WAIT'/demand indicators, audible units and rotating tactile devices shall be capable of operating at 48 volts or less.

3.2.3 Push button units are to be fitted with rotating tactile devices and if specified, audible units. A facility shall be provided to inhibit the audible signal between 22:00 and 07:30 each day or at any other times as specified.

3.2.4 Push button units or demand units shall be mounted so that the centre of the push button is between 1.0m and 1.1m above the finished footway level. Except where installed in islands, they shall be angled away from the kerb slightly (normally at 25º) to enable pedestrians standing at the kerbside to see the “WAIT” or ‘Demand’ indicator or nearside red man / green man display and on-coming traffic. In islands, the units shall be installed parallel to the kerb. Reference should be made to the Contract Drawings and the Overseeing Organisation’s siting instructions for individual site requirements. Any potential for ‘see-through’ shall be reported to the Overseeing Organisation at the time of installation.

3.2.5 During installation and up until the time of commission, pedestrian heads displays and demand units not in use shall be securely covered using purpose made orange opaque bags. Covers shall be removed at the time of commissioning in accordance with the Overseeing Organisation’s instructions. Covers shall be re-applied should the signals not be accepted or the signal switch-on delayed to an alternative date.

3.3 Tactile Equipment

3.3.1 Rotating cone tactile devices shall comply with the referenced documents of TC101.

3.3.2 The tactile equipment shall consist of a tactile unit and power supply. The power supply shall provide an extra low voltage output to energise the drive mechanism of the tactile unit.

3.3.3 Tactile equipment shall be of the brushless variety and shall be capable of terminating after a pre-determined time without controller conditioning.

3.3.4 Tactile devices shall utilise an improved cut away surface on the cone area for people with limited movement/feeling in their hands. AGD tactile variant Cone B (MS-240-621-B-Part number) or equivalent shall be installed.

3.3.5 Tactile input monitoring shall be provided where this can be accommodated in the controller I/O and where audible signals are not provided. Options to be discussed with GCC client.

4.0 Traffic signal detectors

4.1 Inductance loops

4.1.1 Loop detectors shall comply with the referenced documents of TC101 and MOVA / SCOOT advice and guidance.

4.1.2 The Contractor shall install all vehicle detector units in accordance with the manufacturer’s instructions ensuring that operational tolerances are achieved. Loop detector units shall be installed and terminated in the controller’s intelligent backplane and detector racking. Detector units specific to SCOOT UTC shall be installed in the detector racking integral to the Outstation Transmission Unit (OTU) or clearly segregated if integral systems are installed.

4.1.3 All loop detector units shall be suitably labelled on the adjacent racking identifying each channel with its associated input.

4.1.4 Detector sensitivity and frequency settings shall be adjusted to achieve optimum performance for the detection system in operation. Crosstalk between adjacent channels shall be eliminated. The Contractor shall adjust the sensitivity and presence time of each detector channel to the requirements specified by the Overseeing Organisation within the ranges specified in TC101 referenced documents. The Contractor shall demonstrate the correct operation of the detector for all classes of vehicles including cyclists.

4.1.5 Adjacent stop line loops (particularly those installed as rectangles) shall be call delayed in the phase red period. Where these detectors are also used as MOVA detectors the call delay shall be applied to the MOVA detector output (Mdet-xx). Current GCC standards require stop line detection to detect carbon fibre or non-ferrous bicycles with a preference for above ground technology with proven performance in both daylight and low luminance (nighttime) operation and in areas with no street lighting.

4.1.6 Should loop re-cutting be necessary, the loop carriageway box shall be re-opened, the expanding foam broken out and the reinstatement operation repeated without any disturbance to the carriageway or footway finishes.

4.1.7 Loop tail cable slots shall be backfilled with low viscosity epoxy material around the cable. The upper 20mm of the slot shall be filled with hot oxidised bitumen R85/40.

4.1.8 For new installations, where loop tails exceed 5m from the loop position to the carriageway loop box the Contractor shall immediately report to the Overseeing Organisation and before slot cutting works commence.

4.2 Inductance loop installation

4.2.1 At new installations or more major refurbishment works, the loop tails shall be laid into a loop carriageway box type NAL D400 or approved equivalent.

4.2.2 The carriageway loop box shall be connected to an adjacent loop chamber in the footway / verge by way of a 100mm diameter or 50mm diameter smooth bore orange under-kerb duct. There shall be a maximum number of three loop tail pairs cut into any carriageway loop box with only one pair on each side of the box.

4.2.3 After loop installation has been completed, the end of the duct in the loop carriageway box shall have a small amount of expanding foam inserted to prevent detritus from blocking the duct. Where slots in the carriageway loop box are not used then blanking plates shall be placed over the inside faces as supplied by the manufacturer.

4.3 Above ground detection

4.3.1 Vehicle detection may also be specified as above ground detectors, either digital view, image-processed, microwave or infrared technology.

4.3.2 Above ground vehicle detection shall comply with the referenced documents of TC101.

4.3.3 Above ground on-crossing pedestrian detectors shall comply with the referenced documents of to TC101.

4.3.4 Above ground kerbside pedestrian detectors shall comply with the referenced documents of TC101.

4.3.5 Above ground detectors capable of dual or multiple output channels shall be supplied with suitable cable lengths to reach low-level terminations and capacity of cables to achieve maximum capability of the supplied detector unit.

4.3.6 Wiring between above ground detector units shall be factory fitted and continuous between the unit and the low-level termination.

4.3.7 Power supplies for above ground detection shall be 24 volts or less and located in controller.

5.0 Traffic signal controllers

5.1 Hardware and configuration

5.1.1 Traffic Signal Controllers shall comply with referenced documents of TC101.

5.1.2 Wig-wag controllers shall comply with referenced documents of TC101.

5.1.3 Traffic signal controllers shall be configured in accordance with site specific specification data as defined in TC101 and issued by the Overseeing Organisation as part of works information / specification.

5.1.4 Traffic signal junction controllers shall be supplied with a minimum number of 16 phases and shall be capable of a 32-phase configuration.

5.1.5 All traffic signal controllers (including pedestrian and wigwag) shall have an externally accessed manual panel and external DFM indicator. All manual panel switches and indicators shall be clearly labelled with their function including special facilities.

5.1.6 A stage diagram shall be provided on the inside of the manual panel door, with clearly labelled stages and phases, by means of silk-screening or suitable weatherproof adhesive label. For multi-stream junctions, the label should indicate the stages called by which manual buttons.

5.1.7 LEDs associated with stage buttons shall light to show which stage is active on street in all modes with the manual panel door open, without the requirement of plugging in a handset.

5.1.8 Traffic signal controllers shall be fitted with an RS232 interface suitable for handset connection for interrogation and controller command application.

5.1.9 Traffic signal controllers shall be configured with a web-interface. The web - interface must adhere to strict, secure, and accessible standards for monitoring and control, aligning with HTML5 for browser-based, interactive mapping, and live data visualisation, including compliance with the referenced documents of TC101, UKCA, and ETSI standards for controller functionality, and adherence to security guidelines for critical infrastructure.

5.1.10 Controller cabinets shall be fitted with a type RKA27c main door lock and top and bottom compression bolts. The manual panel shall use a Yale type 900 lock. Two

sets of each key including 'T' key, shall be supplied at the SAT. The controller shall have a front opening door and a means of accessing equipment to the rear of cabinet to permit access to all parts of the controller.

5.1.11 Controller cabinets shall include space for the addition of an Outstation Transmission Unit (OTU), an Outstation Monitoring & Control Unit (RMU) or a Microprocessor Optimised Vehicle Actuation Unit (MOVA) and associated router and switches. Space shall also be available for JMW or equivalent compatible Bus Priority Units and CCTV / Fibre router and communication interface.

5.1.12 Adequate provision shall be made for the safe storage of controller documentation in the cabinet by the provision of a door pocket.

5.1.13 Two 13 amp 3-pin electricity supply outlets in compliance with the referenced documents of TC101 and shall be provided inside each controller cabinet (and MEC where appropriate) and shall be protected by a residual current device of maximum rating 30mA. Separately fused supplies shall be provided as required for the use of the OTU / RMU / Router / detection and other ancillary components. A minimum of two fused auxiliary power supplies shall be provided as standard. A minimum of two additional fused auxiliary power supplies shall be provided over and above those used for the initial installation, to be reserved for future use.

5.2 Installation

5.2.1 Controller and MEC setting out shall ensure all doors can fully open with adequate and appropriate clearance to any adjacent street furniture. The location of the cabinets must provide safe working distances from edge of carriageway, routes used by NMU's and any adjacent Road Restraint System. Good visibility of the junction or control facility shall be provided.

5.2.2 The controller shall only be installed once a permanent mains power supply is available.

5.2.3 The controller shall be installed on a NAL root foundation or equivalent or with prior agreement on a standard root foundation at the location detailed on the Contract Drawings. The Contractor shall ensure that the detector fault monitor lamp is visible from the main carriageway without the need to open any doors and that when standing with the controller door open, optimal view of the junction is obtained.

5.2.4 Access to controller cabinets shall be free from any obstruction.

5.2.5 Sealing grommets shall be used with NAL (or equivalent) foundations. Controllers mounted on a root-based plinth shall be sealed at base level. Following the termination of all signal cables the standard base void shall be backfilled with dry compacted sand. This shall be sealed by a 6mm thick epoxy resin to form a water and airtight seal.

5.2.6 All traffic signal controller cabinets shall be permanently numbered externally with the site maintenance number as advised by GCC Client. Numbers shall be self-adhesive with a character height of 50mm and coloured black on white. Numbers shall be positioned such that they are visible from the adjacent road network.

5.3 Outstation Transmission Unit (O.T.U)

5.3.1 Outstation Transmission Units (OTU) shall comply with the referenced documents of TC101.

5.3.2 Full compatibility with the Traffic and Transport Department Urban Traffic Control System (YUNEX Hosted) shall be guaranteed.

5.3.3 Preference shall be given to the use of integral UG405 UTMC UG405 MIB, provided within the traffic signal controller's CPU. The use of hard-wire add-on units may be refused by GCC Client.

5.3.4 The Contractor shall install Outstation Transmission Units (OTU) / UG405 or integral systems, including associated SCOOT detection and router in its appropriate cabinet. The configuration of each unit site address and data mapping shall be carried out by the Contractor in accordance with the specification.

5.3.5 Functionality of the unit shall be demonstrated fully during the SAT including the checking of SCOOT detector inputs and Force/Reply bits. Production and downloading of .CSV or HTML files shall be the responsibility of the Contractor.

5.3.6 A semi-integral unit shall have its own fused auxiliary power supply, suitably rated and marked accordingly.

5.3.7 The Contractor shall liaise with UTC system supplier YUNEX for setting system wide IP tunnels.

5.4 MOVA

5.4.1 Microprocessor Optimised Vehicle Actuation Integral facilities (MOVA) shall comply to the latest issue of MCH1542 “Installation Guide for MOVA” and subsequent advice and guidance.

5.4.2 MOVA systems are to be supplied as integral, being compatible with the iOptima and Optima Hub remote monitoring system. The use of hard-wire add-on units may be refused by GCC Client.

5.4.3 The Contractor shall organise and supply MOVA licence details to the Overseeing Organisation/GCC Client.

5.5 RMU

5.5.1 Remote monitoring units (RMU) shall comply with the referenced documents of TC101.

5.5.2 Full compatibility with Traffic and Transport Department Remote Monitoring System, telent Optima Hub RMS solution shall be guaranteed. Full monitoring shall be provided, complete with current sensing transformers, detector input leads and the appropriate link cable for add-on/semi-integral installations. The TRN-RS232 connecting cable shall provide full handset communications via the RMU to the controller both locally (on site) or from the RMS In-Station. Controller, MOVA and CCTV interrogation shall be possible.

5.5.3 Each site specific RMU shall be supplied fitted and tested as part of the controller installation tests for new or refurbishment installations. The RMS configuration file and IMTRAC setup shall be loaded prior to works completion ready for testing.

5.5.4 An add-on or semi-integral IP addressable platform with router shall be supplied. The use of fully integral facilities shall be approved by the Overseeing Organisation.

5.5.5 The Contractor shall install the Remote Monitoring Unit (RMU) in its appropriate controller cabinet as identified in the scheme specific details. All connections/toroids shall be made on the controller side of incoming cable terminations. The configuration of each RMU shall be carried out by the Contractor to GCC Client requirements at the time of commissioning, including In-Station configuration, and digital mapping.

5.5.6 Add on or semi-integral RMU shall have its own fused auxiliary power supply, suitably rated and marked accordingly.

5.5.7 The RMU may be specified as GSM module as detailed in works information. Where the unit is GSM/Wireless, the Overseeing Organisation or GCC Client shall free issue a data enabled SIM card. Telent RMS IP addressable monitoring shall be supplied and set up using a suitably configured ruggedised router.

5.7 Photocell

5.6.1 Signal lamp dimming shall be provided via a solar cell to 30V (ELV) / 160V (LV). A software command shall be provided to override dimming settings.

5.7 Training and Spares

5.7.1 The Contractor shall arrange for training to be given for any new software or modifications to the controller or any other item supplied which has not been previously used in the County.

5.7.2 The Contractor shall supply a suitable schedule of spares and replacement spares to cover all supplied control equipment which is new to the County.

6.0 Auxiliary equipment cabinets for traffic signalling systems

6.1 Miscellaneous Equipment Cabinets shall be used to ensure that adequate space is provided for all specified equipment and rationalisation of cable and add-on facility connections. Generally, MEC's shall be used primarily to rationalise lamp cables or accommodate SIS electrical disconnection systems. Detector packs may be housed in MEC's where locating remote detection in the controller is impractical. MEC's without detector racks/packs shall be fitted with a thermostatically controlled heater. MEC's may also be used as remote validation stations which shall incorporate 13amp 230v maintenance sockets and multi-port Ethernet extenders. Where an MEC is not specified but the Contractors assessment recommends one being provided; this requirement shall be notified to the Designer and the Overseeing Organisation and the design amended accordingly.

7.0 Power supply feeder pillars for traffic signalling systems

7.1 The Overseeing Organisation or Principal Contractor shall arrange for a direct 230 Volt 50Hz AC power supply, terminated in a feeder pillar or other suitable enclosure rated at a minimum of 32Amps or as calculated and advised. Looped or shared supplies with other street apparatus shall not be approved.

7.2 The fuse rating shall provide suitable discrimination between all safety isolators, cut-outs and controller.

7.3 Should the Contractor be required to supply the feeder pillar this work shall be nominated in site specific works information.

7.4 Should the Contractor be required to supply and fit a mains meter; this work shall be nominated in site specific works information.

7.5 Feeder Pillars shall be fabricated from 3mm (min.) thick hot galvanised mild steel. The pillar shall have a flush fitting hinged door with tri-head or similar screw locks. The earth terminals on body and door shall connected with 10mm² earth strap. The internal backing board shall be of 9mm thick external-grade plywood suitable for housing a cut-out, meter (as instructed), isolator and main earth block.

7.6 The Contractor shall supply and install a suitable fused isolator with appropriate rating and current characteristics, confirming to the latest issue of BS EN60947 Parts 1-7 ‘’Specification for Low-Voltage Switchgear and Control Gear’’. The isolator shall be mounted on the feeder pillar’s mounting board and shall incorporate a double pole switch 230 Volt 50 Hz ac. The unit shall be fitted with integral ‘locking off’ facilities within an IP54 (min.) rated housing. The unit shall incorporate fully shrouded or enclosed clamp type cable connectors and shall be capable of accepting 16mm² meter tails.

7.7 An installation certificate shall be provided by the Contractor certifying his work to be in accordance with the referenced documents of TC101.

7.8 The Contractor shall supply and install a steel wire armoured 6mm^2 (or other appropriately rated) live, neutral and earth cable between the feeder pillar and the controller cabinet.

7.9 The Contractor shall provide and install an additional supplementary 10mm^2 earth bonding conductor between the feeder pillar and the traffic signal controller.

7.10 An Earth Rod system compliant with the 18th Edition IEE wiring Regulations shall be fitted as required.

8.0 Cables for traffic signalling systems & Slot cutting

8.1 Cable specifications

8.1.1 Low voltage and extra low voltage cabling shall comply with the referenced documents of TC101.

8.1.2 Inductive loop cable and loop feeder cable shall comply with the referenced documents of TC101.

8.1.3 Low voltage / Extra low voltage power cable shall be supplied as 1.5mm^2 and shall be subject to the Contractors review and recommendation for cable specifications for site specific circumstances. Lamp cables shall be 16 core (minimum) steel wire armoured copper cable; PVC insulated sheathing shall be coloured ORANGE and be marked TRAFFIC SIGNALS at 1m intervals. Additional core such as 20 core cable shall be provided as required for installations requiring extra connectivity whilst maintaining a minimum of 4 spare cores or 25%, whichever is greater on each cable run. Each pole shall have its own discrete directly connected cable.

8.1.4 Inductive loop feeder cable shall be supplied as 2.5mm^2 1/1.38 plain annealed circular copper conductor with 0.7mm radial polyethylene insulation with four cores (2 pairs). Cores shall be laid up in pairs and twisted together, right hand lay, with 5 to 10 turns per metre, bedded in natural polyethylene of 0.8mm nominal radial thickness. An outer sheath of orange polyethylene of 1.4mm nominal radial thickness shall be applied.

8.1.5 Two-pair non-armoured feeder shall be installed unless otherwise agreed with the Overseeing Organisation, with a separate cable allocated to each loop. Feeder cables shall be terminated in suitable terminal blocks fixed in the base of the controller with a minimum of 1.0m untrimmed excess feeder cable tied back neatly in the controller case or termination cabinet. The feeder cable cores shall then be soft wired into the controller I/O connectors.

8.1.6 Inductive loop cable shall be supplied as 1.5mm^2 30/0.25 tinned annealed copper conductor insulated with 0.8mm radial thickness of ethylene propylene rubber (EPR) and sheathed with 1.4mm radial thickness of Polychloroprene (PCP). Overall diameter shall fall within a tolerance of 6.8mm (minimum) of 7.2mm (maximum).

8.1.7 Controller to controller or to miscellaneous cabinet link cabling shall be to the same specification as 16-core extra low voltage power cable or CAT5 Ethernet cable, or other suitable cable to fulfil specification requirements.

8.1.8 An IP68 rated weatherproof and condensation proof enclosure shall be utilised to terminate all multi-core cables between the controller / MEC and the traffic signal pole and any pole mounted traffic signal equipment.

8.1.9 Wiring between the traffic signal aspect and the low-level termination shall be factory fitted and continuous between the rear of the aspect and the low-level termination without any intermediate terminal or bayonet fixings.

8.1.10 Wiring between the traffic signal solar cell shall be factory fitted and continuous between the unit and the low-level termination.

8.1.11 Wiring between above ground detector units shall be factory fitted and continuous between the unit and the low-level termination.

8.1.12 Multi-core drop cables shall only be used with prior acceptance from GCC Client.

8.1.13 Where retrofit works are specified at sites retaining Pole Cap terminations the above clauses shall apply with terminations made in the pole cap without any intermediate terminal or bayonet fixings.

8.1.14 Where retrofit works are specified at sites retaining Pole Cap or Low-Level access terminations and no other practical solutions are available other than an intermediate termination made between signal aspects or other above ground apparatus, IP 68 rated bayonet fixings shall be used to replace standard terminal blocks.

8.1.15 For modification works all LV and ELV voltage cable runs between the controller and signal poles or an adjacent controller or termination cabinet, shall include for a minimum of 4 spare cores or 25% whichever is greater throughout their length. All cables shall connect directly between the controller and each pole, except where termination cabinets are employed. For new installations the same capacity standards shall apply, but only ELV systems shall be utilised.

8.2 Cable installation

8.2.1 Where present in any partial refurbishment work, extra-low voltage cores shall be terminated in separate terminal blocks to low-voltage cores.

8.2.2 For modifications works, low-voltage cables shall not utilise the same ducts as extra-low voltage cables. For new installations, only ELV supplies shall be used.

8.2.3 Signal cables shall not pass through ducts or inspection chambers used for or by any other services. Similarly, no other service shall utilise the traffic signal duct and chamber system. The Contractor shall bring to the attention of the Overseeing Organisation any deviation from these standards.

8.2.4 Two turns of all signal cables shall be left in the traffic signal access chamber at the base of each signal pole. Two turns of loop and feeder cable shall be left in each traffic signal access chamber at each joint location.

8.2.5 With the exception of cable joints between loop and feeder cables or terminations made in MEC's, no other joints shall be permitted in the cable runs. This shall include all pole mounted equipment in the form of signals heads, solar cell and detector units, where factory fitted cable looms and fly leads shall be supplied in a continuous uninterrupted length between the aspect or unit and the low-level termination enclosure.

8.2.6 All unused cores returned to the controller shall be neatly secured and connected to earth. All unused cores between low-level or pole cap terminations shall be connected to earth. Sufficient terminals and termination points shall be provided at the controller to accommodate neutral and earth connections.

8.2.7 All cables including detector loop feeders and push button supplies, shall be permanently labelled at the controller as to their function and destination. Cable core terminations at all other locations shall be permanently labelled as to their function, origin and destination.

8.2.8 All draw ropes shall be replaced in each duct following/during cable installation.

8.3 Slot Cutting Operations

8.3.1 Installation shall not commence until carriageway surfacing and road marking refresh / installation is complete, and positions have been verified by the Overseeing Organisation. The Contractor shall be responsible for determining

number of turns per loop for all detection systems unless otherwise informed by the Overseeing Organisation. The Contractor's supervisory staff shall check the quality of workmanship before laying cable and backfilling.

8.3.2 In order to minimise damage and contamination to their mains supply, water companies require that Contractors use a double non-return valve assembly on their standpipe when it is connected to a hydrant. The Contractor shall arrange for a water supply from a nearby fire hydrant to be made available for slot cutting operations. A minimum of 5-working days' notice of intention to use a hydrant must be given to the water supply company in order that the necessary permission may be obtained.

8.3.3 A water bowser will be required where a hydrant is not available or where a carriageway crossing is necessary. Hoses must not be laid across the carriageway unless it is closed to traffic.

8.3.4 Slot cutting shall not be conducted in wet weather, or when the ambient temperature or road surface temperature is below 0ºC.

8.3.5 Loop positions shall avoid areas of poor reinstatement in the road surface. Slots shall be cut at least 1 metre from any such disturbance or from any ferrous objects such as manhole covers.

8.3.6 Slots for loop cables shall have a width of 10.0mm with a tolerance of +2.0mm/-0.0mm. The slot width shall exceed the maximum diameter of the loop cable by at least 2.0mm. The depth of each slot shall be checked by the Contractor with a depth gauge at intervals along the whole length of the slot. The depth of loop slots shall be (65 +7.0n)mm with a tolerance of +10.0mm/-0.0mm. In concrete surfaces the depth shall be (25 + 7.0n)mm with a tolerance of +5.0mm/-0.0mm where 'n' is the number of cables and the first figure is the minimum depth of cover.

8.3.7 Where an angle of 100º or more acute is formed at the junction of two adjacent loop slots, the slot junction shall be truncated with a saw cut at the apex of the junction.

8.3.8 Slots for loop tails shall be 15mm wide, with a tolerance of ± 3mm. The slot width shall exceed the maximum width of the loop tails by at least 2.0mm. The depth of the slot shall be 65mm in bituminous surfaces (45mm in concrete surfaces) with a tolerance of + 10/0mm/-0.0mm.

8.3.9 Slots for loop tails shall be cut along the crown of the road wherever this is possible but should be least 300mm from any longitudinal asphalt joints. This slot should be installed so as to not obliterate any road markings in whole or part.

8.3.10 Loop tails and feeder cable shall be joined in footway boxes and identified at both feeder cores and loop tails.

8.3.11 For vehicle actuation operation each loop shall be separated from adjacent loops by a minimum of 300mm unless agreed otherwise with the Overseeing Organisation. Loops operating the MOVA system shall be offset from lane lines and kerbs by distances specifically provided for each installation. Generally, loops shall be set out 0.4m from the kerb and 0.8m from adjacent lane lines. A minimum distance of 3.0m shall be maintained between these loops and any adjacent bus priority, SCOOT or queue loops.

8.3.12 Debris and silt shall be cleared from the base of the slot and the slot blown dry with compressed air prior to cable laying. The Contractor shall ensure that the cable lies evenly in the bottom of the slot and shall secure the cable in such a position if necessary. Sharp implements shall not be used to seat the cable in the slot.

8.3.13 Loop tails shall be twisted and separately taken back to the joint box so as to enable any single loop to be disconnected from the feeder cable. Joints shall be made using jointing kits complying with latest version BS EN60529 (IP68 CAT1). All cable joints shall be made using screw terminal open pot reusable connectors. The joint shall be made in accordance with the manufacturer's instructions.

8.3.14 The Contractor shall ensure that all slots are clean and dry immediately prior to backfilling and that all silt and debris has been removed from the slot.

8.3.15 Slots shall be backfilled with a low viscosity epoxy resin, approved by the Overseeing, to give a minimum of 10mm cover above the uppermost cable. The resin shall be poured at a viscosity of between 50 and 100 poise. The remaining volume of loop slot shall be backfilled with blown grade hot oxidised R85/40 or R85/25 bitumen to the level of the road surface. Where alternative backfill, products can be sourced to comply with risk reduction and COSHH regulations the Contractor shall provide suitable alternatives.

8.3.16 The normal method of connecting loop cable into footway chambers shall be by utilising a D400 carriageway loop box. Where these are not provided, slots through kerb edges shall be formed at natural kerb joints where possible and be backfilled with a layer of resin, followed by hot pour bitumen in several layers to fill the slot flush with the adjacent kerb. Any recess in the kerb remaining shall be grouted with sand / cement mortar.

8.3.17 Where partial excavation of the footway is required to access stub duct ends, the exposed loop tails shall be covered with resin and then bitumen in several layers as necessary after sealing the end of the stub duct and prior to reinstatement of the footway with cold setting asphalt and sealing with hot pour bitumen.

8.3.18 Where armoured feeder cable is installed; with the feeder cables jointed to their inductive loops, the armouring of the feeder cable shall be connected to its earth point and the impedance of the feeder cores to earth shall be tested. The impedance of the feeder cores to earth shall be greater than 20 Megaohms.

9.0 Traffic signal posts (poles)

9.1 Pole specification

9.1.1 All traffic signal poles shall be low-level access with vented caps and IP68 rated terminal enclosures. They shall not be supplied with pre-drilled holes for push button units. Holes shall be drilled on site as required in accordance with the design or Overseeing Organisation's site instructions.

9.1.2 Where a signal pole is to be used in a retention socket or (with specific acceptance) a pole box, the Contractor shall supply the appropriate length signal pole and cable entry system.

9.1.3 Where a passively safe pole is specified, the Contractor shall supply and install an automated electronic disconnection device for each cable serving that pole. If the works specification does not include this system, please contact GCC Traffic Signal Team.

9.1.4 The Contractor shall supply 114mm (base) expanding to 145mm diameter poles or similar equivalent with vented caps and low-level access door assemblies with integral backing boards. The base of the pole shall be sealed to prevent the ingress of moisture after cable installation with a suitable IP68 rated terminal enclosure provided.

9.1.5 2 & 3m push button unit poles shall be low-level access supplied with vented top cap and earthed bonded via a brass stud, tapped into the push button unit. Where stub poles carry a nearside display and push button assembly, the pole must extend the whole length of the display unit.

9.1.6 All cantilever poles shall be swan neck design with smooth formed internal sections.

9.1.7 Tall poles between 6-8m in length shall have vented top caps and large (165/168mm) base complete with access door and fitted backing board. The base of the pole shall be sealed to prevent the ingress of moisture after cable installation and an IP68 rated enclosure provided. Where appropriate, hinged type poles compliant to BS EN12767 and EN12899 shall be supplied for ease of maintenance. Risk assessments should be used to determine requirements. It should be noted that certain suppliers utilise a 165mm base post. Where these are to be installed in conjunction with NAL RS168DF retention sockets, suitable reducing shims shall be installed.

9.1.8 Mast arms shall comply to Highway Agency design and installation standards. Mast arms may be root fixed or mounted on specifically designed foundations with bespoke holding-down assemblies. Mast arms shall be supplied in segments for site assembly and in accordance with site specific specifications to be provided in works information. The base of the mast arm shall be sealed to prevent the ingress of moisture after cable installation with a suitable IP68 rated terminal enclosure provided. Rotating type poles compliant to BS EN12767 shall be supplied for ease of maintenance. Risk assessments should be used to determine requirements.

9.1.9 Supplier fabrication, erection and wind loading details of tall poles and mast arms must be undertaken and may be requested from the Contractor during the design stage of the project. These details shall be supplied as part of the As Built information.

9.2 Passive Safety

9.2.1 Passively safe traffic signal poles shall be provided as indicated in the contract and on the drawings. Poles shall be designed to reduce the severity of injury and vehicle damage in the event of vehicular impact, while maintaining adequate performance under normal operational loading.

9.2.2 Passive safe poles shall comply with BS EN 12767, Passive safety of structures for road equipment and be independently tested and certified to BS EN 12767 with

valid test reports.

9.2.3 Certification shall be provided for every pole type supplied, including variations in height, outreach, foundation type or door position. Where the contract provides classification options to be selected by the Contractor, approval shall be sought form GCC client prior to commencement of works.

9.3 Safe Isolation System (SIS)

9.3.1 Where specified in association with passively safe poles or as agreed with the Overseeing Organisation, SIS Electrical Disconnect System (Safe Isolation System) shall be provided to allow rapid and safe isolation of the electrical supply to traffic signal equipment, particularly under impact or emergency conditions.

9.3.2 The system shall ensure compliance with UK electrical safety legislation and provide a clear means of isolation for maintenance and emergency response.

9.3.3 The SIS breaker and monitoring system shall be housed in separate MEC.

9.3.4 The SIS system shall provide monitoring outputs via the controller to the Optima Hub RMS.

9.3.5 The SIS system shall comply with BS 7671 (IET Wiring Regulations) Requirements for electrical installations, the Electricity at Work Regulations 1989, Relevant DfT / National Highways traffic signal standards and manufacturer certification for highway signal applications.

9.3.6 The SIS Electrical Disconnect System shall provide local isolation of the electrical supply to the traffic signal installation, enable safe disconnection without exposure to live conductors and be capable of being operated:

- Following vehicular impact
- During emergency response
- During routine maintenance

9.3.7 The SIS unit shall be:

- Installed within the traffic signal pole, base, or approved enclosure
- Readily accessible without specialist tools
- Clearly labelled to indicate its function

9.3.8 The SIS system shall disconnect:

- The incoming supply to the signal equipment
- All associated live conductors downstream of the isolation point

9.3.9 Where used in conjunction with passive safe poles, the SIS system shall not compromise the passive safety certification. Cabling, connectors and isolators shall disconnect cleanly during pole failure or separation and avoid creating additional hazards following impact

9.3.10 Installation shall follow the pole manufacturer's approved details.

9.4 Pole positioning and setting out

9.4.1 Pole setting out shall consider adequate and appropriate clearance to all equipment and safe working distances from edge of carriageway and any adjacent Road Restraint Systems.

9.4.2 Signal Poles shall be supplied and installed at the positions shown on the Contract Drawings. Position and pole types compliant with drawings and specifications shall be verified on site in conjunction with the Overseeing Organisation.

9.4.3 All traffic signal poles shall be permanently numbered. Pole numbers shall be self-adhesive, incorporating a character height of 50mm and coloured white on black. The numbers shall be sited at a minimum height of 2.1m and located so that they are visible from the controller.

9.4.4 Where signal poles are to be installed in retention sockets, the Contractor shall be responsible for erecting the poles unless otherwise agreed with the Overseeing Organisation. A suitable method / machine shall be used to erect the poles safely and ensure verticality. Waterproof grommets and reducing shims shall be installed at the pole and socket interface in accordance with manufactures installation details.

9.4.5 The Contractor shall report to the Overseeing Organisation immediately, any poles which are not vertical or any pole socket foundations that show signs of movement.

10.0 Chambers for traffic signalling systems

10.1 General

10.1.1 Civil engineering works shall normally be supplied by the Principal Contractor. If minor civil engineering works such as duct, access chamber, signal pole and signal controller root installations are required of the Contractor, a separate works specification and works information pack shall be issued. Should no other information be supplied, the following standards shall be used.

10.1.2 The Contractor shall take particular care when working in the vicinity of existing statutory undertakers (SU) ducting and apparatus. Protection shall be provided, and disturbance minimised. SU representatives shall be given adequate prior notice should any excavation, moving or backfilling of their service ducts or other apparatus be necessary. The Contractor shall comply with the Special Requirements of the SU companies.

10.1.3 Trial excavations under the supervision of the Overseeing Organisation shall be undertaken in areas where Statutory Undertakers apparatus are identified as being in proximity of poles footings, or where existing duct runs are to be captured within

new access chambers. Trial excavations shall be programmed either in advance or at start of main works to enable suitable variations to me made where required.

10.1.4 The Contractor shall conform to environmental and waste management regulations and requirements for all civil engineering or site clearance activities.

10.1.5 Site clearance drawings shall identify the removal of traffic signal equipment and pole retention systems / Access chambers. Redundant signal equipment shall be taken to the GCC stores for maintenance stock or to tip off site.

10.1.6 The location of all Access chambers shall be accurately shown on Contractor supplied As-Built drawings.

10.2 Access chambers and foundations

10.2.1 All chambers shall be “Style Y” twin wall construction STAKKA-box type or equivalent, with a 12mm LDPE integrated base, with a pre-drilled 50mm diameter soak away hole in the centre of the chamber, as supplied by NAL Ltd or equivalent.

10.2.2 All chambers shall have covers and frames fitted. These shall comply to EN124 standard and be Class B125 (12.5 tonnes) Warwick composite covers with extra deep galvanised steel raising frames, unless C250 or D400 (40 tonnes) type covers and frames are specified on the scheme drawings.

10.2.3 All frames shall be secured to the chamber by means of bolts. All covers shall be clearly embossed with the words “Traffic Signals”. Chambers shall have a 150mm backfill around the chamber using ST2 concrete, unless manufacturers details stipulate otherwise. In unmade verges, all covers, and frames shall have a ST4 concrete surround formed from wood shuttering to extend 300mm from each side and 150mm deep.

10.2.4 Where new ducts are installed into existing Access chambers, the ducts are to be cut flush with the Access chamber walls or have maximum protrusion of 50mm. Ducts must not be installed through the base of Access chambers as this leaves them susceptible to blockage through muck and debris falling into the chamber over time.

10.2.5 Traffic signal poles shall be erected in retention sockets. Socket types shall be approved by the Overseeing Organisation. Manufacturers waterproof grommets and pole restraint system to be installed. Manufacturers levelling system to be used where poles are installed at transition kerbs or on uneven ground.

10.2.6 Variations in depth of sockets as indicated in GCC standard details shall be approved by the Overseeing Organisation.

10.2.7 Installation and foundations shall be in accordance with suppliers’ details.

10.2.8 Passive safe poles shall be installed on compatible passive safe foundations or root systems. Foundations shall be designed to ensure the passive safety performance of the complete system and comply with the pole manufacturer’s certified installation details. No modifications or substitutions shall be made that compromise the certified passive safety performance.

11.0 Cable Ducts for traffic signalling systems

11.1 Ducts shall be H.D.P.E / M.D.P.E, high impact resistant smooth inner bore, a minimum 5mm wall thickness and orange in colour, with an internal diameter of 100mm and clearly marked “TRAFFIC SIGNALS” in white lettering at ONE metre intervals. Orange smooth bore ducts of 50mm diameter may be used from the electric supply housings to the controller.

11.2 No preformed bends shall be permitted along the duct runs, except with the prior written permission of GCC.

11.3 Corrugated ducting will not be permitted without the prior written acceptance of GCC.

11.4 All 100mm ducting shall be proven, by the Contractor passing a 90mm mandrel through the whole length of the completed ducting.

11.5 All ducts shall be fitted with nylon drawstrings between access chambers and shall be flushed clear, using compressed air, prior to installation of traffic signal cables.

11.6 Ducts shown on the drawings for the use of traffic signal cables shall not be used to carry any other type of service. ELV and LV traffic signal cables must be separately ducted.

11.7 The minimum cover for ducts laid in the carriageway shall be 750mm.

11.8 Where ducting in the carriageway has less than 750 mm cover, reinstatement proposals shall be agreed with GCC before works are undertaken. Alternatively, NAL multi-duct systems may be proposed for acceptance.

11.9 The minimum cover for ducts laid in the footway/verge shall be 450mm.

11.10 The location of all ducts shall be accurately shown on Contractor supplied As-Built drawings.

11.11 The maximum distance between connected access chambers shall be 40m, unless otherwise agreed with GCC.

11.12 The maximum distance between any pole NAL socket and its connecting access chamber shall be 4m unless otherwise agreed with GCC.

11.13 Loop cable joints shall not be housed in road crossing access chambers.

12.0 Defects correction period and maintenance warranties

12.1 Maintenance

12.1.1 The Contractor shall provide maintenance and fault attendance for the installation in addition to the Defects Period or Warranty Period commencing from the acceptance of the traffic signal installation. The Maintenance Period may be 12 months, or 28-days as stipulated by the Overseeing Organisation in the works specification. When the Maintenance Period is identified as being 28-days, this shall be a 28-day fault free period, the period re-starting after replacement or repair of defective components having been completed and reported in writing to the

Traffic and Transport Department GCC Traffic Signals Team. This does not relieve the Contractor of his obligations under the Defects Period or Defects Correction Clauses.

12.1.2 Maintenance standards shall accord with the latest issue of Traffic Signals specifications issued under the DMRB and the current GCC maintenance specification.

12.1.3 All goods and materials used by the Contractor in carrying out his obligations under the Contract shall be in accordance with the technical specification appropriate to the equipment and in accordance with current approved standards.

12.1.4 The Contractor shall execute the works from a designated maintenance facility adequate for receiving fault reports and shall maintain the equipment supplied under the contract throughout the Defects Period or other agreed duration. The Contractor shall provide all the necessary labour and equipment including spares to provide the maintenance service set out below.

12.1.5 An attended service to receive and record faults notified in respect of the equipment supplied and installed, covering 24 hours a day, 7 days a week (inclusive of Public Holidays). The Contractor shall be responsible for locating the cause of all faults (including software and system faults where applicable) and identifying these to the Overseeing Organisation and GCC Client.

12.1.6 Notification of arrival on site and departure shall be made verbally by telephone and recorded on fault attendance forms. Written confirmation of clearance shall be made within 24 hours by email or via fault management systems where applicable.

12.1.7 Maintenance standards shall be the same as those in force under the GCC maintenance contract at the time of commissioning.

12.2 Fault Classification

a) Urgent Fault - The following events shall be classified as Urgent Faults during the hours 05:00 to 21.00 each day.

- All Signals Unlit
- Signals failing to change
- Defective signals likely to cause abnormal traffic conditions or danger.
- Equipment damaged and in a dangerous condition.
- Tactile devices not working.
- Red lamp failures

b) Non-Urgent Fault

- All other faults not covered by the above

12.3 Warranties

12.3.1 A twelve-month warranty shall be provided, from the date of site acceptance of the equipment. Under warranty, the Contractor shall replace or repair all parts found to be defective by reason of faulty design, materials or workmanship. The repaired, or replacement parts shall be delivered and installed free of charge to the site location by the Contractor.

12.3.2 During the first twelve months of service excluding the initial 28-day fault free period the controller shall not exceed more than four firmware or hardware related faults resulting in junction control failure. Should the controller fail to perform to this service requirement, the Contractor shall replace it with another new controller of proven reliability meeting the same hardware and software specification of the original. A further twelve-month warranty shall then be given on the replacement controller.

12.3.3 LED aspects shall be supplied with a 5-year warrantee.

13.0 STANDARD DRAWINGS

13.1 All works shall conform to the Overseeing Organisation / GCC Client Standard Construction drawings issued and updated under this contract. Any deviation shall be agreed with GCC prior to works being carried out.

13.2 Designer may use additional scheme standard details subject to technical acceptance.

GCC Standard details

SD001 – Signal Pole Installation Details - Rev B
SD002 - NAL Controller Base Installation – Rev A
SD003 – Standard Controller Base Installation – Rev B
SD004 – Inductance Loop Reinstatement Details – Rev B
SD005 – Inductance Loop to Footway Box Connection Details – Rev B
SD006 – Typical Controller Layout Plan Detail – Rev B
SD007 – Composite Access chamber Type DP1 and DP2 Detail – Rev B
SD008 – Inductance Loop Setting Out Details – Rev A
SD009 – Tactile Paving and Signal Pole General Setting Out Detail – Rev A
SD010 – Typical Layout for Stand-Alone Cycle & Pedestrian Crossing
SD011 – Typical Feeder Pillar

APPENDIX A

FORMS OF COMPLETION AND INSPECTION
FACTORY ACCEPTANCE TEST CERTIFICATE

I/We being the person(s) responsible (as indicated by my/our signatures below) for the Inspection and Test of the electrical equipment as indicated on page 1 of the Test Schedule CERTIFY that the said equipment is to the best of my/our knowledge in accordance with the Regulations for Electrical Installations published by the Institution of Electrical Engineers latest Edition and the attached Factory Acceptance Test Schedule as demonstrated on this day ..... except for departures, if any, stated below.

The following tests have failed to comply with either the TOPAS 2500 forms as completed by the Designer or the Specification or DMRB Specifications.

List of departures/test failures.

The above tests shall be demonstrated at a subsequent FAT to be arranged within one week.

. . . .

. . . .

The above tests shall be demonstrated at SAT in addition to the SAT test schedule.

. . . .

. . . .

(Delete as appropriate).

This equipment may be delivered to site for installation and further testing as detailed above and in accordance with the SAT test schedule.

Designers signature .....

Purchasers signature .....

Signal Company Engineers Signature .....

APPENDIX B

FACTORY/SITE ACCEPTANCE

TEST SCHEDULE

FOR TR2500 CONTROLLER

CUSTOMER:	
SITE NAME:	
SITE REFERENCE:	
CONTROLLER TYPE:	
CONFIG REFERENCE:	
CONFIG ISSUE:	

FACTORY ACCEPTANCE TEST RESULTS

DATE OF TEST:		PASSED / FAILED (delete as appropriate)
COMMENTS		
LATEST DATE FOR CORRECTIVE ACTION:		
SUPPLEMENTARY FAT REQUIRED - YES / NO (delete as appropriate)		
TRAFFIC SIGNAL ENGINEER:	Name: Signature:	
SIGNAL COMPANY ENGINEER:	Name: Signature:	

FACTORY ACCEPTANCE TESTS
(Alternative forms may be substituted for differing controller types).

General:

* Indicates commands that only apply to the ST800.

	Pass/Fail
Check Configuration Identity Code Number & Issue with the Specification (CIC)	
Note serial number of controller	
Set all detectors to Off, all computer bits to Off, select Normal on the Manual Panel Switch on mains supply, initialise RAM (PME, TKE, LRN, CNN), check time/date (STM, CKL, TOD, DAY, WEK) and switch signals on	
Check controller starts up in correct stage and that the correct indications are given	
Check the starting inter-green time (IGS)	
Check demands have been inserted for all stages and the controller serves all phases	
Use the Configuration printout/handset to check the following basic parameters are as specified:-	
Minimum Green times (MIN)	
Green Extension times (EXT, IPX*)	
Maximum Green times (MAX, MBX, MCX, MDX, MEX*, MFX*, MGX*, MHX*)	
Pedestrian Blackout times (PBT)	
Pedestrian Window times (PWN)	
Pelican Sequence times (PAR*, PIT*, PBT, CMX*, CDY*, CRD* – 141C only)	
Puffin Sequence times (PAR*, PIT*, PBT, CMX*, CDY*, CRD* – 141C only)	
Pedestrian Sequence times (PAR*, PIT*, PBT, CMX*, CDY*, CRD* – 141C only)	
Toucan Sequence times (PAR*, PIT*, PBT, CMX*, CDY*, CRD* – 141C only)	
Intergreen times (IGN)	
Phase Delay times (DPG, DMV, DFZ)	
Timetable Entries and Event Parameters (TSW, TDY*)	
BST Changeover Weeks (BSA, BSR, CKA*, CKR*)	
Handset Limit Values	

Mode Priority:

Check that the mode priority operates as specified (MOD, STS*)	

Manual Mode:

Check manual disable via handset, if specified (MND)	
Select each configured manual button & check stage/phase relationship is correct	
Check filter green arrow appearance under manual mode is as specified	
Check permitted 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/indicators on the manual panel	

FACTORY ACCEPTANCE TESTS – continued

Detector and Push Button Functions:

	Pass/Fail
Check DFM times are as specified (DFD, DGP*, DSA*, DSI*, PBG*)	
Check Call/Cancel times are as specified (DCL & DCN)	
Check for correct active states on each detector input (IPS*)	
Check for correct DFM force states on each detector input (DFA)	
Check Push Button Demand Extension times are as specified (IPX* - 141C only)	
Check Kerbside Demand Extension times are as specified (IPX* – 141C only)	
Check Registered Demand Extension times are as specified (PDX* – 141C only)	
Check that all inputs perform the correct functions, e.g. latched/unlatched demands, green extensions, light wait indicators, etc (SPH)	
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 (SCT)	
Check SD/SA operation	

Fixed Time Mode:

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

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 that 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 (SPH)	
Check stage movement constraints (i.e. permitted, prohibited, alternative moves)	
Check timetable change points for switched maxes by altering the clock (STM, CKL)	
Check operation of signals with permanent demands on all detectors ensuring that all phases are satisfied	

Cableless Linking Facility Mode:

Check plan timings/influences are as specified (PLT, PLI, IFA, IFB, IFC, IFD, CYC*, PLE*, PLX*, OFF*, IFN*)	
Check timetable change points for CLF plans by altering the clock (STM, CKL, CCP)	
Check that all plans operate, especially demand dependant stages	
Check CLF permitted movements by writing a plan with a non-permitted move in it	

FACTORY ACCEPTANCE TESTS – continued

UTC Mode (or add-on MOVA):

Reset all detectors to off and select Normal on the Manual Panel	Pass/Fail
Check mode changes when a force bit is activated, with TC bit if specified (MOD, STS*)	
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 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 DX bit runs specified stages/phases to maximum in VA mode	
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	
Check that the correct G-bit replies are returned for each stage	
Check that any phase confirm bits are correctly returned	
Check reply bits returned for specific controller conditions (lamps off, DFM, manual, etc)	
Check operation of any other miscellaneous reply bits	

Part Time Mode:

Check timetable change points by altering the clock (STM, CKL)	
Check that signals switch off in correct stage, once minimums have expired (MOD, STS*)	
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 (DHC)	
Check Hurry Call Hold times are as specified (HHC)	
Check Hurry Call Prevent times are as specified (PHC)	
Check operation of request detectors	
Check operation of cancel detectors	
Check that correct stage is called in relation to the detector (MOD, STS*)	

FACTORY ACCEPTANCE TESTS – continued

Vehicle Priority Mode:

	Pass/Fail
Check Priority unit basic requirements are as specified (PUT, PUP, PMT, PDE, PRE, PRI, PDR, PUI, PSE, PSA, PVG)	
Check Priority Extension times are as specified (PVE)	
Check Priority Maximum times are as specified (PVM)	
Check Inhibit times are as specified (PVI)	
Check Phase Compensation times are as specified (PCn)	
For each priority unit check operation of priority demands/extensions, inhibit periods and compensation periods (PVU, PVP, PVS, PIA, PDS, PIU)	

All Red Extensions:

Check All Red Extension times are as specified (REX)	
Check All Red Maximum times are as specified (RMX)	
Check that appropriate detectors extend appropriate stage moves	
Check all red extensions are operative or auto-extend to max in the appropriate modes	

Pedestrian Linking:

Check Pedestrian Link timings are as specified (PIR, CDT*)	
Check operation of pedestrian link	
Check operation of override timer	

Red Lamp Monitoring:

Check that 1 red lamp out extends appropriate intergreens by the specified duration (SIE, RLT*)	
Check that 2 reds out inhibit conflicting pedestrian phases or shutdown part-time stream	
Check that failure of all (or 2) monitored reds on a channel of a stand-alone pedestrian stream causes shutdown (141C only)	
Check that red lamp failure actions cease when lamps are replaced	

Green Conflict Monitoring:

Check all green/green conflicts using a test box	
Check fault log for correct conflict data (FLF, FLD, FFS*, FDS*, LOG*)	

Special Conditioning:

Check operation of any special conditioning not covered by any of the preceding tests	

FACTORY ACCEPTANCE TESTS – continued

Miscellaneous:

Perform any other miscellaneous tests that may be required (define below):-	Pass/Fail
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	

APPENDIX C
Pre-Commissioning Test Schedule

GCC - Traffic Signals Pre-Commission Test Schedule
To be completed by the Installation Contractor

Date & Time:

Traffic signal installations shall be pre-commissioned by the Contractor in advance of Site Acceptance Testing.

Changes in Layout or any noted deviation from the design shall be reported to the Overseeing Organisation.

Signals to be bagged over on completion of tests

Electrical Test Certificates

The Contractor shall supply and complete to the satisfaction of the Overseeing Organisation electrical test certificates in accordance with the latest edition of the Electricity at work Act and the IEE Wiring Regulations.

Pre-commissioning shall include the following:

		Pass/Fail	Comments
1	General compliance with specifications and standards		
2	Road surface condition		
3	Orientation and clearance off signal apparatus		
4	Stability of poles		
5	Location of inductance detectors		
6	Location of controller		
7	Location of Power Supply Pillar		
8	General site safety		

Site Address

Site Reference Number

Controller Type

Controller Configuration Reference

Controller Serial Number

General:

	Pass/Fail	Comments
Check neatness of wiring, base seal / integrity and that ancillary equipment is fitted in accordance with the specification		
Check spare core and test core availability		
Check for correct dimming voltage connection		
Check location and operation of solar cell		
Check that time and date are correct		

Red Lamp Monitoring:

	Pass/Fail	Comments
Check that 1 red lamp out extends appropriate intergreens by the specified duration		
Check that 2 reds out inhibit conflicting pedestrian phases or shutdown part-time stream		
Check that failure of all (or 2) monitored red lamps on a channel of a stand-alone pedestrian stream causes shutdown		
Check that red lamp failure actions cease when lamps are replaced		

NB: Lamp monitoring should have been emulated at FAT. Only conduct multiple lamp failure testing in live conditions if it is safe to do so.

General Lamp Monitoring:

	Pass/Fail	Comments
Check that general lamp failures are detected and reported correctly		

Linking:

	Pass/Fail	Comments
Check that link input / outputs are issued and received correctly		

Miscellaneous:

	Perform any other miscellaneous tests that may be required (define below)	Pass/Fail	Comments
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

The above installation has been Pre-Commissioned in accordance with company testing regimes and the above test schedule and is recommended for Site Acceptance Testing.	
The above installation has been Pre-Commissioned in accordance with company testing regimes and the above test schedule and requires further testing / works before Site Acceptance Testing.	

	Date	Signature
Signed and dated Test & Commission Engineer		

APPENDIX D

Site Acceptance Test Schedule

GCC - Traffic Signals Site Acceptance Test Schedule
To be completed by the Overseeing Representative

Notes:

Traffic signal installations shall be pre-commissioned by the Contractor in advance of the Site Acceptance Testing to be witnessed by the Local Authority.

Site Acceptance Tests shall be conducted by the Contractor and recorded by the Contractor or the local authority Term Consultant.

Before commencement of the traffic signal acceptance tests the site shall be inspected for compliance with design drawings and schedules.

Electrical Test Certificates

The Contractor shall supply and complete to the satisfaction of the Overseeing Organisation electrical test certificates in accordance with the latest edition of the Electricity at work Act and the IEE Wiring Regulations.

Date of Pre-Commission

Date & Time:

This inspection shall include the following:

		Pass/Fail	Comments
1	General compliance with specifications and standards		
2	Signs appropriate to the works		
3	Markings and studs appropriate to the works		
4	Road surface condition		
5	Visibility of signals		
6	Inter-visibility between vehicles and pedestrians		
7	Orientation and clearance off signal apparatus		
8	Stability of poles		
9	Location of inductance detectors		
10	Location of controller		
11	Location of Power Supply Pillar		
12	Clearance of traffic management		
13	General site safety		

Site Address

Site Reference Number

Controller Type

Controller Configuration Reference

Controller Serial Number

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Gloucestershire County Council
Traffic and Transportation Department
Manual for Streets Specification Appendix
2026

General:

	Pass/Fail	Comments
Check neatness of wiring, base seal / integrity and that ancillary equipment is fitted in accordance with the specification		
Check availability of cable spare cores and test cores		
Check for correct dimming voltage connection		
Check that time and date are correct		
Check that BST Changeover Weeks are correct		
Check controller log book details and complete as required		
Check controller configuration and site drawing hard copies are present		
Check Pouch / document door tray fitted		
Check RMS router is fitted and configured and supply SIM Card		
Check DFM lamp is visible		
Check stage LED indicators function with manual panel door open		
Confirm electrical safety testing has been undertaken		
Check that green conflict test has been undertaken and certified		

Initial Detector and Push Button Functions:

	Pass/Fail	Comments
Check all loop detector packs for the correct settings		
Check that all loops are connected to the correct controller input		
Check that each inductance loop has individual 2pr feeder connection and reusable joint		
Check that all above ground detectors are connected to the correct controller input		
Check all red clearance detection		

Lamps:

Be aware of safety of operation conducting flash test in live traffic either with or without temporary signal operating	Pass/Fail	Comments
Carry out flash testing		
Switch Signals On		
Check forward visibility and orientation of signal heads - adjust as required		
Check location and operation of solar cell		
Monitor operation for safety of intergreens and pedestrian / cycle phase timings		
Carry out SIS trip and breaker testing where fitted		

Detector and Push Button Functions continued with lamps on:

	Pass/Fail	Comments
Check settings for Bi/Uni-directional operation		
Check virtual loop / detector images and vehicle / NMU user capture is correct		
Record above ground detector Wi-Fi / Bluetooth referencing and connection protocols		
Check that all push button units are connected to the correct controller input		
Check that all wait indicators are functioning correctly along with any tactiles/audibles		
Check for correct operation of push buttons with kerbside detection		
Carry out On-Crossing detection walk testing and confirm appropriate clearance times are operating		
Check cycle detection and setting / use of AI imaging		
Check SD/SA for correct operation		
Check for correct operation of any Hurry Call inputs		

UTC Mode (or add-on MOVA):

	Pass/Fail	Comments
Check control bits are connected to the correct controller input		
Check reply bits are connected to the correct controller output		
Check router is connected and setup and fitted with supplied SIM card		
Ensure IP address details are visible and logged		

MOVA:

	Pass/Fail	Comments
Load or check MOVA dataset and enable for testing		
Check detector inputs trigger correct MOVA detectors		
Check force and reply bits and correct stage operation		

Site to be left in VA until MOVA Validation is completed
NB: refer to MCH 1542 and the specification for full MOVA commissioning procedure

Remote Monitoring:

	Pass/Fail	Comments
Check that OMU can be dialled from instation		
Check that correct controller status/fault information is returned to the instation		
Ensure IP address details are visible and logged		

Red Lamp Monitoring:

	Pass/Fail	Comments
Check that 1 red lamp out extends appropriate intergreens by the specified duration		
Check that 2 reds out inhibit conflicting pedestrian phases or shutdown part-time stream		
Check that failure of all (or 2) monitored red lamps on a channel of a stand-alone pedestrian stream causes shutdown		
Check that red lamp failure actions cease when lamps are replaced		

NB: Lamp monitoring should have been emulated at FAT. Only conduct multiple lamp failure testing in live traffic conditions if it is safe to do so.

General Lamp Monitoring:

	Pass/Fail	Comments
Check that general lamp failures are detected and reported correctly		

Linking:

	Pass/Fail	Comments
Check that link input / outputs are issued and received correctly		

Poles & Heads

	Pass/Fail	Comments
Check pole stability, orientation and verticality		
Test hinged pole lowering systems		
Check head alignment and safety clearances		

Miscellaneous:

	Perform any other miscellaneous tests that may be required (define below)	Pass/Fail	Comments
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

The above installation has been tested in accordance with the test schedule and is safe and appropriate to remain switched on and live to traffic with no required remedial actions. The fault free maintenance period will commence from this date. ☐

The above installation has been tested in accordance with the test schedule and is safe and appropriate to remain switched on and live to traffic with remedial actions as noted above. ☐

The above installation has been tested in accordance with the test schedule and is not safe or appropriate to remain switched on and live to traffic due to the above noted failures. ☐

Remedial activities to be programmed and completed in accordance with the specification and no longer than ( ) weeks from the test date. ☐

	Date	Signature
Signed and dated Test & Commission Engineer		
Signed and dated Signals Engineer		
Signed and dated Witness		
Signed and dated Witness		

APPENDIX E

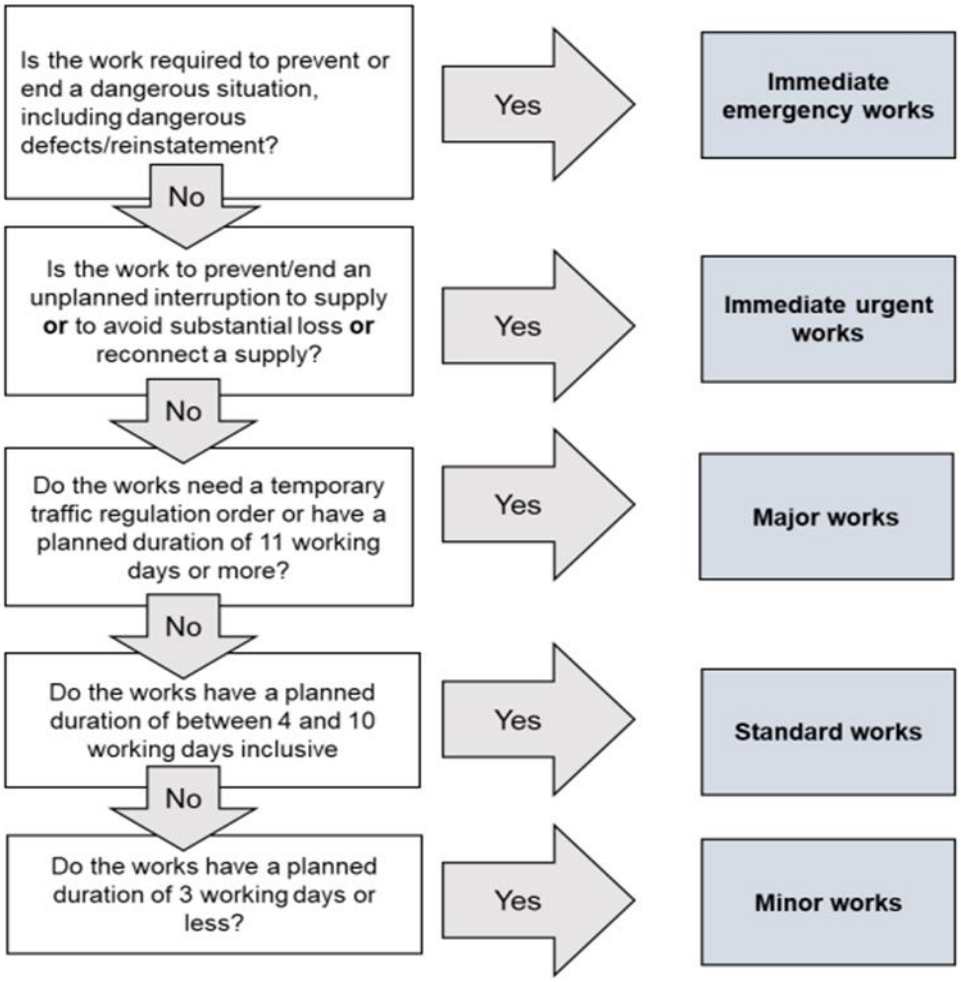
APPLICATION FOR CONSENT – NOTICE PERIODS

The below flow chart provides clarity on the legal notification periods required for each type of works in accordance with the New Roads and Street works Act 1991.

Works are categorised by duration, except for immediate works, which are not time specific. The works categories are defined in the 2007 noticing regulations, with emergency works defined in section 52 of NRSWA.

The works description, along with the duration of works, within the permit should provide adequate information to demonstrate that the correct category of works has been used.

What type of permit/notice do I need?



Permit Category	Notice Periods
Major Works more than 10 days duration or a TTRO is required	3-months' notice
Standard Works 4 – 10 days duration	10 days in advance
Minor Works Less than 4 days duration	3-days in advance
Immediate Works – Urgent and Emergency	Within 2-hours of works having begun

Appendix F

DMRB TC-101 Reference Schedule

Gloucestershire County Council Traffic Signals

Recommended adoption / amendments to National Highways specification

TC101 Version E/1.0.0

To be read in conjunction with TP101 and the GCC Signals Specification & Standard Details.

Where TC 101/WSR/XXX details are not completed the designer / Contractor shall provide equivalent information in the form of specifications and drawings and may use the GCC Traffic Signal Specification and Standard details contained within the GCC MfS as a base for Traffic Signal Installation works.

Sections or Clauses included in TC101 shall be:

A = Accepted
R = Redacted
U = Under review
N = Contain additional notes or references

Section 1 – General requirements for traffic signalling systems	**Clause**	**A/R/U/N**	**Notes**
General requirements for traffic signalling systems	1.1 – 1.6	A	
Installation requirements for traffic signalling systems	1.7 – 1.8	A	
Road markings and road studs for traffic signalling systems	1.9 – 1.10	U	
Maintenance hardstandings and hardstanding maintenance working areas for traffic signalling systems	1.11 – 1.12	U	
Tactile paving for traffic signalling systems clause	1.13	U	
Asset identification labels for traffic signalling systems	1.14 – 1.17	N	GCC Traffic signal specification refers
Bar code labels for traffic signalling systems	1.18 – 1.21	R	
Colour and external finish of traffic signalling systems	1.22	A/N	GCC Traffic signal specification refers
Telecommunication service provider (TSP) interface	1.23 – 1.26	N	GCC Traffic signal specification refers
Verification requirements for traffic signalling systems	1.27 – 1.37	A/N	Requirements accepted and GCC Traffic signal specification refers
Documentation requirements for traffic signalling systems	1.38 – 1.48	A/N	Requirements accepted and GCC Traffic signal specification refers
Site records for traffic signalling systems	1.49 – 1.51	A	

Section 2 - Traffic Signals Heads	Clause	A/R/U/N	Notes
Traffic Signal Heads	2.1	A	
Product requirements for traffic signal heads	2.2 – 2.18	A	
Scope of works for traffic signal heads	2.17	A/N	GCC Traffic signal specification and design drawings refer
Installation requirements for traffic signal heads – Mounting of heads	2.18	A/N	GCC Traffic signal specification and design drawings refer
Installation of traffic signal backing boards	2.19 – 2.20	A/N	GCC Traffic signal specification and design drawings refer
Covering of traffic signal heads	2.21 – 2.23	A	
Documentation for traffic signal heads	2.24	A	

Section 3 – Nearside light signals and wait indicators	Clause	A/R/U/N	Notes
Nearside light signals and wait indicator equipment	3.1	A	
Product requirements for nearside light signals and wait indicator equipment	3.2 – 3.17	A	
Scope of works for nearside light signals and wait indicator equipment	3.18	A/N	GCC Traffic signal specification and design drawings refer
Installation requirements for nearside light signals and wait indicator equipment	3.19 - 3.20	A/N	GCC Traffic signal specification and design drawings refer
Covering of nearside light signals and wait indicator equipment	3.21 - 3.23	A	
Documentation requirements for nearside light signals and wait indicator equipment	3.24 – 3.28	A	

Section 4 – Traffic Signal Detectors	Clause	A/R/U/N	Notes
Product requirements for traffic signal detectors	4.1 – 4.8	A/N	GCC Traffic signal specification and design drawings refer
Scope of works for traffic signal detectors	4.9	A/N	GCC Traffic signal specification and design drawings refer
Installation requirements for traffic signal detectors	4.10 – 4.13	A/N	GCC Traffic signal specification and design drawings refer
Verification requirements for traffic signal detectors	4.14 – 4.19	A	
Product compliance documentation for traffic signal detectors	4.20 – 4.23	A	
Test and commissioning documentation for traffic signal detectors	4.24	A	

Section 5 – Traffic Signal Controllers	**Clause**	**A/R/U/N**	**Notes**
Traffic Signals Controllers	5.1	A	
Product requirements for traffic signal controllers	5.2 - 5.18	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Scope of works for traffic signal controller	5.19 – 5.21	N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Installation requirements for traffic signal controllers	5.22 – 5.23	A/N	GCC Traffic signal specification and design drawings refer
Traffic signal controller configuration	5.24 – 5.26	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Outstation Transmission Unit	5.27 – 5.28	A/N	GCC Traffic signal specification and design drawings refer
MOVA unit	5.29 – 5.31	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
RMS unit	5.32 – 5.33	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Photo cell	5.34 – 5.35	A/N	GCC Traffic signal specification and design drawings refer
Verification requirements for traffic signal controllers	5.36 – 5.38	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Documentation requirements for traffic signal controllers	5.39 – 5.40	A	

Section 6 – Auxiliary equipment cabinets for traffic signalling systems	**Clause**	**A/R/U/N**	**Notes**
Auxiliary equipment cabinets for traffic signalling systems	6.1	A	
Product requirements for auxiliary equipment cabinets for traffic signalling systems	6.2 – 6.8	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Scope of works for auxiliary equipment cabinets for traffic signalling systems	6.9	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Installation requirements for auxiliary equipment cabinets for traffic signalling	6.10 – 6.11	A/N	GCC Traffic signal specification bespoke

systems			forms and tables and design drawings refer
Documentation requirements for auxiliary equipment cabinets for traffic signalling systems	6.12	A	

Section 7 – Power supply feeder pillars for traffic signalling systems	**Clause**	**A/R/U/N**	**Notes**
Product requirements for power supply feeder pillars for traffic signalling systems	7.1 – 7.9	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Scope of works for power supply feeder pillars for traffic signalling systems	7.10 – 7.11	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Installation requirements for power supply feeder pillars for traffic signalling systems	7.12 – 7.16	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Documentation requirements for power supply feeder pillars for traffic signalling systems	7.17 – 7.18	A/N	GCC Traffic signal specification and design drawings refer

Section 8 – Cables for traffic signalling systems	**Clause**	**A/R/U/N**	**Notes**
Cables for traffic signalling systems	8.1	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer, to include cables for CCTV and data capture systems as specified
Product requirements for cables for traffic signalling systems	8.2 – 8.7	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Traffic signal cables	8.8 – 8.9	A	
Power cables for traffic signalling systems	8.10	A	
Scope of works for cables for traffic signalling systems	8.11 – 8.12	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Installation requirements for cables for traffic signalling systems	8.13 – 8.15	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Installation of cables for traffic signalling systems in ducts	8.16 – 8.17	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer

Termination of cables for traffic signalling systems	8.18 – 8.21	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Jointing of cables for traffic signalling systems	8.22 – 8.25	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Marking of cables for traffic signalling systems	8.26 – 8.28	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Earthing and bonding of traffic signalling systems	8.29 – 8.30	A	
Documentation requirements for cables for traffic signalling systems	8.31 – 8.32	A	

Section 9 – Traffic signal posts	**Clause**	**A/R/U/N**	**Notes**
Product requirements for traffic signal posts	9.1 – 9.6	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Scope of works for traffic signal posts	9.7 – 9.8	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Foundations for traffic signal posts	9.9 – 9.10	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Installation requirements for traffic signals posts	9.11 – 9.12	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer

Section 10 – Chambers for traffic signalling systems	**Clause**	**A/R/U/N**	**Notes**
Chambers for traffic signalling systems	10.1	A	
Product requirements for chambers for traffic signalling systems	10.2 – 10.10	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Product requirements for covers and frames for chambers for traffic signalling systems	10.11 – 10.13	A	
Scope of works for chambers for traffic signalling systems	10.14 – 10.16	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Installation requirements for chambers for traffic signalling systems	10.17 – 10.22	A/N	GCC Traffic signal specification bespoke

			forms and tables and design drawings refer
Installation of traffic signal chambers	10.23 – 10.25	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Installation of plastic traffic signal chambers	10.26 – 10.27	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Verification requirements for chambers for traffic signalling systems	10.28 – 10.30	A	
Verification testing for plastic traffic signal chambers	10.31 – 10.33	A	

Section 11 – Cable ducts for traffic signalling systems	**Clause**	**A/R/U/N**	**Notes**
Cable ducts for traffic signalling systems	11.1	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer and shall include cables for CCTV and data capture systems as specified
Product requirements for cable ducts for traffic signalling systems	11.2 – 11.6	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Traffic signal cable ducts	11.7 – 11.9	A	
Power cable ducts	11.9	R/N	DNO power cable ducts shall be black. Private power cable ducts shall be orange. GCC Traffic signal specification bespoke forms and tables and design drawings refer
Marker tape for traffic signalling systems	11.10 – 11.14	A	
Scope of works for cable ducts for traffic signalling systems	11.15	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Installation requirements for cable ducts for traffic signalling systems	11.16 – 11.21	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Cable ducts into traffic signal chambers	11.22 – 11.23	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Cable sub-ducts for traffic signalling systems	11.24	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Marker tape for traffic signalling systems	11.25	A	

Backfilling to cable duct trenches for traffic signalling systems	11.26 – 11.29	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Reinstatement of existing surfaces	11.30	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Additional requirements for cable ducts for traffic signalling systems	11.31	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Verification requirements for cable ducts for traffic signalling systems	11.32	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer
Documentation requirements for cable ducts for traffic signalling systems	11.33	A/N	GCC Traffic signal specification bespoke forms and tables and design drawings refer