

Llay New Road / Plas Acton Road, Wrexham- Traffic Signals Installation

Specification - Appendix 12/5

DOCUMENT CONTROL SHEET**Issued by:**

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1. Scope of Works

1.1. Scope

- 1.1.1. This scheme is part of an installation to install traffic signals, ducting and cables and provide a reliable ELV (Extra Low Voltage) site.
- 1.1.2. Supply and install of a new ELV (Extra Low Voltage) traffic signal controller.
- 1.1.3. NAL Cabinet Controller base to be installed for all the controller cabinets.
- 1.1.4. Link and connect the power supply from Haldo pillar to the new controller.
- 1.1.5. A new Siemens OMU latest type and compatible with Wrexham County Borough Council (WCBC) installation to be installed and configured / tested to the satisfaction of WCBC engineer.
- 1.1.6. 4G SIM card will be provided by WCBC for installation in the OMCU.
- 1.1.7. The controller shall be capable running two streams of integral or semi-integral MOVA and latest MOVA version is required.
- 1.1.8. Supply and installation of all ELV type LED signal heads, all signal cabling and all associated loops and detectors works.
- 1.1.9. Supply and install of all associated ducting and chambers.
- 1.1.10. All traffic signal chambers shall be TWIN wall with Grade B load anti-skid lid frame.
- 1.1.11. The traffic signal designer shall carry out the preparation of the MOVA datasets to include installation and setup.
- 1.1.12. The traffic signal designer is to undertake MOVA validation of the junction, to include a MOVA validation report and link lane diagrams within one month of installation. The Validation engineer must be competent with MOVA validation and qualified with a valid sector 8 card which includes the MOVA module.
- 1.1.13. For working times and programme please refer to the scheme pre-construction information pack. Please refer to scheme programme for works commencement dates and schedules.
- 1.1.14. The traffic signal contractor is to provide site specific method statements, risk assessments and electrical test certificates for all activities to be undertaken as part of the works. This must be signed by all personnel undertaking the works to indicate that they have fully understood the details of the works, and the health and safety requirements. No works will commence on site until these have been approved by WCBC.
- 1.1.15. Traffic signal contractor shall supply cable schematics and loop test certificate before the commissioning.

- 1.1.16. WCBC Engineer shall be given opportunity to attend the Factory Acceptance Test, Site Acceptance Test and Validation, at least two weeks' notice shall be given for any of these activities.

1.2. Specification Documents

Table 1.3: Specification Documents		
The supply, installation, commissioning and maintenance of the equipment shall be in accordance with the latest versions of the following documents		
A	The contract drawings, specification and appendices	
B	Traffic Signal Controller	TOPAS 2500A
C	Performance Specification for Below Ground Vehicle Detection Equipment	TOPAS 2512A
D	Traffic Signs Manual, Chapter 6	Traffic Control 2019
E	The Installation of Traffic Signals and Associated Equipment	TA 82
F	Pedestrian Facilities at Signal Installations	TA 15
G	Code of Practice for Traffic Control and Information Systems	TA 84
H	Layout of Large Signal Controlled Junctions	TA 86
I	All Purpose Trunk Roads MOVA System of Traffic Control at Signals	TD 35
J	The Geometric Layout of Signal-Controlled Junctions and Signalised Roundabouts	TD 50
K	Audible and Tactile signals at pelican crossings	TSM Chapter 6
L	Toucan Crossing Development	TSM Chapter 6
M	The use of Above Ground Vehicle Detectors	TSM Chapter 6
N	The Installation of Puffin Pedestrian Crossings	TSM Chapter 6
O	General Principles of Traffic Control by Light Signals	TSM Chapter 6
P	Installation Guide for MOVA	MCH 1542

Table 1.3: Specification Documents

The supply, installation, commissioning and maintenance of the equipment shall be in accordance with the latest versions of the following documents

Q	Code of Practice for Traffic Control and Information Systems for All Purpose Roads. (DRMB Volume 8)	TA84/06
R	Use of Passively safe signposts, lighting columns and traffic signal posts to BS EN 12767 Annex E	TD89/08
S	National Highway Sector Schemes 8, 9B and 10. The installation and maintenance of Highways Electrical and/or Highway Electronic Equipment and/or associated Highway Works	Issue 12 2010
T	Pedestrian Facilities at Signal-Controlled Junctions	TSM Chapter 6
U	The Assessment of Pedestrian Crossings	LTN 1/95
V	The Design of Pedestrian Crossings	LTN 2/95
W	The Installation of Traffic Signals and Associated Equipment	LTN 1/98
X	Performance Specification for Above Ground On-Crossing Pedestrian Detection Systems	TOPAS 2506
Y	Performance Specification for Nearside Signals and Demand Units	TOPAS 2511
Z	Installation of Detector Loops on Motorways and All-Purpose Trunk Roads	MCH 1540

2. Introduction

2.1. Glossary of Terms

Table 12/5-1: Glossary Schedule

Term	Meaning / Definition
CDM	Construction Design and Management
ELV	Extra Low Voltage
EPROM	Erasable Programmable Read Only Memory
FAT	Factory Acceptance Test
GSM	Global System for Mobile communications
LV	Low Voltage
MOVA	Microprocessor Optimised Vehicle Actuation
OMCU	Outstation Monitoring and Control Unit
OTU	Outstation Transmission Unit
SAT	Site Acceptance Test
SCOOT	Split Cycle Offset Optimisation Technique

2.2. Introduction

- 2.2.1. The purpose of this appendix is to detail the steps required to install, test and commission the traffic signal aspects which form part of the Llay New Road / Plas Acton Road junction to install new traffic signals and ensure that all the equipment is fully operational.
- 2.2.2. This appendix shall be read by all key parties who are involved within this installation, testing and commissioning of the traffic signal equipment.

3. General Requirements

3.1. Main Contractor

- 3.1.1. The appointed Main Contractor shall be responsible for the overall construction of the scheme, including the programming and co-ordination of the installation activities and the arrangement of traffic management.
- 3.1.2. The Main Contractor is to arrange a pre-construction meeting with the following parties in attendance. All attendees should be notified a minimum of **TWO WEEKS** in advance.
 - 3.1.2.1 WCBC Engineer.
 - 3.1.2.2 Main Contractor Supervisor.
 - 3.1.2.3 Traffic Signal Contractor Supervisor.
 - 3.1.2.4 Traffic Signal Controller Configuration Engineer.
 - 3.1.2.5 Site Acceptance Test (SAT) Engineer.
- 3.1.3. A copy of proposed civil works and signal installation programme is to be presented to the WCBC signal engineer at the pre-construction meeting. The installation programme shall include the duration of all areas of works, including Factory Acceptance Test (FAT), SAT and Commissioning.
- 3.1.4. Once commenced, works shall take place over consecutive days. Any deviation from this shall be agreed beforehand by the WCBC Engineer.
- 3.1.5. Throughout the works the Main Contractor is to arrange and attend weekly on-site signals works progress meetings with the Traffic Signal Contractor.
- 3.1.6. The Main Contractor shall be responsible for all safe working methods whilst on site. Particular attention shall be paid to chapter 8 of the current Traffic Signs Manual, The Electricity at Work Regulations 1989, HSG47 "Avoiding Danger from Underground Services" and any site specific rules or instructions.
- 3.1.7. The Main Contractor shall co-ordinate with the Traffic Signal Contractor to arrange all necessary traffic management in accordance with the requirements of chapter 8 of "The Traffic Signs Manual" (2009), to carry out all necessary works under this contract.
- 3.1.8. No on-site facilities will be provided for storage of signal equipment during the contract period unless prior agreement is obtained. Facilities may be provided by the Main Contractor at their discretion.

3.2. Traffic Signal Contractor

- 3.2.1. The proposed traffic signal equipment layout and ducting loops layout are shown on the drawings numbered **C1758/100** and all new traffic signal equipment shall be installed in accordance with TA 84/06 "Code of Practice for Traffic Control & Information Systems For All Purpose Roads" and LTN 1/98 "Installation of Traffic Signals & Associated Equipment" and the signal design drawing and this specification.
- 3.2.2. The Traffic Signal Contractor is deemed to have inspected the site prior to tendering for the works. The Traffic Signal Contractor is to notify the Design Engineer of any problems that would affect installation of traffic signal equipment prior to submitting their tender. All additional work required to rectify faults after submission of tenders shall be funded by the Traffic Signal Contractor.
- 3.2.3. The Traffic Signal Contractor shall ensure that all staff involved in installation are fully aware of all relevant specifications and are supplied with all the information and equipment necessary to comply fully with all the requirements. The Traffic Signal Contractor must also ensure that all staff involved in installation are fully site inducted.
- 3.2.4. The Traffic Signal Contractor supervisor shall be present, on site, whilst any signal installation works are being carried out.

3.3. Procurement

- 3.3.1. All equipment shall be fully type-approved by the Department for Transport (DfT) and shall comply with the current versions of the DfT specifications (MCE and TR series) and British Standards Institution (BS) documents. Where later amendments to these documents are issued, equipment shall comply with their revised requirements in force at the time of SAT. Where revisions to the documents occur after the tender return date, the Traffic Signal Contractor shall seek written authority from the Signal Design Engineer before modifying the equipment to comply with the new requirements.

3.4. Health and Safety

- 3.4.1. The traffic signal contractor is to provide site specific method statements and risk assessments for all activities to be undertaken as part of their works. This must be signed by all personnel undertaking the works to indicate that they have fully understood the details of the works, and the health and safety requirements. No works will commence on site until these have been approved by WCBC.
- 3.4.2. All Contractors must not start work on a construction site until they have been provided with basic information. This should include information from the client and designers about any significant risks associated with the works. **Site inductions must have been undertaken by all personnel working on the site, and copies are to be held, indicating that inductions have taken place, at the site offices.**

- 3.4.3. Contractors must also comply with the duties placed on them under the Health and Safety Regulations, including CDM and NRSWA.
- 3.4.4. All contractors are to ensure that the site remains a safe and healthy place to work. The key to this is the proper coordination of the work, underpinned by good communication and cooperation between all parties involved. This includes informing all parties about risks to other site workers or members of the public resulting from their work.
- 3.4.5. All Contractors shall ensure that the site is kept tidy, removing all discarded materials at the end of each working day.

4. Traffic Signal Controller Requirements

4.1. General

- 4.1.1. Traffic signal controllers shall be ELV and comply with TOPAS 2500 issue A “Microprocessor Based Traffic Signal Controller” including all released amendments and to TOPAS 2513. All controllers shall comply with appropriate sections of this general specification as required by the technical specification for the individual scheme.
- 4.1.2. All controllers shall be capable running two MOVA streams with latest MOVA version.
- 4.1.3. All cabinets shall be grey, and supplied with two keys of each type, including T keys, required to gain access to all parts of the controller, broadly in accordance with TR2206A.
- 4.1.4. Security access to the manual facilities shall be provided by the use of a Yale key, 10½ Section, change 900. Security access to the controller cabinet shall be provided by RK27c lock(s) and double “D” type screw locks.
- 4.1.5. The Traffic Signal Contractor shall provide a suitable maintenance log book. This will take the form of an A5 book with cardboard covers. Each page shall be divided into 4 columns and each column shall be headed date, purpose of visit, action taken, and engineers initials. It shall be available at the SAT in order that subsequent site visits records can be maintained. The existing controller log books shall also be moved into the new controller cabinets.
- 4.1.6. Dimming facilities, controlled by a solar switch located on the signal post as located on the detail design drawing , shall be provided.
- 4.1.7. Detector monitoring facilities are required. The delay period that occurs before illumination of the detector failure shall be as detailed in the TR2500 specification form. A DFM lamp, which is clearly visible from the exterior of the controller cabinet shall be provided.
- 4.1.8. All uni-directional logic equipment shall be in accordance with MCE 2030 Issue A.
- 4.1.9. The type of controller supplied must be discussed with the WCBC engineer prior to procurement as controllers that are not in general use in Wrexham have maintenance and training implications for the authority. Controllers by manufacturers that are not in general use may require that the developer funds training for staff required to maintain the equipment as well as additional spares equipment.

4.2. Installation

- 4.2.1. The proposed orientation of the controller cabinet shall be agreed with the WCBC Signal Engineer prior to installation. The cabinets and feeder pillars shall be so located as to ensure that all approaches are clearly visible from the controller. The Traffic Signal Contractor shall provide the Main Contractor clear instructions with each cabinet to show the recommended method of installation and final level of adjacent footway. Parts of the controller cabinet which are treated to be below ground level should be clearly indicated.
- 4.2.2. The area around the controller and cabinets shall be paved for at least 1.5 metres in all directions in either asphalt or concrete flags and shall link either to the footway.
- 4.2.3. Each cabinet door shall be fitted with a suitable stay, to secure the door during windy conditions and shall be provided with a door pocket suitable for a 38mm A4 ring binder. A self-adhesive A4 folder shall not be acceptable.
- 4.2.4. A mounting shall be provided within the traffic signal controller cabinet(s) for the installation of an Outstation Monitoring and Control Unit (OMCU). The mounting shall allow for a full width horizontally mounted equipment rack and shall include bolts and captive nuts. Where there is direct access to the rear of the units, it shall be unimpeded.
- 4.2.5. The Traffic Signal Contractor shall be responsible for the supply and affixing of self adhesive controller SCN number following the installation of controller cabinet.

4.3. Setup and Configuration

- 4.3.1. The new controller's setup and configuration shall be compliance with TR2500 Specifications which shall be provided and approved by WCBC Signal Engineer. The signal contractor is to enter the MOVA detectors and any MOVA special conditioning requirements.

5. MOVA Requirements

5.1. General

- 5.1.1. The provision of Microprocessor Optimised Vehicle Actuation (MOVA) shall comply with the requirements of MCH 1542 Issue C (2005) "MOVA equipment installation and commissioning guide".
- 5.1.2. The provision, installation and commissioning of all necessary hardware and software to provide MOVA control in accordance with this specification and signal design drawing shall be provided by the Traffic Signal Contractor and shall include all necessary licences, and interface connections between the MOVA unit and the control equipment to enable its operation and IP Ethernet system.
- 5.1.3. Within 4 months of tender award a completed MOVA design, including MOVA detection locations, link diagrams, emergency vehicle priority proposals, controller linking requirements and initial datasets shall be submitted to WCBC representative for approval.
- 5.1.4. Each controller or OMCU / MOVA unit shall be capable running two streams of MOVA.
- 5.1.5. The integral or semi-integral latest version of MOVA shall be installed.
- 5.1.6. Dataset files shall be provided in both .mds and .mova format, compatible with MOVA tools software.

5.2. Setup and Configuration

- 5.2.1. Each MOVA unit is to be capable of being monitored and configured via a laptop computer.
- 5.2.2. The MOVA units are to be capable of being monitored and configured on the in-station via PSTN line or IP networks.
- 5.2.3. All methods of communication shall be by means of the TRL program MOVA COMM.
- 5.2.4. A clearly labelled LED within the manual control panel is required to indicate when the controller is under MOVA control. Where the location of the LED may be determined during configuration, the label shall be supplied for installation in the Traffic Signal Contractor's depot prior to Factory Acceptance Testing.

6. Remote Monitoring Requirements

6.1. General

- 6.1.1. The Traffic Signal Contractor shall supply and install all associated equipment for the use with the OMCU to connect to the Siemens RMS in-station.

6.2. Installation

- 6.2.1. Each OMCU shall be mounted within the traffic signal controller cabinet
- 6.2.2. All necessary mounting equipment and racking shall be provided by the Traffic Signal Contractor to enable each OMCU to be suitably installed within the controller.
- 6.2.3. The Traffic Signal Contractor shall supply and install all necessary cabling/interface leads between the traffic signal controller and the OMCU to provide the required monitoring facilities. OMCU units to be hard wired to provide independent monitoring facilities for **ALL** integral or serial interfaced detection.
- 6.2.4. The OMCU shall be supplied with facilities to enable interrogation of the traffic signal control equipment remotely by the in-station operator. This shall enable the operator at the in-station terminal (via the OMCU) to communicate with the control equipment to carry out 'manual' checking and amendment of RAM data if required.
- 6.2.5. Cable forms for OMCU installations are to be of a standard length and are not to be cut down to fit the dimensions of the traffic signal controller during installation. All excess and spare cables are to be coiled and tied to an appropriate part of the controller chassis in such a way it will not impede any subsequent maintenance works to the controller or the OMCU.
- 6.2.6. Each cable from torroid current sensors, high voltage inputs, detector inputs and the solar cell input is to be numbered and lettered suitably to enable clear identification of each cable. A spade connector is to be connected to the end of each high voltage and detector input cable irrespective of whether it is in use or not.

6.3. OMCU Setup and Configuration

- 6.3.1. The Outstation Monitoring and Control Unit (OMCU) shall be capable of monitoring the operation of the control equipment, operating/monitoring on dial up systems and reporting to the in-station any faults that are detected. The OMCU shall be compatible with the highway authority remote monitoring equipment and shall have the current firmware issue installed.
- 6.3.2. The OMCU shall be able to detect and report to the in-station the following fault conditions:
 - 6.3.2.1 LED signal lamp failures, including differentiating between red, amber and green aspects.

6.3.2.2 Signals off, and be able to distinguish between:

- a) Mains power failure,
- b) Controller fault i.e. Power failure to signal aspects,
- c) Signal lamps switched off at manual panel

6.3.2.3 Timing violations of the following periods:

- a) Minimum green period,
- b) Intergreen period,
- c) Maximum green period,
- d) All red period

6.3.2.4 Signals stuck in phase/stage

6.3.2.5 Detector Faults

6.3.2.6 Dim/Bright Failures

6.3.2.7 Loss of MOVA control

6.3.2.8 Controller modes and mode changes

6.3.2.9 Electricity isolation system fault

6.3.3. The OMCU shall be provided and installed with standby batteries to enable “last gasp” dialling facilities to ensure the OMCU is capable of reporting, within 1 minute, a mains power failure whilst mains power is not present.

6.3.4. All detectors are to be monitored by the OMCU for each installation

6.3.5. The Traffic Signal Contractor shall provide and install any additional in-station hardware/software that may be necessary to provide full compatibility with the OMCU.

6.3.6. Live update drawing and configuration to be provide by the traffic signal contractor.

7. Street Furniture Requirements

7.1. General

- 7.1.1. All street furniture shall comply with TR 2206A "Specification for Road Traffic Signals".
- 7.1.2. All the street furniture shall have minimum 450mm clearance standards from the kerb.
- 7.1.3. All non-working erected signal heads shall be covered at the end of each day of installation. Durable waterproof orange coloured covers will be provided by the Traffic Signal Contractor for this purpose. The Traffic Signal Contractor will also be responsible for their fitting and maintenance during the installation period and their removal prior to testing.

7.2. Installation

- 7.2.1. All items of street furniture shall be treated with an appropriate protective coating which shall be intact at the time of delivery. Where in the course of installation of any item of street furniture sustains minor damage, an appropriate repair shall be undertaken to reduce the risk of corrosion.
- 7.2.2. The location of all street equipment shall be marked on site prior to works commencing during a site meeting attended by the WCBC Signal Engineer and a suitable representative of the Traffic Signal Contractor.
- 7.2.3. The transportation to or from site of all necessary street equipment required to carry out the signal installation will be the responsibility of the Traffic Signal Contractor.
- 7.2.4. The Traffic Signal Contractor will also be responsible for all necessary on-site handling of street equipment in the course of installation works and will be responsible for the safe keeping of all equipment being provided under this contract until site acceptance by the WCBC Signal Engineer.
- 7.2.5. All mini and Haldo pillars, including any pole access doors, shall be sealed to prevent the ingress of water.

7.3. Traffic Signal Poles

- 7.3.1. The Traffic Signal Contractor shall be responsible for the supply and affixing of self-adhesive pole numbers following the erection of each pole and signal head.
- 7.3.2. The supplied numbers shall be to the following specification (table 7.1):

Table 7.1: Pole Number and Letter Detail	
Term	Meaning / Definition
Title size	75mm x 75mm
Character Height	50mm
Colour	Black character on white background
Material	Non reflective, self-adhesive

- 7.3.3. The poles shall be numbered as shown on design drawings and numbers shall be affixed 200mm below the bottom signal head bracket.
- 7.3.4. The pole number shall face in the same direction as the head.
- 7.3.5. The Traffic Signal Contractor is to ensure that all poles supplied under this contract are supplied with head mounting holes suitably drilled in order to comply with the requirements of this specification.
- 7.3.6. Signal poles shall be supplied **without** pre-drilled holes for pedestrian demand units
- 7.3.7. All poles are to be mounted in NAL (or equivalent if agreed by highway authority) retention sockets and as such the poles shall be slot-less. All installation shall be in accordance with manufacturer's recommendations on planting depths, inserts/shims, etc.

7.4. Traffic Signal Heads

- 7.4.1. Brackets shall be protected with an appropriate plastic coating or catalytic paint. They shall be long enough to provide at least 120 degree rotational movement on each traffic signal head where several are mounted on one pole.
- 7.4.2. If a signal head is shown as being bracket mounted, a bracket shall allow for the signal head to be offset from the pole as specified in the design.
- 7.4.3. Signal Heads shall be designed in accordance with BS EN 12368 and be compliant with TSRGD.
- 7.4.4. All signal aspects with Louvers shall be vertical louvers installed.
- 7.4.5. All signal heads shall be of **ELV LED** type. The optical performance of all signal heads shall comply with the requirements of BS EN 60825 and TR 2206A.
- 7.4.6. All vehicle signal heads on poles shall be positioned so that the vertical height between the adjacent carriageway surface (and footway) and the bottom of the signal head/bracket assembly shall be not less than 2.1 metres and not more than 2.55 metres. Each nearside signal head and its associated offside signal head shall be installed on the same horizontal plane.

- 7.4.7. External wiring between signal heads and poles shall be protected by flexible tubing which shall be fixed securely to the back of the signal head using a nylon or plastic gland. Sufficient tubing shall enter the appropriate hole in the signal pole to ensure that it remains in the pole during flexing of the signal head during all weather conditions.
- 7.4.8. Traffic signal heads shall come complete with backing boards (unless otherwise specified) that have been factory treated with BS EN12899-1; 2001 Class 1 retro-reflective white borders.
- 7.4.9. Signal heads shall be so installed that any kopex, above ground vehicle detector plugs and sockets and all associated cabling is not loose or generally susceptible to damage by the actions of adverse weather or vandals.
- 7.4.10. Transformers and power supplies for tactile devices, pedestrian detectors or audible/tactile equipment shall not be installed in any traffic signal head.

8. Above Ground Detection Requirements

8.1. Above Ground Detection

8.1.1.1 N/A

8.2. Installation

8.2.1. N/A

9. Below Ground Detection Requirements

9.1. General

- 9.1.1. Below ground detection equipment shall comply with TOPAS 2512A "Performance Specification for Below Ground Vehicle Detection Equipment". All detector units shall feature the auto-retune facility described in TOPAS 2512A.
- 9.1.2. All loops shall be connected to OMCU to enable communicate with RMS in-station.

9.2. Installation

- 9.2.1. The siting of detector loops shall conform with MCE 0108C "Siting of Inductive Loops for Vehicle Detecting Equipment at Permanent Road Traffic Signal Installations" and shall be installed in accordance with MCH 1540F "Specification for the installation of detector loops on Motorways and All Purpose Trunk Roads" and set out as per Canwell Consulting Detail Design drawing, copies of which can be obtained from design consultants
- 9.2.2. Reference should be made to the signal design drawing and the detector loop locations table on Canwell design drawings. Guidance is to be sought from the Signal Design Engineer prior to commencing slot-cutting operations.
- 9.2.3. In the event that slots are cut at locations not in accordance with the signal design drawing / information supplied by the Signal Design Engineer, the Traffic Signal Contractor will be liable for all costs associated with the re-installation of the loop detectors at the correct location(s).

9.3. Slot Cutting

- 9.3.1. Slot cutting operations shall be carried out by motorised machine fitted with a diamond saw blade in accordance with MCH 1540F and shall not be conducted in periods of rain, nor when the ambient or road surface temperature is below 2°C.
- 9.3.2. Slot cutting shall only take place during the permit working hours on carriageways that are open to traffic, unless approval is provided by the Principal contractor. No additional costs shall be sought by the Traffic Signal Contractor for slot cutting operations outside of these times.
- 9.3.3. The Specialist Contractor should avoid areas of carriageway where the surface integrity is poor and slots should be installed a minimum distance of 0.5 metre from carriageway ironworks or 1.5 metres from expansion joins in concrete sections.
- 9.3.4. All debris, silt and other cutting detritus shall be washed away from the base of the slot and surrounding carriageway before laying the loop cable. The slot and the surrounding carriageway shall then be blown dry with compressed air prior to laying the loop cable.
- 9.3.5. Slots for loop cables shall have a minimum width of 10mm and shall not exceed the diameter of the cable by a maximum of 12mm.

- 9.3.6. Slots for loop cables shall be at an adequate depth to ensure that there is 65mm of continuous cable cover in bituminous surfaces and 35mm cover in concrete sections.
- 9.3.7. Where the loop cable turns in the slot at an angle of less than 110 Degrees, the apex of the corner shall be removed in accordance with MCH 1540F.
- 9.3.8. Upon completion of slot cutting operations, each inductive loop collection chamber shall have its feeder duct end sealed with expanding foam sealant and then the bottom of the chamber shall be filled with sand and topped off with hot bitumen or cold-poured epoxy sealant, which shall be allowed to set prior to replacing the chamber lid.
- 9.3.9. Care should be taken to ensure that the level of the sealant does not foul the seating of the chamber lid.
- 9.3.10. The "Slot Cutting Measurement Certificate" shall be completed prior to site acceptance when it will be signed and handed to the WCBC Signal Engineer.
- 9.3.11. All efforts shall be made to keep the slots clean and dry before the back fill is complete.

9.4. Water Supply

- 9.4.1. A mains water supply will be used for cooling saw blades during slot cutting. The Traffic Signal Contractor shall be responsible for the gaining of permission from the appropriate water supply company for the extraction of water required for slot cutting purposes.
- 9.4.2. In order to minimise the possibility of damage to the mains or contamination of the water supply, the Traffic Signal Contractor shall supply and use a double non-return valve assembly on standpipe(s) when connected to a hydrant(s). The water company may stipulate that hoses must not be laid across a carriageway unless it is closed to traffic.
- 9.4.3. Where a hydrant is not available, or when a carriageway crossing is necessary, the Traffic Signal Contractor shall provide a water bowser. A water pump may be connected to the bowser's outlet to supply high pressure water to the slot cutting machine. With respect to permission for the extraction of water from a hydrant to the bowser and the type of standpipe required, the conditions in paragraphs 9.4.1 and 9.4.2 shall apply.
- 9.4.4. During slot cutting operations only highway drainage shall be used to dispose of contaminated water. Under no circumstances shall open drainage be used to dispose of contaminated water. Advice shall be sought from the Principle Contractor prior to any slot cutting operations.

9.5. Back Fill

- 9.5.1. Nothing in this Appendix shall relieve the Contractor of his obligations under the Control of Substances Hazardous to Health Regulations 2002 (COSHH) and his responsibility for the development of safe working practices.

- 9.5.2. Where the slot cut is greater than 11.5mm the backfilling process shall be: 3mm size fine graded wearing course material to BS 4987, rammed into the slot finished with a minimum layer of 20mm hot bitumen to BS 3690:Part 2, the surface upper fill should be left approximately 3mm proud of the road surface to allow for settlement (as detailed in figure G14 of MCH 1540).
- 9.5.3. Where more than one pair of loop tails share a common 'Cut Back' slot, a layer of epoxy resin shall be poured over each pair to avoid entrapment of air amongst the loop cables.
- 9.5.4. The back fill for armoured cable shall be a three part process, comprising of a layer of resin followed by cold setting asphalt which shall be rammed into the slot and finally covered by hot pour bitumen.
- 9.5.5. The manufacturer's recommendations shall be followed explicitly regarding the handling, mixing, and use of resins. In all cases the resin pour must be sufficient to provide a 5 mm cover to the upper cable in the slot. The resin must be allowed to set before the application of hot pour bitumen or cold setting asphalt as appropriate.
- 9.5.6. In the carriageway, the mouth of the duct or ducts under the kerb shall be temporarily blocked to avoid the egress of water during the slot cutting process. The blockage shall only be removed following the successful completion of the back fill operation. Both the exposed tails from the slot cut and the mouth of the duct shall be blocked by an appropriate duct plug.
- 9.5.7. The excavation in the carriageway, adjacent to the kerb shall be filled with cold setting asphalt and finished with a layer of hot pour bitumen.

9.6. Jointing

- 9.6.1. All loops shall be cut back to the underkerb duct provided and the loop cable led back to the joint chamber. Approximately 500 mm of surplus loop cable shall be left at the footway chamber.
- 9.6.2. Joint connections are to be of the 'Screw terminal' type.
- 9.6.3. Only IP68 re-usable jointing kits shall be used, shrink joints will not be acceptable.

10. Electrical Requirements

10.1. General

- 10.1.1. All wiring shall comply with the BS 7671 (IEE Wiring Regulations) 17th Edition -2008, including all amendments.
- 10.1.2. All cables including loop feeder cables but excluding loop detector cables shall have their outer-sheath coloured orange. Additionally, they shall be embossed with the legend "TRAFFIC SIGNALS" in 9 mm high characters generally in accordance with BS 6346: 1997 "Electric cables. PVC insulated, armoured cables for voltages of 600/1000 V and 1900/3300 V".
- 10.1.3. For each installation a diagram showing proposed cable runs, types and lengths shall be made available to the WCBC Engineer not less than one month prior to the installation date in order to demonstrate compliance with the following requirements.
- 10.1.4. Cables are also to be labelled with their termination points in all inspection chambers. In all other respects the cables shall comply with the requirements of BS EN 7671 and all other relevant specifications and standards.
- 10.1.5. The ends of all spare cores, including loop feeder cables, shall be earthed in the controller cabinet.

10.2. Traffic Signal Cable Installation

- 10.2.1. ELV Cables shall have a yellow "pull tight" tag securely fixed to each end and shall be clearly written on each tag in indelible ink.
- 10.2.2. Each cable run between the controller and signal or an adjacent controller shall include 25% spare cores (minimum 4 cores) throughout its length, available for use at each intermediate point served by the cable.
- 10.2.3. Cable runs/connections shall be arranged so that one signal pole knockdown or one cable fault does not extinguish all the signals on any one approach. Each signal head shall be capable of being isolated individually at low level.
- 10.2.4. All incoming loop feeder cables shall be terminated in the controller cabinet and termination cabinet at "Low Level" by means of suitable termination blocks and soft wired into associated detector packs.
- 10.2.5. A "Cable Schedule -Extra Low Voltage" shall be completed for each controller cabinet showing the unique identity of each cable, and the location of its terminations. The "Cable Core Schedule" shall be completed for each cable showing the function of each core within the cable. The completed schedules shall be passed to the WCBC Engineer for signature prior to site acceptance.

- 10.2.6. The Traffic Signal Contractor shall complete a schedule detailing the location and function of each terminal block connection, as installed within the controller cabinet and termination cabinet. The schedule may be in the form of a controller works specification or similar document. Terminal blocks may be identified by an annotated diagram or by clear labelling cross-referenced to the schedule. The completed details shall be passed to the Signal Design Engineer prior to site acceptance.

10.3. Loop Feeder Cable Installation

- 10.3.1. Inductive loop cable shall comply with TR 2029D “NMCS Inductive Loop Detector Cable”. The minimum overall cable diameter defined in clause 5 of TR 2029 shall be increased to 6.8mm.
- 10.3.2. Feeder cables shall comply with TR 2031E “NMCS Feeder Cable for Inductive Loop Detectors”. The cable shall be sheathed in orange polyethylene, not grey as required by clause 5.10.1 of TR 2031E.
- 10.3.3. Feeder cables shall generally not exceed 200 metres. Exceptionally this maximum length may be increased to 300 metres in accordance with MCH 1540 Issue F, provided specific authorisation from the WCBC Engineer is obtained. Where these limits would otherwise be exceeded, a detector haldo pillar shall be installed at an intermediate location, to be agreed by the WCBC Engineer. Cables between such housings and the controller cabinet shall comply with the requirements of this specification.
- 10.3.4. A minimum of 1 pair of unarmoured feeder cable shall be used per loop. No feeder cable shall be jointed unless it is connected to a detector loop.
- 10.3.5. Where multiple loops share the same detector channel, each individual feeder cable shall be connected to an individual termination point within its associated controller or termination cabinet. Each termination point is to be connected using light gauge wire prior to connection to its detector channel.
- 10.3.6. Feeder cables shall be terminated in one or more heavy duty termination blocks. The termination block(s) shall be securely and directly bolted to a fixed metal support. Light gauge stranded wire, twisted in pairs, and shall be used to connect from the heavy duty block to the detector back-plane.
- 10.3.7. Each feeder cable shall have a green “pull tight” label securely fixed to each end and in all associated chambers, with the identity of the loop(s) attached to the cable, as shown on the signal design drawing. This shall be clearly written on each label in indelible ink.

10.4. Main Power Supply

- 10.4.1. The electricity supply from the haldo / feeder pillars to the traffic signal controller cabinets, the termination cabinets shall comply with the requirements of chapter 8 in TR 2206A and incorporate a 30A lockable double pole isolator with single pole fuse. A secondary isolation fuse (double pole MCE 040DN or similar) incorporating a 20A fuse shall also be fitted in the mini pillar connected to the electricity supply via a 6mm² double insulated cable.
- 10.4.2. The Traffic Signal Contractor shall be responsible for all liaisons with the Main Contractor, with regards to the procurement and connection of the electricity supply to the controller cabinets and termination cabinets of this 230 volt supply. The Main Contractor shall be responsible for the supply and installation of the electricity supply to the haldo / feeder pillars by the controller cabinets.
- 10.4.3. An Electricity Supply pillar (Haldo or equivalent) that is GALVANISED STEEL and not plastic coated shall be supplied for the termination of the electricity supply. Within the pillar a wooden panel shall be fixed which has a space of at least 180 mm high x 100 mm wide x 95 mm deep available for the electricity supplier to mount and connect the cut out. In the pillar a suitable lockable double pole fused isolation switch, to enable the supply to the controller to be isolated, shall be fitted. All earth bonding within the pillar shall be terminated at a main earth terminal. Ducting shall be installed between the Electricity Supply pillar and the Controller.
- 10.4.4. **The cable connecting the supply to the controller cabinet shall be provided and installed by the Traffic Signal Contractor**, however, the final connection and installation of the electricity supply company's cartridge fuse may only be undertaken by the electricity company's authorised staff. This work is to be arranged by the Main Contractor.
- 10.4.5. A 6mm² core armoured cable shall be used to link the power supply secondary isolator fuse to the signal controller and termination cabinet. The pillar casing, door and earth core of the controller link cable shall be bonded together to a main earth terminal with a 10mm² earth cable.
- 10.4.6. When multiple isolators exist in any feeder pillar, a clear label shall be installed to identify the supply to each controller and termination cabinet.
- 10.4.7. A switched dual 13 amp socket shall be provided for maintenance tools and test equipment only. These sockets, to BS1363, shall not be isolated by the controller equipment switch and shall be protected by a residual current device of maximum rating 30mA residual current to the functional requirements of BS EN 61008. This socket shall be protected by a 5A fuse. A label shall be affixed in the vicinity of each socket which shall read "MAINTENANCE ONLY 5A MAX".
- 10.4.8. Maintenance sockets shall be installed in all controller and termination cabinets.

10.4.9. Within the Traffic Signal Controller a 5 amp fused supply shall be provided for powering the OMCU and MOVA unit, irrespective of whether it is specified that a separate unit is to be fitted.

11. Service Duct Requirements

11.1. General

11.1.1. Ducting and access chamber layout is shown on the signal design drawing and shall be installed in accordance with manufactures guidelines.

11.1.2. The following document gives details of service duct requirements for traffic signal installations in Wrexham.

Item	Requirement	Comments
Duct in footway/verge depth of cover	450mm	As per NJUG*
Duct in carriageway depth of cover	750mm	As per NJUG*
Max duct run length between chambers	45m	Unless otherwise agreed
Main Ducting Material	Polyethylene or UPVC	
Main Ducting Colour	Orange	As per NJUG*
Main Ducting Flexibility	Solid wall, Rigid	Unless otherwise agreed
Main Ducting Flexibility *Only permissible by exception*	Twin Wall, Smooth internal wall	Single wall corrugated duct not permitted
Main Ducting Markings	White/Black lettering, min 9mm high at max 1m "TRAFFIC SIGNALS"	Duct to be laid so markings face upwards
Main Ducting Internal Properties	Must be smooth	
Main Ducting Internal Dimensions	Min 94mm	Ducting to be "100mm"
Main Ducting External Dimensions	Max 110mm	Ducting to be "100mm"
Main Ducting Wall Thickness	Min 4mm	
Main Ducting Marker Type	Yellow with Black Legend	As per NJUG*
Main Ducting Topology	Ring	4 way across carriageway
Main Ducting Testing Methodology	Mandrel – HCD I2	
Ducting to Carriageway Loop Box Material	MDPE/HDPE or UPVC	
Main Ducting Flexibility	Rigid Solid Wall or Flexible Twin Wall	Single wall internally corrugated duct not permitted
Ducting to Carriageway Loop Box Colour	Orange	

Ducting to Carriageway Loop Box Internal Dimensions	49mm Min	
Ducting to Carriageway Loop Box External Dimensions	100mm Max	
Ducting to Carriageway Loop Box Internal Properties	Must be smooth inner wall	Internally corrugated not permitted
Ducting to Carriageway Loop Box Surround	ST2 Concrete	
Draw Cord Material	Polypropylene or Nylon	Must be present for all duct runs
Draw Cord Colour	Blue	To make clearly visible in dirt
Draw Cord Breaking Strain	500kg	This equates to min 6mm dia.
Draw Cord Ends	Must be tied at ends	To avoid losing rope in duct
Chamber Type	Modular Twin Wall	Preformed Liners not acceptable
Chamber Material	Preformed Polypropylene	For structural strength
Chamber Surround Footway	To match reinstatement	Surface to match current paved
Chamber Surround Verge	From 150mm depth to surface to be ST4 concrete extending 150mm around chamber frame with EF kerb edge on outer edge	EF kerbing is to prevent concrete breaking away
Chamber Bedding Footway/Verge	Compacted SHW type 2 sub base	For drainage purposes
Chamber (Controller Access) minimum size	600 x 600	
Chamber (Road Crossing) minimum size	600 x 450	
Chamber (Pole Access) minimum size	450 x 450	
Chamber (Loop Access) minimum size	450 x 4500	
Chamber Lid Minimum Spec (Footway/Verge)	BSEN124: Class B 125	
Chamber Lid Minimum Spec (Regular low speed trafficked areas)	BSEN124: Class C 250	

Chamber Lid Minimum Spec (Carriageway)	BSEN124: Class D 400	
Chamber Lid Labelling	"Traffic Signals"	
Chamber Lid Min PSV	50	Skid resistant cover & frame
Signal Pole Installation Method	Retention Socket	Not to be Pole Chamber or direct buried. Manufacturer to be NAL unless otherwise agreed.
Signal Pole / retention socket in verge surface surround	4m ² hardstanding with EF kerb edge	To footway construction Unless otherwise agreed
Retention socket foundation	750 x 610 x 610mm	See manufacturer guidance
Signal Pole / Controller Cabinet Colour	Black	Check with engineer, location dependant
Signal Pole Retention Socket distance to nearest chamber	Max 5m	Unless otherwise agreed
Product Certification	Must conform to Construction Products Regulation 2015	(All equipment used must be CE marked)

* NJUG refers to *NJUG GUIDELINES ON THE POSITIONING AND COLOUR CODING OF UNDERGROUND UTILITIES' APPARATUS*

11.2 Site Specific Requirements

11.2.1 Site meet all standard needs of ducting and chambers apart from a complete duct ring cab not be achieved due to no footway around the church court yard, note any road crossing with be a minimum of two ducts.

11.3 General Ducting Requirements

11.3.1 All chambers and ducting must comply with the requirements set out in the above table.

11.3.2 Duct locations are as depicted on the Canwell scheme drawing C/1758/100 with any alteration being agreed by the engineer.

11.3.3 The duct network should provide sufficient spare capacity to allow for any further development of the site.

11.3.4 Joints between ducting sections must be flush and properly fitted. The connection of duct section without proper connectors or joints is not permissible.

- 11.3.4 Ducts will terminate into pre-formed chambers incorporating adjustable steel frames and covers to standards defined in table above dependent on specific location requirements. All ducting shall be cut to be flush with the internal wall of the pre-formed chamber.
- 11.3.5 All duct runs are to be straight and bend using preformed bends
- 11.3.6 All duct runs shall have draw cords installed for installation purposes, and where signal poles are installed there shall be a draw cord from the adjacent chamber to the top of the pole.
- 11.3.7 All traffic signals ducting is exclusively for the use of traffic signal cabling.
- 11.3.8 Under no circumstances are LV (230v) and ELV (<50v) cables to share the same ducting.
- 11.3.9 Ducting for use by utilities such as power and communications shall be in accordance with the relevant utility supplier's specifications.

11.4 General Access Chamber Requirements

- 11.4.1 All chambers and ducting must comply with the requirements set out in the above table.
- 11.4.2 Chamber locations are as depicted on the Canwell scheme drawing C/1758/100 with any alteration being agreed by the engineer.
- 11.4.3 Ducting entry into chambers is to be horizontal with no sharp edges and to have a maximum protrusion of 40mm and a minimum protrusion of the level that is flush with inner wall of chamber.
- 11.4.4 Chambers are to have pre-drilled duct entries with removable caps
- 11.4.5 Chambers located within heavily trafficked areas should be avoided. Where a chamber must be located within tactile area, the surface of the chamber lid must match the surrounding area. Any instances of this must be specifically agreed with the Wrexham Council Engineer.
- 11.4.6 The traffic signal controller is to be installed on a cabinet controller base. The supplier NAL Ltd can provide such an item. Should another supplier be proposed this must be agreed by the WCBC Traffic Signals Engineer.
- 11.4.7 Carriageway loop boxes must be installed for detector loops, unless otherwise agreed.
- 11.4.8 Under no circumstances are LV (230v) and ELV (<50v) cables to share the same chambers.

11.5 General Retention Socket Requirements

- 11.5.1 Pole retention sockets must connect to duct network. Slotless poles and poles without retention sockets are not permitted.
- 11.5.2 Retention socket locations are as depicted on the Canwell scheme drawing C/1758/100 with any alteration being agreed by the engineer.

- 11.5.3 Pole retention sockets must have a clamping mechanism and include a cover for pole hole when socket is not in use. The preferred retention socket is the RS115 manufactured by NAL Ltd. Should another supplier be proposed this must be agreed by the WCBC Traffic Signals Engineer.
- 11.5.4 Pole Retention Sockets to be installed as per manufacturer's instructions, with correct foundation material and sizing. Proper installation method of socket is essential to ensure poles are upright. Any incorrect installation of retention socket (foundation or otherwise) will require mandatory reinstatement of pole retention socket. Should it be necessary to reduce the length of the pole sleeve to obtain the correct depth of the pole socket, this must be agreed with the engineer, the sleeve cut must be de-burred and cleaned before re-assembling. The corresponding depth shall be removed from the pole, de-burred and treated with an anti-corrosion treatment.
- 11.5.5 Poles must be installed in socket correctly with any shims as necessary to ensure there is not undesirable vertical, horizontal or rotational movement.
- 11.5.6 Where retention sockets are located on a pedestrian ramp block or footway paving a wedge section must be provided to allow for a level footway finish.

11.6 General Testing Guidance

- 11.6.1 Following installation, the duct network is to be blown / flushed clear and all chambers cleared from debris.
- 11.6.3 Following testing draw cords (Polypropylene or Nylon, Blue in colour, 5Kn breaking load) are to be installed into each duct and secured at each end to avoid being inadvertently drawn back into the duct network.
- 11.6.4 Retention sockets will be tested by exerting rotational and directional force on the pole. Significant movement in the pole, or any movement in the retention socket will require that the installation is made good.

12. Testing

12.1. Factory Acceptance Test

- 12.1.1. One printed copy of the user handbook or guide shall be supplied to the WCBC Signal Engineer for each type of ancillary equipment. The documentation shall include a full list of operator commands and their functions and details of the functions of all switches accessible to the Signal Design Engineer. The Traffic Signal Contractor shall supply the documentation to the WCBC Engineer at the time of the Factory Acceptance Test (FAT).
- 12.1.2. The Traffic Signal Contractor shall make all necessary arrangements for the WCBC Engineer to attend the FAT (at the local depot of the Traffic Signal Contractor) and shall give the WCBC Engineer at least two weeks' notice of the proposed FAT date. On successful completion of the tests, configuration supplied shall be programmed with the controller specific data ready for installation.
- 12.1.3. The Traffic Signal Contractor shall ensure that the control equipment on test during the FAT is the actual hardware and software that is proposed to be installed for this contract.
- 12.1.4. The WCBC Engineer reserves the right to uniquely mark parts of the control equipment (following a successful FAT).
- 12.1.5. Should it not be possible during the initial FAT for the Signal Engineer to accept the control equipment due to the failure of facilities, test gear or control equipment supplied by the Traffic Signal Contractor, all reasonable costs incurred by the Signal Engineer to attend subsequent FAT(s) will be recovered from the Traffic Signal Contractor prior to settlement of the final account.

12.2. Signal Installation Electrical Test

- 12.2.1. Earth Leakage Impedance Tests complying with the latest edition of BS 7671 "Requirements for Electrical Installation" shall be carried out by the Traffic Signal Contractor, using appropriate test equipment, at each of the controller cabinets, termination cabinet and each associated pole.
- 12.2.2. A "Signal Installation Electrical Test Certificate" shall be completed prior to site acceptance when it will be signed by the Signal Engineer. Pole numbers used on the certificate shall be as shown on the signal design drawing.
- 12.2.3. The Traffic Signal Contractor shall notify the Signal Engineer in writing of any precautions that are required to safeguard the controller hardware and software during such tests. A list of these precautions shall be left in the controller following commissioning.
- 12.2.4. The Traffic Signal Contractor shall forward a copy of the completed certificate to the Signal Design Engineer within five working days of site acceptance test.

12.3. Detector Performance Test

- 12.3.1. Each loop detector installation shall be checked by means of tests as detailed in Section 5 of MCH 1540F. All insulation measurements to be carried out at a test voltage of 500 volts DC, for the duration of one minute. The results shall be recorded on a suitable Detector Performance Test Certificate supplied by the Traffic Signal Contractor.

12.4. OMCU Commissioning

- 12.4.1. Commissioning of the OMCU is to be carried out in the presence of the WCBC Signal Engineer. Interrogation of the unit shall be demonstrated by the Traffic Signal Contractor to the Signal Design Engineers satisfaction by means of a suitable interrogation device.
- 12.4.2. The Traffic Signal Contractor is to provide the unit's configuration and a live graphic update, on disk or via e-mail at least one week prior to the SAT.
- 12.4.3. The Traffic Signal Contractor shall complete and forward a copy of the completed "OMCU Installation Details Certificate" form to the WCBC Signal Engineer prior to the SAT.
- 12.4.4. The Traffic Signal Contractor shall test the unit in the presence of the WCBC Signal Engineer to demonstrate that the on-site equipment corresponds with the number of lamps being monitored per phase and detector input locations, etc.
- 12.4.5. The Traffic Signal Contractor shall also override the dimming sensor in order to force the control equipment to change to the dim state. The unit shall be tested to confirm that the dim state has been recognised and that no lamp faults (as a result of the dim state) are reported by the OMCU to the In-Station.
- 12.4.6. The Traffic Signal Contractor shall remove one signal lamp per phase in turn at each signal installation being commissioned. Confirmation from the in-station operator shall be sought by the WCBC Signal Engineer that the lamp failure has been identified by the OMCU for the correct aspect and phase.
- 12.4.7. The WCBC Engineer reserves the right to instruct the Traffic Signal Contractor to carry out any other tests that they may consider necessary to prove the correct operation of the monitoring equipment.
- 12.4.8. Each OMCU must be capable of monitoring phase/stage extensions and report any phase or stage not being extended between the minimum and maximum green values when extensions are present.
- 12.4.9. The OMCU must be able to monitor variable all red periods and report violations as faults. Variable all red periods shall include:
 - 12.4.10. i) Extra clearances introduced by speed measuring equipment.
 - 12.4.11. ii) All red periods between phases or stages introduced by all red detectors loops.
- 12.4.12. The OMCU shall be capable of monitoring all detector input types for each installation and be able to report a detector as faulty if it detects a non-change of state.

12.5. Site Acceptance Test

- 12.5.1. One copy of the Traffic signal controller and cabinet keys shall be given to the Signal Design Engineer prior to site acceptance testing.
- 12.5.2. Site Acceptance Testing (SAT) will require the Traffic Signal Contractor to provide SAT Engineer to demonstrate to the Signal Design / WCBC Engineer the compliance of the installation with the specifications in all respects. The Traffic Signal Contractor shall also provide all testing equipment required.
- 12.5.3. The Traffic Signal Contractor is to conduct pre-switch on tests and complete all relevant documentation required under this specification, prior to inviting the WCBC Engineer to attend a SAT.
- 12.5.4. A "Traffic Signal Site Acceptance Certificate" will be signed by the WCBC Engineer and the Traffic Signal Contractor when the installation has been shown to comply with the specifications and all documentation is complete.
- 12.5.5. The Traffic Signal Contractor shall supply the WCBC Engineer with two copies of appropriate controller interrogation software, and interface leads to enable on site communication with the traffic signal controller via the RS 232 engineers port.
- 12.5.6. All necessary blank forms / certificates and / or schedules shall be completed and handed over to the WCBC Engineer. Without this information, the site will not be accepted.

13. Equipment Maintenance and Warranty

13.1. Maintenance and Warranty

- 13.1.1. Maintenance will be required from the start of works contract for 12 months following final commissioning. The contractor must attend all maintenance issues during the works, or by separate agreement nominate.
- 13.1.2. Maintenance arrangements are generally in accordance with Department of Transport Advice Note TD 24/97, and as detailed below.
- 13.1.3. As part of this contract, 28 consecutive days fault free operation for the new equipment will be required before the equipment can be handed over to our maintenance contractor. Until 28 consecutive days fault free operation has elapsed.
- 13.1.4. The 28 days will not commence until a “final” takeover certificate has been signed, prior to this the contractor will be fully responsible for the site in all respects including controller maintenance, lamp maintenance and any third party damage should it occur.
- 13.1.5. The contractor shall observe all relevant safety precautions whilst making inspections/effecting repairs etc. these are described in Department of Transport Advice Note TA 24/81.
- 13.1.6. Whenever the controller is opened, the signal contractor shall check for the smell of gas. If gas is suspected to be present, the Gas board shall be called.
- 13.1.7. Cover will be required 24 hours a day, seven days per week including bank holidays.
- 13.1.8. Three categories of fault repair are required:
 - Traffic signals failure – site all out. Service to be restored within 2 hours.
 - Lamp Failure – Red/green fault. Repair within 4 hours
 - Other traffic signals faults. Repair within 24 hours.
- 13.1.9. Equipment to be maintained includes, all equipment supplied and installed as part of these works. It also includes bulk lamp changes and periodic inspections, should they fall due prior to the installation being handed over. In the case of LED signal heads cleaning will be required at 6 monthly intervals in place of bulk lamp changing.
- 13.1.10. The maintenance does not include the equipment supplied and installed by a third party, except where the third party is employed as a subcontractor to the signals contractor.
- 13.1.11. All the LED traffic signal aspects shall have a minimum 5 years warranty.

13.2. Timing Amendments –Revised Configurations

- 13.2.1. The Traffic Signal Contractor shall include in the quotation for the provision and installation of **TWO** revised configurations within the first twelve months maintenance and warranty period for each controller provided under this contract. This shall incorporate any timings, CLF, stage / phase change or configuration amendments deemed necessary by the Signal Design Engineer.

13.3. Detector Packs

- 13.3.1. The signal contractor shall supply 25% spare detector packs in each controller and termination cabinet. Packs shall be new and stored in original electrostatic packaging. Spare detector packs shall not be removed from site without prior permission of the WCBC Engineer.
- 13.3.2. Spare detector packs used to replace faulty packs shall be replaced.

Appendix A

TRAFFIC SIGNAL SCHEDULE OF EQUIPMENT

The following is a schedule of equipment for the Signal Junction –Llay New Road / Plas Acton Road, Wrexham

- 1 No - ELV Microprocessor 16 phase Junction Controller equipped to provide the facilities specified.
- 1 No - Siemens MOVA / OMUC / 4G Router complete with all necessary cables and mounting brackets to be housed within the Controller. Plus, instation configuration with live drawing provided.
- 3 No - Detector Packs.
- 4 No - 4.0m Drilled Grey Galvanised & Plastic Coated Straight Signal Pole.
- 5 No - LED Signal Head Assemblies with 3-200mm (Red/Amber/Green) Optical Systems as detailed on Canwell drawing.
- 1 No - LED Signal Head Assemblies with 4-200mm (Red/Amber/Green/ Right Green Arrow) Optical Systems as detailed on Canwell drawing.
- 1 No - Signal Solar Switch.
- 1 No - Charles Manufacturing Lockable Isolator

1 No - Feeder Pillar

Item - 16 core armoured Signal Cable.

Item - 20 core armoured Signal Cable.

Item - 1-pair 1.5mm armoured Feeder Cable.

Item - Slot Cutting

1 No - MOVA licence

Appendix B

Cable Core Allocation Sheet

Appendix C

Installation Test Certificate

Table D.1: Installation Test Certificate for Continuity and Insulation Resistance	
Site Name	
SCN	
Drawing No.	
Contractor	
Contractors Engineer: Print	
Contractors Engineer: Sign	
Date Tested:	

Table D.2: Installation Test Certificate for Continuity and Insulation Resistance

[illegible]

Appendix D

Sample FAT/SAT forms

Table E.1: Sample FAT / SAT forms				
	Test	Pass	Fail	Comments
1.0 General				
1.	Check controller serial number with spec			
2.	Make visual inspection of site to see if it is ready to be commissioned.			
3.	Check all controller terminations (bare ends etc)			
4.	Check earthing conductors			
5.	Check all signals are located as per plan and secure			
6.	Check Signals are of correct colour and orientation			
7.	Check any additional equipment is fitted and wired in.			
8.	If required that a phone line is installed and connected			
9.	Check controller operation with lamps off			
10	Check clock and calendar are correct			
11	Check BST advance and retard are set			
12	Supervise flash test to check cabling			
13	Switch Signals On and check flashing sequence			
14	Check controller fault log for any faults on start up.			
15	Check activation unit wired up and operational.			
16	Check clearance between signal head and carriageway is 0.5m minimum.			
17	Signal poles firmly located and installed in pole sockets in concrete foundations.			
18	Equipment type approval documents received.			
2.0 UTC MODE				
1.	Where an OTU is fitted check interface wiring			

Table E.1: Sample FAT / SAT forms				
	Test	Pass	Fail	Comments
2.	Check control and reply bits to UTC centre that the mode changes when a force is sent individual demand bits			
3.	Demand dependant forces with both street demands			
4.	The UTC stage change logic is correct			
5.	That sending more forces than expected causes no problems			
6.	Permitted movements especially out of UTC to another mode			
7.	DX runs specified stages to max (no force present) that no phase minimum is violated			
8.	Reply bits are returned for specific controller conditions (lamps off=G1+G2,DF,maual, LF,etc.			
9.	Check that fault conditions are displayed on the control panel			
10	When leaving UTC mode that demands are inserted for all phases			
3.0 UTC MODE CHECKS FOR AN ADD-ON MOVA UNIT				
1.	Mode changes when a force is sent?			
2.	Mode changes when a TO is sent? NO			
3.	Mode changes when a force & TO is sent?			
4.	Stage confirm bits are all present and correct			
5.	Phase confirm bits are all present and correct			
6.	All stage force bits are all present and correct			
7.	CRB presence			
8.	CRB operation (select manual or other modes) that TO actuation changes mode			
9.	Stage change logic is correct			

Table E.1: Sample FAT / SAT forms				
	Test	Pass	Fail	Comments
10	Send multiple forces- OK?			
11	That G1/G2 are on when lamps are off.			
12	If CRB toggle configured it operates correctly			
13	All prohibited moves or via's are prohibited in MOVA			
14	When leaving MOVA/UTC demands are inserted for all phases.			
15	All moves can be can be achieved			
16	Phase mins are same as link minimums in MOVA			
17	Revert in normal mode is same as revert in MOVA			
4.0 Electrical Isolation Units				
1.	Check operation of every impact sensor, electrical isolation on activation			
2.	Check fault output from SIS to controller / OMU.			
5.0 Detector Inputs				
1.	Detector inputs are correct and operate			
2.	Detectors have correct functions(latch,call/cancel)			
3.	Detectors demand/extend the relevant stage			
6.0 Local Link				
1.	That any associated pedestrian facility is inhibited during specified stages			
2.	Operation of override timer			
7.0 Hurry Call				
1.	Operation of detectors			
2.	That correct stage is called in relation to the detector			
3.	The call delay period			
4.	The hold period			
5.	The prevent period			

Table E.1: Sample FAT / SAT forms				
	Test	Pass	Fail	Comments
8.0 Pedestrian Crossing				
1.	Operation of red lamp monitoring (if specified)			
2.	P1 Green To Vehicles			
3.	P3 All Red			
4.	P4 Green Man Time			
5.	P5 Fixed Blackout			
6.	P6 Extendable Blackout			
7.	P7 Bonus Blackout			
8.	P8 All Red			
9.	On Crossing Detectors (extension time)			
9.0 Special Conditioning				
1.	Aux LED's: Higher Priority mode LED active when in UTC/MOVA mode			
2.	Any other requirements specified			
3.	Any which would affect MOVA?			
10.0 Other				
1.	Electrical / ELI test carried out and certificates issued			
2.	Check all cable markings			
3.	Pole and controller numbering carried out			
4.	Detector Installation and test certificates issued			

Table E.1: Sample FAT / SAT forms				
	Test	Pass	Fail	Comments
Comments...				
Design Engineer 1				
Print Name		Signature		
Date				
Design Engineer 2				
Print Name		Signature		
Date				
Traffic Signal Company Engineer				
Print Name		Signature		
Date				