

Torbay Council Highways and Engineering

Traffic Signal Installation Standards Version 2.0



Issue 1

Requirements for Installation of Permanent Traffic Signal Equipment in Torbay.

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1. Introduction

- 1.1 The aim of this document is to provide a guide to enable suppliers of service details on the specific requirements of Torbay Council for the supply and installation of equipment in the Authorities area.
- 1.2 Although this document is not in the form of an “ APPENDIX 12/5:TRAFFIC SIGNS : TRAFFIC SIGNALS AND ASSOCIATED EQUIPMENT” suppliers should ensure that items covered within this document are replicated within any Appendix 12/5 that they produce for work on Traffic signals in the Torbay Council area.
- 1.3 Traffic signals for both vehicle and pedestrians control, in Torbay are required to meet a number of requirements in both function and installation. As a result this guide should be read with reference to Torbay Council standard detail drawings. The most relevant of which are contained within the appendix of this document.
- 1.4 The National Code of Practice MCH 1869A shall apply throughout the design and installation cycle. In addition, the “Guide to Good Practice” shall be used as a reference (when published by EITAC).
- 1.5 All designs and installations shall be subject to Safety Audit either in accordance with HD 19/90 and HD 42/90 or IHT Standards. This shall include the completed Signal Controller Specification. The completed and Audited specification shall be signed and dated by the Engineer who carries out the Audit. The Original of all Audits shall be retained in the Torbay Council office Traffic Signal section.
- 1.6 The installation of traffic signal equipment shall only be undertaken by a Contractor certificated to BS EN ISO 9002 : 1994, and in line with the current edition of the IEE wiring Regulations for electrical installations.
- 1.7 The Works contained in this appendix shall refer to the installation of Traffic Signals, Pelican crossings, Puffin crossings, Toucan crossings and cycle facilities.
- 1.8 Installers shall at all times conform to Health and Safety at Work Acts, the Electricity at Work Regulations and the Construction Design & Maintenance Regulations. Installers shall also ensure that installation procedures conform with all relevant DfT advice notes and directives, especially signing and guarding shall conform to Chapter 8 of the Traffic Signs Manual. All operatives working the Torbay Council Contract will require Sector 8 approval.

2. Standards, specifications and regulations

2.1 All works shall be undertaken in accordance with the following:

- (a) EN 12368:2000
- (b) IEE Regulations for Electrical Installations (current edition) BS 7671 : 1992
- (c) Current Department of the Environment, Transport and the Regions (DfT) Specifications relating to traffic signals and associated equipment
- (d) Highways Agency Manual of Contract Documents for Highways Work Volume 1 Specification for Highways Works Series 1400. 'Electrical Work for Road Lighting and Traffic Signs'.
- (e) Current DfT Standards relating to traffic signals and associated equipment
- (f) Current DfT Advice Notes relating to traffic signals and associated equipment
- (g) The Traffic Signs Regulations and General Directions 2002
- (h) The Zebra, Pelican and Puffin Pedestrian Crossings Regulations and General Directions 1997
- (i) DfT Local Transport Note 1/98 The Installation of Traffic Signals and Associated Equipment
- (j) DfT Specification TR2500 / MCE1827B
- (k) The Traffic Signs Manual
- (l) The Health and Safety at Work Act, 1974
- (m) Electricity at Work Regulations 1989
- (n) Code of Practice for Traffic Control and Information Systems (MCH 1869 Issue A)
- (o) MCH 1815 A System Certification
- (p) New Roads and Street Works Act (NRSWA) 1991
- (q) Construction (Design Management) Regulations 1994
- (r) Highways Act 1980
- (s) Road Traffic Regulations Act 1984

3. Equipment

3.1 General

- 3.1.1 The Works shall allow monitoring using the Urban Traffic Control system or Remote Monitoring system as specified by the Employer. It is the Contractors responsibilities to ensure the equipment provided can be used on the existing system and shall perform in the same way and provides the same level of control/monitoring utilising the same communications system requirements.
- 3.1.2 The Contractor is to store, deliver to the Site at a time specified, install, test and commission the equipment associated with the Works.
- 3.1.3 All street furniture shall be fully type-approved and in accordance with the latest issue of TR 0102 "DTp Standard Traffic Signals", incorporating all released amendments, which supplements and amends BS 505: 1971 "Road Traffic Signals". If it is proposed to use street furniture without full type approval, the supplier shall state the level of approval and what, if any conditions or limitations have been imposed on use or operation. Except with the prior written permission of TORBAY COUNCIL traffic signals engineer the street furniture shall be manufactured by Telent Traffic, Siemens Traffic Controls Ltd or PEEK.
- 3.1.4 Any equipment not to the Engineer's approval identified up to the signing and acceptance of final Taking Over Certificates shall be replaced by the Contractor at their own expense.
- 3.1.5 All equipment, materials and workmanship shall be covered by a 12 month warranty by the Contractor which shall take effect from the date of the Taking Over Certificate.
- 3.1.6 All street furniture shall be set out in accordance with the Engineer's siting instructions; the drawing provided shall be used for guidance purposes only. An Engineer from Torbay Council Traffic Signals section shall agree the position of all traffic signal street furniture and detection on site before the equipment is installed. Where engineering difficulties necessitate alternative positions the Contractor shall inform the Engineer prior to installing the furniture and provide amended drawings to show all new positions.
- 3.1.7 Unless otherwise specified, the installation of ducts, draw pits, controller base, pole retention sockets and the feeder pillar will be undertaken by the main civil engineering Contractor for the Works.
- 3.1.8 Signal dimming, will be required and is to operate from a Photocell. The photocell shall be located as shown on the drawing or in a position furthest away from overhead lighting units.

3.2 Controller and Controller Functions

- 3.2.1 Except with the prior written permission of TORBAY COUNCIL traffic signals engineer the controller shall be manufactured by Telent, Siemens or PEEK.
- 3.2.2 If the controller type supplied is new and less the 10 units of that type are in use to TORBAY COUNCIL then a full set of documentation shall be supplied free of charge and facilities offered for the training of Engineers from TORBAY COUNCIL and their Maintenance Contractors. If the controller type supplied is new then a full set of documentation shall be supplied free of charge and facilities offered for the training of Engineers from TORBAY COUNCIL and their Maintenance Contractors in addition one spare identical signal controller shall also be provided for maintenance purposes.
- 3.2.3 The operation of traffic signal installations shall be in accordance with TR2500 - General Specification Form
- 3.2.4 The Controller shall be fitted as a minimum with a 20 amp double pole switch fuse.
- 3.2.5 The controller shall be constructed on a foundation all in accordance with the manufacturers/suppliers recommendations. Excepting where the 'stool' is an integral part of the controller cabinet, the controller base shall be levelled by the Civils contractor and stable prior to installation of the controller cabinet.
- 3.2.6 The controller base shall be sealed immediately after installation is completed and accepted. The installer shall accept responsibility for damage caused by failure to seal the equipment properly.
- 3.2.7 The Contractor shall provide Unlimited EPROM reconfigurations at the Engineer's request within 12 months of the issuing of the final Take Over Certificate. The reconfigurations shall not result from a non-compliance at the Factory Release Test nor subsequently from the equipment failure. The Contractor should allow for the Factory Release Test to be undertaken but not for the Contractor's time on site.
- 3.2.8 Controllers are to be installed so that the DFM lamp may be readily seen from the carriageway and such that all normal maintenance and checking can be readily carried out without encroachment on the carriageway by equipment or personnel.
- 3.2.9 Controllers mounted on a root based plinth shall be sealed at base level and controllers mounted on a post shall be sealed just below the post access door. Following the termination of all signal cables the Contractor shall backfill the controller void with dry compacted sand. This shall be sealed by a 6mm thick epoxy resin to form a water and airtight seal.
- 3.2.10 Where a controller cabinet base seal has been broken for removal or installation of cables the fine dry sand backfill shall be reinstated and an epoxy resin base seal repair shall be made.
- 3.2.11 The Contractor shall ensure that a separate 50mm diameter duct for a telemetry connection has been provided before sealing the base. The duct shall link between the main controller pit and shall terminate above the final base seal level within the controller. The duct entry shall be sealed to prevent the ingress of moisture but the seal shall be removable to allow telemetry equipment to be installed subsequently.
- 3.2.12 The controller to be supplied shall have full type approval to DfT specification, MCE1827B/TR2500 for traffic signal junctions, Pelican crossings, Puffin crossings, Toucan crossings and cycle facilities.
- 3.2.13 The controller shall include a Master Time Clock System (MTCS) to permit the use of alternative maximum timings, fixed time plans.
- 3.2.14 The controller shall have a back up power supply for all detector commands, timing details and MTCS.

- 3.2.15 The controller shall be capable of interrogation using an Oyster 4 handset terminal to provide a static display of 1 row by 16 characters. The controller output display shall not scroll without operator intervention such that a multi-line output can be read. The controller output shall not be capable of interrogation by a lap top computer only.
- 3.2.16 Manual push buttons shall be labelled to indicate the stage number/letter using the facility panel's standard lettering.
- 3.2.17 A staging diagram should be provided on the inside of the manual panel door, with clearly labelled stages and phases, by means of silk-screening or adhesive label.
- 3.2.18 The controller shall include a 3U equipment rack(s) with sufficient void space to accommodate an Outstation Monitoring Unit, Outstation Transmission Unit and/or a camera surveillance unit as specified in the Contract. The minimum void space within the 3U equipment rack shall be 300mm wide by 300mm deep for each module stated above. The Contractor should satisfy himself that the controller contains adequate void space within the rack to accommodate the stated modules prior to tendering. Subsequent failure to meet this requirement shall result in the Contractor replacing the controller cabinet, and internal hardware, as necessary, and undertaking all remedial works at his own expense.
- 3.2.19 The Contractor shall include the supply and fitting of an approved lamp monitoring device in the controller if required. At sites where signals operate on a part-time basis and at sites where a pedestrian phase is included the Contract shall include for the supply and fitting of an approved red lamp monitoring device. At sites that are to be connected to UTC the Contractor shall include for the supply and fitting of a separate lamp monitoring device.
- 3.2.20 Two 13 amp 3 pin electricity sockets to BS 1363 shall be provided inside the controller cabinet, protected by a residual current device of maximum rating 30mA residual current. The sockets shall be marked for maintenance use only and be connected via a dual lockable isolator switch to the controller mains.
- 3.2.21 Provision shall be available within the controller to supply two devices via a separately fused auxiliary supply.
- 3.2.22 Sufficient terminals and termination points are required at the controller to accommodate all Neutral and Earth connections.
- 3.2.23 Two complete sets of keys to all parts of the apparatus, including 'T' bars, Type 900 for manual control panel, and type RKA27c for access to main cabinet shall be provided at the time of commissioning.
- 3.2.24 The controller access door(s) shall be fitted with a door stay.
- 3.2.25 A suitable fixed facility to store controller documentation & drawings shall be provided within the cabinet, where this is not a welded plate on the inside of the door approval should be sought for it from TORBAY COUNCIL.
- 3.2.26 The Controller cabinet shall have front and rear opening doors or a swing frame in order to provide access to the rear of the equipment.
- 3.2.27 The controller shall include a location at which to securely fix a telemetry termination unit.

3.3 Signal Heads General

- 3.3.1 The lowest part of any signal head assembly including brackets shall have a minimum clearance above the finished ground level of 2.1 metres or 2.4 metres in the case of Toucan Crossings.
- 3.3.2 All entry points into signal heads for cables shall have a secure and permanent watertight seal.
- 3.3.3 Backing boards shall be securely attached to all vehicular signal heads. The composite head including any additional signs shall be bordered on the front by a high intensity white retro reflective tape between 45mm and 55mm wide.
- 3.3.4 There shall be a minimum clearance of 450mm between the edge of the signal head and the edge of the carriageway. Where the minimum clearance cannot be achieved the Contractor shall notify the Engineer immediately.
- 3.3.5 Pelican/Puffin/Toucan crossings, unless otherwise shown on the design, all vehicle signal head cowls shall be Primary, to maximise the angle of view of the optics.
- 3.3.6 The Contractor shall align all signal heads in accordance with the Contract drawing and as required by the Engineer at the site commissioning.
- 3.3.7 All vehicular signal aspects shall include cowls. The primary signal shall include cut away cowls and the secondary heads shall include full length cowls. In addition where specified, the Contractor shall supply and install louvered cowls.
- 3.3.8 Adjustable horizontally louvered cowls designed to reduce the driver's visibility to the aspect shall only be used on the amber and green aspects of the primary or secondary signals. The angle of the slats shall be capable of being adjusted on site by the Contractor to the Engineer's requirements. The cowl shall be a minimum of 300mm long and include a minimum of 5 slats. Adjustable louvered cowls shall be constructed from galvanised steel and finished in black.
- 3.3.9 Where detailed/specified fixed vertically louvered cowls designed to reduce the driver's visibility to the opposing secondary aspect shall be used on the aspects. The cowl shall be a minimum of 500mm long and include a minimum of 3 slats. Fixed vertically louvered cowls shall be constructed from galvanised steel and finished in black.
- 3.3.10 Where signal heads include additional filter or right turn arrow signals or box signs the configurations shall be as specified in the signal head schedule on the Contract drawing.
- 3.3.11 The Contractor shall be responsible for installing vehicular signal heads on overhead mast arms and tall signal poles (exceeding 4 metres length) including the hiring of lifting equipment and traffic management. The lamp transformers shall be located in the base of the column overhead mast arm and both the door and column shall be earthed to current IEE wiring regulations.
- 3.3.12 Where two signal heads (twin) are positioned adjacent to each other on the same signal pole the Contractor shall ensure the structural stability of signal pole and provide a base plate where necessary.
- 3.3.13 The Contractor shall supply tungsten halogen lamps for vehicular signal heads unless specified elsewhere in the Contract. Where other signal lamps are to be supplied, the Contractor shall specify the type and shall provide Type Approval documents.

3.4 Traffic Signal Poles

- 3.4.1 All traffic poles shall be installed using the NAL pole retention system or a similar system that has TORBAY COUNCIL approval, which allows the pole to be removed following a knockdown. The poles retention system is to have at least two bolts to securely fix the pole in place, to reduce the risk of rotation.
- 3.4.2 All traffic signal poles that are not installed in a retention socket shall have a slot to provide cable entry access and shall be installed in a pole box.
- 3.4.3 All poles are to be set to ensure that the centre of the ambers are at 3.2metres above finished ground level.
- 3.4.4 All traffic signal poles shall be galvanised prior to the application of a grey plastic coating. Poles shall not be supplied with pre drilled holes for push buttons. Holes shall be drilled on site as required and shall be treated with a suitable zinc rich paint or other suitable rust inhibiting paint as agreed by the Engineer.
- 3.4.5 Stub poles shall be of a one piece, welded top, construction and shall be galvanised prior to the application of a grey plastic coating.
- 3.4.6 Signal head extension brackets ('D' type) shall be galvanised prior to the application of a black final coating. Brackets shall only be used where specified (in position and length) on the relevant site drawings, or following approval of the TORBAY COUNCIL traffic signals engineer.
- 3.4.7 Signal head mounting brackets ('L' type) shall be galvanised prior to the application of a black final coating. All brackets shall be long enough to provide sufficient rotational movement to allow correct alignment of heads, with a minimum movement of 120 degrees.
- 3.4.8 Responsibility for checking the vertical alignment of signal posts rests with the Contractor who shall also ensure that there is adequate stability before fitting signal heads. The Contractor shall notify the Engineer immediately if any signal poles fail to satisfy the aforementioned requirements.
- 3.4.9 Where necessary to achieve the correct location for the pedestrian push buttons and achieve not less than 500mm clearance to the side of the signal head/heads, cranked signal poles shall be used. Only the formed type shall be used. Consideration to matching cranks for cosmetic reasons shall be made.

3.5 Vehicle Detection

- 3.5.1 Unless otherwise specified all detector packs shall be housed within the controller cabinet.
- 3.5.2 Detection shall be supplied as 4 channel detection cards. System D, UTC, MOVA or speed loops and not to be mixed on the same detector card.
- 3.5.3 All new loop detector cards shall be of automatic self-tuning multi-channel microprocessor type and shall be fully type-approved and in accordance with the latest issue of MCE 0100.
- 3.5.4 System D and Stop line detector loops are shown schematically on the relevant site drawings and shall be cut to the standard configuration shown on the attached drawing: "Standard Detail for the Configuration of Loop Detectors". The location of detector loops shall conform with the latest issue of MCE 108B "Siting of Inductive Loops for Vehicle Detecting Equipments at Permanent Road Traffic Signal Installations", incorporating all released amendments.
- 3.5.5 Special facility loops e.g. SCOOT, MOVA, Call/Cancel, presence or red light camera loops or where specific conditions require, shall be sited under the instruction of the TORBAY COUNCIL traffic signals engineer. Where this is necessary, the position and size of loops shall be set out on site by the Engineer with the Contractor in attendance prior to slot cutting work commencing.
- 3.5.6 Speed discrimination and speed assessment equipment shall be capable of being monitored by means of a Soundmark Test Set with a suitable controller housed interface or an Oyster 4 handset terminal.
- 3.5.7 Where the use of Microwave Vehicle Detectors and infra-red detectors are specified these shall be Type Approved and shall comply with TR2123 "Above ground vehicle detector systems for use at permanent traffic signal installations". The use of the above ground detection shall be in accordance with the manufacturer's instructions. The alignment of all pedestrian above ground detection shall be set up as required by the Engineer at the site commissioning.

4. Loop Detection Installation

- 4.1 All detector channels shall be labelled to indicate the detector name. The label shall be waterproof and marked adjacent to the detector channel.
- 4.2 Loop feeder cables shall be kept clear of main switch and maintenance sockets within the cabinet.
- 4.3 The standard dimension for the width of the slots shall be 10.0mm (+1mm/-0mm). The formula for the overall depth of the slots shall be $50+7n$ mm (+10mm/-0mm), where 'n' is the number of layers of cable in the slot. In general the depth shall allow for 50mm of cover above the uppermost cable in the slot.
- 4.4 Where a surface comprises black top overlaying concrete, the installer shall ensure that all loops are laid within one material, subject to a minimum cover which may be discussed with TORBAY COUNCIL traffic signals engineer.
- 4.5 Slot cuts between adjacent 'System D' loops (where required) shall be made along the centre line of single carriageways or the offside of dual carriageways (not along the gutter edge).
- 4.6 Detector loops are to be connected via individual pairs of non-armoured feeder cables.
- 4.7 No feeder cable shall be jointed unless it is to connect a detector loop.
- 4.8 All joints used shall be of the re-useable type and made in accordance with the manufacturer's instructions and recommendations.
- 4.9 Detector feeder cables shall be jointed to the detector loop within the specially provided connection chamber in the footway/verge. No additional joints between the detector loop and detector unit shall be permitted unless agreed with the Engineer prior to commencement of works. Individual cores shall be jointed by means of insulated crimp connectors using a ratchet type of crimping tool and staggered to avoid the possibility of any short circuits. The joint shall be waterproof and able to withstand a vigorous "pull-test" of approximately 3kg.
- 4.10 Slots through kerb edges shall be backfilled with a layer of resin if possible, 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 cement.
- 4.11 Where partial excavation of the footway is required to access stub-duct ends, then 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 re- instatement of the footway with cold setting asphalt and sealing with hot pour bitumen.
- 4.12 Working Practice when Cutting Slots and Laying Loop Cable
 - (a) Slots shall be cut at least one metre from any ferrous objects or areas of poor surfacing unless otherwise approved by the Engineer.
 - (b) Slots shall be properly dried and cleared of all debris before laying loop or detector feeder cable and the slots shall be kept clean and dry before the backfill is complete.
 - (c) The depth of the slot shall be checked with a depth gauge along the whole length of the slot.
 - (d) All cable shall be dry before laying in slots.
 - (e) Sharp implements shall not be used to seat cable in slots.
 - (f) Where the corners of the slot are at an angle of less than 100 degrees then this angle shall be rounded with the use of a cold chisel or the corners of the loop shall be crosscut.

- (g) After backfilling, which shall be hot pour bitumen, excessive spillages of bitumen shall be removed from the road surface and loose asphalt shall be swept clear of the road surface and disposed of off site.
- (h) The type of bitumen used shall not embrittle at temperatures above 5 degrees Celsius. The temperature of the 'kettle' shall be in accordance with the suppliers instructions.
- (i) Loop cable shall conform to Departmental Specification TR2031.
- (j) The Contractor shall be responsible for erecting, maintaining and dismantling all Chapter 8 Traffic signing including traffic control required to complete the slot cutting. The method of traffic control is to be stated by the Engineer and may include the use of temporary traffic signals at the Contractor's own expense.
- (k) Loop cable shall be taken through a length of orange colour plastic ducting marked Traffic Signals with a minimum diameter of 50mm leading to a chamber situated in the footway/verge where the loop tails and detector feeder cables shall be jointed. The Contractor shall include for excavation (the minimum necessary) at the channel to access this duct and for reinstatement with bitumen (as used for sealing slots). The holes shall then be backfilled with hot rolled asphalt or cement. The depth of cover for the duct end at back of footway shall be 60mm.
- (l) All slot cutting shall be carried out only once appropriate Chapter 8 signing and traffic control has been put in place.
- (m) Where the bitumen backfill is below the road surface, the Contractor shall be responsible for topping up the bitumen backfill to achieve a level finish with the road surface. The Contractor shall be responsible for additional backfilling of the slots should the level of backfill fall below the road surface within 28 days of the issue of the Taking-Over Certificate.
- (n) Where the contract drawing indicates the application of new special surfacing on the carriageway, the contractor shall complete all slot cutting and backfilling of cables in these areas prior to the application of the special surfacing.

5. Cabling

- 5.1 Cables shall be terminated in the controller at the appropriate terminal block and in the correct terminal position.
- 5.2 Detector feeder cables shall be terminated in an appropriate terminal block and "soft wired" to the correct labelled detector unit, using light gauge stranded wire, twisted in pairs.
- 5.3 With stranded conductors or with conductors having a diameter less than 2.5mm sq, a crimped pin or protective leaf shall be used in the terminal.
- 5.4 All labels shall be permanent and marked in ink.
- 5.5 Cable sheath and cable core identification is to be undertaken on all signal cables within the controller as per ANNEX C.
- 5.6 Cable sheath identification only is to be undertaken on all signal cables, at the pole tops as per ANNEX C.
- 5.7 All loop feeders shall be labelled with the detector name or conductor function at both ends as near as is possible to the appropriate terminal or connection.
- 5.8 All loop conductor wire pairs shall be connected together with zip ties or similar, and labelled as close to the point they enter the draw pit as possible.
- 5.9 All cables shall be armoured in multi banded steel and covered in an outer sheath of orange coloured PVC.
- 5.10 All Cables including loop feeder cables shall comply with or exceed the TORBAY COUNCIL specification shown in Appendix A and comply with the requirements of B.S.505 as amended by TR0102.
- 5.11 Detector signals shall not be brought back on the same cable carrying the supply to signal heads or push buttons.
- 5.12 The core provision shall provide not less than 25% spare cores overall to each pole.
- 5.13 Each signal pole shall be cabled directly to the controller. The looping of any cables between signal poles will not be accepted. ONLY in exceptional circumstances, as directed by the Engineer, will alternative means of cabling be acceptable.
- 5.14 Unused cores at the controller shall be left for future expansion but isolated to ensure no earth loops can be created.
- 5.15 Unused cores between poles shall be connected to Earth at one pole top.
- 5.16 Unused cores between the pole and the controller shall be connected to Earth at the pole top.
- 5.17 Signal cables shall not pass through ducts or boxes used for any other service.
- 5.18 Duct shall be in accordance with NJUG Standards, Orange 100 mm diameter with 'traffic signals' stamped at regular intervals.
- 5.19 A mixture of extra low voltage (ELV) and low voltage (LV) circuits in multicore cables is not acceptable in any circumstances.
- 5.20 Cables carrying 230v lamp power shall occupy separate ducts from cables carrying extra low voltage (push button/audible, detection etc) although they will use the same chambers
- 5.21 One duct shall be left empty on all road crossing.

- 5.22 Draw strings will be provided in all duct runs and to the pole tops by the main civil engineering contractor. The Contractor shall be responsible for ensuring that a drawstring is retained in each duct run and pole following the installation of the cables.
- 5.23 Pulling of cables will be the responsibility of the Contractor. All cabling shall be installed as shown on the relevant site drawing
- 5.24 Cables shall not be bent to a radius of less than 12 times their diameter or less than a radius recommended by the manufacturer, whichever is the greater.
- 5.25 Low voltage and extra low voltage cables shall not be terminated in the same position in the pole tops.
- 5.26 Where possible all cable runs shall include a minimum of 1 metre of slack cable in each draw pit, along the full length of the run.

6. Electricity Supply

- 6.1 The mains input shall be to a Haldo pillar positioned close to the controller, in a position where the chance of impact by vehicles leaving the carriageway is minimised. The Mains Electricity supply shall incorporate a protective earth. The supply will be 230 V 50Hz.
- 6.2 The pillar shall be approximately 560 mm high, by 250 mm wide by 160 mm thick above the ground, with an installation depth of approximately 250 mm
- 6.3 Where it has been agreed with the engineer not to install a separate power supply pillar, a space 150mm high by 82mm wide must be available on a mounting board within the controller to accommodate the Electricity Board's fusible cut-out in a position so that the equipment is readily accessible.
- 6.4 For pole mounted controllers, where it has been agreed with the engineer not to install a separate power supply pillar. Where the supply is installed prior to the fitting of the controller to controllers of the type with a board in the base of the pole a blanking plate enabling the pole to be safely sealed must be fitted. For pole mounted controllers without a board in the base of the pole and non-pole mounted controller a dummy case to allow for an electricity supply prior to the erection of the controller shall be required.
- 6.5 Connection to the Electricity Board's supply must only be made by the Electricity Board's authorised staff. Fuse ratings shall be 60 amp cut-out 25 amp fuse for Traffic Signals and 60 amp cut-out 16 amp fuse for Pedestrian Crossings in accordance with BS 88 Part 2.

7. Testing of Installed Cables and Marking of Cable Drawing

- 7.1 The Contractor shall supply to the Engineer at the site commissioning the relevant electrical test certificates. The Contractor's failure to supply these test certificates may cause the switching on of the signals to be delayed. The Contractor shall be liable for all expenses involved with re-attending the subsequent site commissioning.
- 7.2 The electrical test certificates shall be in accordance with the format shown in Annex A & B.
- 7.3 The Contractor shall notify the Engineer prior to tests being undertaken so that the Engineer or his representative may be present to verify the tests.
- 7.4 The following tests shall be carried out:
- 7.5 Series resistance of loop and feeder. The resistance shall not exceed 2.5 ohms.
- 7.6 Impedance to earth of the armouring of every feeder cable and connecting cable before the armouring is bonded to earth. The reading shall not be less than 10 megohms.
- 7.7 Impedance to earth of cable armouring after the armouring has been connected to earth. The reading shall not exceed 0.5 ohms.
- 7.8 Impedance to earth of loop and feeder conductors with both feeder conductors connected together, using at least 500 volts DC applied for at least one minute. The cable shall be disconnected at both ends during the taking of this reading.
- 7.9 Impedance to earth of connecting cable conductors with all conductors connected together, using at least 500 volts DC applied for at least one minute. The reading shall not be less than 10 megohms. The cable shall be disconnected at both ends during the taking of this reading.
- 7.10 Any loop or feeder or connectable cable which fails any of the tests shall be replaced by the Contractor before the site is commissioned.
- 7.11 The Contractor shall reset the detector card power supply where necessary and shall observe and monitor the LED for the correct operation of each loop connected to the detector card. Any defects or malfunction shall be reported immediately to the Engineer. This work shall be carried out for all detectors which have been affected by the Works.
- 7.12 Measurement of linear meterage may be carried out with a measuring wheel that has been calibrated within the previous 12 months. The Engineer shall have the right to check any measurement and request that any electrical test be repeated at the contractor's expense during commissioning.

8. Testing and Commissioning

- 8.1 The Contractor shall give the Engineer at least ten working days notice of the controller(s) being ready for Factory Release Testing (FRT) and shall allow for attendance at those tests by the Engineer's representative. The location of the acceptance test is to be at the contractors premises.
- 8.2 The installer shall supply the TORBAY COUNCIL traffic signals engineer with a copy of the controller specification prior to or at the above tests.
- 8.3 Suitable signal lamp mimics and means of simulating inputs shall be required and the test shall demonstrate compliance with the operational specification, including necessary green conflict monitoring. Any non-compliances identified by the Engineer shall be rectified by the Contractor at his own expense.
- 8.4 The Contractor shall supply suitable opaque signal head covers. The Contractor shall use these to completely cover all signal head assemblies including pedestrian heads and push-buttons that are not controlling traffic during installation. The covers shall only be removed by the Contractor when commissioning the signals.
- 8.5 The SCN of the site shall be displayed on the controller cabinet in characters approximately 50 mm high. (i.e. 3621) The method of application shall be approved by TORBAY COUNCIL.
- 8.6 All signal poles shall be numbered, starting with the pole closest to the controller and proceeding in a clockwise direction around the facility, these numbers should be visible from the controller where possible.
- 8.7 On completion of the installation the site shall be left clean and tidy and all rubbish shall be removed.
- 8.8 After installation of the equipment, site testing shall be carried out by the Contractor prior to the commissioning in order to demonstrate compliance with the specification. The Contractor shall test the operation of all lamps, detectors and push buttons. Only after the tests have proved satisfactory shall the Engineer or his representative be asked to attend the installation in order that it may be commissioned. The Contractor shall supply all equipment necessary for testing purposes.
- 8.9 The Contractor shall give at least one week advance notice to TORBAY COUNCIL traffic signal section's traffic signal engineer to attend the commissioning tests. TORBAY COUNCIL reserve the right to invite their maintenance contractor to attend the site commissioning.
- 8.10 Any non-compliances identified by TORBAY COUNCIL shall be resolved at the commissioning by the Contractor. If after taking all reasonable action the Contractor is unable to rectify the outstanding non-compliances and at the commissioning the Engineer considers that the non-compliances are such that the signal equipment cannot be switched on the Contractor shall re-attend the site to resolve the non-compliances immediately the following day and each day thereafter until the item is rectified. Where the non-compliances are not deemed by the Engineer to affect the switching on of the signal equipment and the Contractor has taken all reasonable measures at the commissioning, the outstanding non-compliance items must be resolved within 5 working days. All labour, plant and materials required to resolve the non-compliant items shall be undertaken at the Contractor's own expense.
- 8.11 Following a successful site commissioning the installation will be handed over to the Engineer's maintenance contractor. The maintenance contractor shall be responsible for the site maintenance and in the event of a fault with any of the equipment, other than lamps, shall inform TORBAY COUNCIL who will then decide what action is to be taken. Either TORBAY COUNCIL will instruct the maintenance contractor to return the faulty equipment to the Contractor for its repair or replacement, or shall instruct the Contractor to attend the site and to rectify the fault.

- 8.12 In addition to any faults that occur following site acceptance the maintenance responsibilities and liability for any traffic signal equipment shall not be accepted by the Engineer until final Taking-Over Certificates have been signed and accepted by TORBAY COUNCIL. If during this period a fault develops, TORBAY Council's maintenance contractor shall attend the site, to rectify the fault at the Contractor's expense.

9. Documentation

- 9.1 The following documents are to be supplied by the Contractor and retained in the controller at commissioning:
- (i) A Log Book
 - (ii) A copy of the controller specification
 - (iii) A scale detailed drawing as detailed in 9.3
- 9.2 The Contractor shall supply to the Engineer at the site commissioning the relevant electrical test certificates. The Contractor's failure to supply these test certificate may cause the switching on of the signals to be delayed. The Contractor shall be liable for all expenses involved with re-attending the subsequent site commissioning.
- 9.3 Within 30 days of the commissioning the contractor is to supply three "as laid" cable and signal drawings. One shall be retained within the controller, the remaining two shall be sent to the Engineer. The Contractor is in addition to supply the "as laid" drawing in AutoCAD format. The file may be 'zipped' when supplied on disk.
- 9.4 Within 7 days of the commissioning the contractor is to supply a further two sets of the EPROM specification.

10 Connection to Urban Traffic Control (UTC) SCOOT

- 10.1 Where UTC facility and/or connection is specified the Contractor should ensure that the following requirements are met.
- 10.2 The controller is to be modified as necessary for UTC including a UTC interface with a 3U rack including sufficient void space and back wiring to accommodate a Siemens Telecomm and 12 Outstation Transmission Unit (OTU).
- 10.3 The modification wiring is to include all sockets for connection to the OTU.
- 10.4 The bit pattern shall be as specified in the UTC database sheet(s) of the General Specification forms.
- 10.5 The Police panel is to be fitted with a 'computer on' LED operated by the presence of force bits from the UTC computer and with a remote reconnect switch. The police panel LED shall be labelled 'UTC on'.
- 10.6 The Contractor is to provide self tuning multi-channel detector units for all SCOOT loops which are to be mounted and wired in the OTU detector rack using the power from the OTU detector power pack. The Contractor is to arrange all wiring forms for the detectors, both SCOOT and intersection plus connections to the power supply.
- 10.7 It is the Main Contractor's responsibility to arrange for a telemetry line to be fitted in the controller cabinet and to liaise with TORBAY COUNCIL signal engineer to determine the exact telephone requirements.
- 10.8 The Contractor shall be responsible for commissioning the SCOOT detection control and reply bits. The Contractor shall be responsible for supplying all necessary equipment for testing purposes.
- 10.9 Any unused data transmission bits shall be strapped out.

11 Connection to Remote Monitoring (RMS)

- 11.1 Unless specified otherwise by the Engineer in writing the installation will be connected to Torbay Council County Council's Remote Monitoring System. The following requirements are to be met.
- 11.2 A standard 3U rack is to be provided for a Outstation Monitoring Unit (OMU) to be fitted in the controller cabinet containing a 300mm wide by 300mm deep void space.
- 11.3 It is the Main Contractor's responsibility to arrange for a telemetry line connected to the Public Switched Telephone Network to be fitted in the controller cabinet.
- 11.4 All controller detector inputs shall be capable of being remotely monitored.
- 11.5 A separately fused supply shall be provided solely for use of the OTU/OMCU.
- 11.6 The OMU equipment shall be of a type approved by the Engineer to ensure compatibility with the Instation operating system.
- 11.7 The OMU shall be connected with phase indications in order, followed by phase wait lamps in order. The detectors shall be connected in the order in which they appear in the controller input.

Appendix A Cable Specification

A) Loop Cable

2.5mm² 30/0.25 tinned annealed copper conductor, insulated with 0.8 mm radial thickness of EPR and sheathed with 1.4 mm radial thickness of PCP. Overall diameter 6.8 mm (minimum), 7.2mm (maximum)

B) Feeder Cable

2.5mm² 1/1.38 plain annealed circular copper conductor, steel wire armoured, 0.7 mm radial polyethylene insulation, 2 or 4 cores with cores laid up with 5 turns per metre

C) Power Cable (low voltage or extra low voltage)

1.5mm², 8, 12 or 16 core steel wire armoured, with orange PVC sheathing and colour coded cores according to requirements, noting the need for spare cores:-

Black	Green	} 8 core	} 12 core	} 16 core	
Red	White				
Blue	Orange				
Brown	Yellow				
Red/Brown	Red/Yellow	}	}		
Red/Grey	Red/White				
Red/Blue	Red/Black	}	}		
Purple	Grey				

ANNEX A**TEST CERTIFICATE FOR DETECTOR CABLING**

Controller No:

Contractor:

Site Address:

Date of Test:

Cable Layout Drawing No:

Loop Name or Cable Description	A	B	C	D	E

ETC

Key: A = Series Resistance of loop and feeder (measured in ohms)
 B = Impedance to earth of cable armouring, not connected to earth (measured in megohms)
 C = Impedance to earth of cable armouring, when connected to earth (measured in ohms)
 D = Impedance to earth of all conductors connected together at 500 volts dc (measured in megohms)
 E = Detector frequency and setting

I certify that the equipment has been tested according to the Department of the Environment, Transport and the Regions Specification and tested as shown above.

Signed Printed
Name acting as
Position for (Company)

ANNEX B

EARTHING & INSULATION CERTIFICATE

Location or Junction Ref No:

Date of Test:

Earth Loop Impedance Test

Controller Reading * ohms

Pole No	Distance # Metres	Impedance Measured (ohms)	Max Pass Value (ohms)	Result P or F	Notes

ETC

Rating of Cut-out Fuse fitted at completion of test: amps

Main Switch : amps

RCCB Rated tripping Current: amps

Tested Tripping Time: _____ amps

* Impedance Value measured at Controller Earth Terminal

#	Total Distance from Controller to Pole under test
1	1.00
2	1.00
3	1.00
4	1.00
5	1.00
6	1.00
7	1.00
8	1.00
9	1.00
10	1.00
11	1.00
12	1.00
13	1.00
14	1.00
15	1.00
16	1.00
17	1.00
18	1.00
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86	1.00
87	1.00
88	1.00
89	1.00
90	1.00
91	1.00
92	1.00
93	1.00
94	1.00
95	1.00
96	1.00
97	1.00
98	1.00
99	1.00
100	1.00

This installation conforms to latest IEE Regulations (a) Earthing and Bonding arrangements; (b) Testing of Effectiveness of Earthing and Insulation.

Signed _____ Printed Name _____ acting as _____

(Position) for (Company)

ANNEX C

SPECIFICATION FOR CABLE AND CABLE CORE IDENTIFICATION

This Schedule is issued to ensure that all cable and cable cores in traffic signal installations are identified by the same method and code.

1 CABLE IDENTIFICATION

- 1.1 All cables entering any equipment housing shall be identified by a 'Pull-Tite' tag fixed around the inner sheath immediately above the Steel Wire Armouring (SWA) termination gland.
- 1.2 The tag shall be marked, using an approved waterproof, indelible, black marker pen, in the following manner:-

(a) Low Voltage Signal Cables

The tag shall be red and shall be clearly marked with the number of the pole, serviced by the cable.

(b) Extra Low Voltage Cables (Pedestrian Push Buttons, etc)

The tag shall be yellow and shall be clearly marked with the pole number serviced by the cable, in addition the letters ELV shall be added.

(c) Extra Low Voltage Cables (Linking Cables)

The tag shall be yellow and shall be marked with the Site reference number of the linked equipment and in addition the letters ELV shall added.

Examples:-



Note:

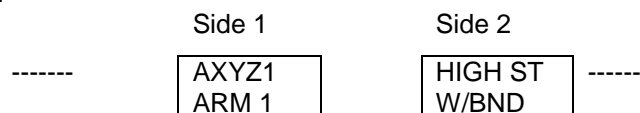
The pole numbers referred to above are as shown on the contract drawing.

(d) Loop Feeder Cables

The identification of these cables is as follows:-

One side of the yellow tag shall be marked with the detector and arm designation - the other side shall be marked with the Street or Road name.

Example:-



2 CABLE CORE IDENTIFICATION

- 2.1 All individual cable cores in cables used in a traffic signal installation shall be identified using coloured PVC grip type markers with black lettering. The markers shall be positioned on the core adjacent to the termination point in such a way that they can be read easily.
- 2.2 Three types of identification marker shall be used:-
- (a) Numbered markers indicating poles numbers. These will be colour coded in accordance with the international resistor colour code. The number shall indicate the pole fed by that cable ie the next pole to which the cable runs.
 - (b) Legend markers indicating the function of the core as shown below.
 - (c) Lettered markers indicating the phase of the core.
- 2.3 The colours, numbers, function, letters and arrangement of the markers shall be as follows:-

- 2.3.1 (a) Low Voltage Signal Cables - This arrangement shall be used for all cables in the controller and for all cables leaving a signal pole.

First Marker		Second Marker			Third Marker
(Pole)		(Function)			(Phase)
Colour:-	Colour Coded	Red			White
1	Brown	RED	AMBER	GREEN	A
2	Red	R/MAN	G/MAN	WAIT	B
3	Orange	I.G/A	F.G/A	SIGN	C
4	Yellow	P/EL	PE/N	PE/SW	D
5	Green	SIG/N	SIGN/N	SPARE	E
6	Blue				F
7	Violet	Note:- Functions not covered by the above to be written onto blank markers with an approved pen. (Two Markers)			G
8	Slate (Grey)				H
9	White				etc
10	Brown and Black				

- 2.3.1. (b) Low Voltage Signal Cables - This arrangement shall be used for all cables arriving at a signal pole or equipment housing.

Only two markers shall be used ie the Second and Third marker as in 2.3.1 (a) above.

- 2.3.2 (a) Extra Low Voltage Cables - This arrangement shall be used for all cables in the controller and for all cables leaving a signal pole.

First Marker		Second Marker			Third Marker
(Pole)		(Function)			(Phase)
Colour:-	Colour Coded	Yellow			White
1	Brown	PUSH/B	BLEEP	TACT	A
2	Red	COMM	INHIB	LINK	B
3	Orange	T/O	PB/COM		C
4	Yellow	DET+	DET-		D
5	Green	MVD	IRD	SPARE	E
6	Blue				F

7	Violet	Note:-	Functions not covered	G
8	Slate (Grey)		by the above to be	H
9	White		written onto blank	
10	Brown and Black		markers with an	etc
			approved pen.	
			(Two Markers)	

- 2.3.2 (b) Extra Low Voltage Cables - This arrangement shall be used for all cables arriving at a signal pole or equipment housing.

Only two markers shall be used ie the Second and Third marker as in 2.3.2 (a) above.

Examples of above:-

Controller



Marker
Colour

Brown

Red

Red

White

Pole 12



Red

White

Post 12 (cont'd)



Blue

Red

White

Post 6



Red

White