



East Sussex County Council

Transport & Environment Department

Traffic Signal Design and Installation Standards

Issue 1.7
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2. Introduction and General Requirements

2.1. Introduction

The aim of this note is to provide a guide to enable promoters of schemes to prepare signal designs, which address the specific requirements of East Sussex County Council (ESCC).

Traffic signals for vehicle and pedestrian control in East Sussex are required to meet a number of national standards and local criteria covering both function and installation. The aim is to produce a consistency of approach for the benefit of the public who use the signals and to facilitate maintenance.

All designs should follow current national standards, specifications and guidelines. The main references are listed at Para 2.3 but it will be the responsibility of the designer and contractor to check that all relevant and current standards are followed.

This ESCC document complements national standards by identifying specific local requirements where they exceed national standards or where there is a preference between available options.

All systems should be designed to minimise energy consumption. ELV controllers and full ELV systems are required, but where this is not possible, monitored CLS-type LED lanterns should be used.

All designs and installations shall be subject to formal Safety Audits in accordance with current DfT guidelines and ESCC Policy. This shall include the completed Signal Controller Specification (TR2500 forms). The completed and audited specification shall be signed and dated by the Engineer who carries out the audit. The originals of all audits shall be retained by ESCC.

In addition, where appropriate, modelling data from programs such as Linsig or Transyt to demonstrate the proposed signalling arrangements can operate satisfactorily shall be supplied to ESCC in both electronic and paper versions. These must include sufficient information to allow the design to be audited, and any assumptions used in the design, for example a pedestrian stage appearing once in every three cycles, shall be fully documented and justified.

The installation of traffic signal equipment shall only be undertaken by a Contractor certificated to BS EN ISO 9000 : 2000, and in line with the current edition of the IEE wiring Regulations for electrical installations. Installers shall at all times conform to Health and Safety at Work Acts, the Electricity at Work Regulations, the Construction Design & Maintenance Regulations and all other relevant legislation. Installers shall also ensure that installation procedures conform to all relevant DfT advice notes and directives, in particular, signing and guarding shall conform to Chapter 8 of the Traffic Signs Manual.

Any deficiencies found in the design or in the operation of the equipment shall remain the responsibility of the promoter of the scheme for a period of 1 year from the date of the take over of the site following a successful site commissioning or for a year following the date that the associated development is opened and the initial impact of the full traffic and pedestrian flows are realised, whichever is the later. It is therefore the responsibility of the promoter to ensure that all data regardless of source is correct, and that the consequence of any imposed conditions are well documented and acknowledged.

2.2. Definitions and Abbreviations Used

The terms consultant and contractor are used throughout the document in the context of the work or design under consideration. They are not prescriptive, and the developer or scheme promoter named in the legal agreement with ESCC shall ensure all tasks are undertaken by appropriate personnel. In all cases the developer or scheme promoter shall remain responsible for the design, specification and construction of the works until they have been accepted and taken over by ESCC

Common abbreviations found in this document appear in the table below. Where other abbreviations have been used the abbreviation is shown in brackets after the first occurrence of the phrase. The abbreviation is used thereafter.

Table 2 – Abbreviations and Definitions

BVPI	Best Value Performance Indicator
CLF	Cableless Linking Facility
CLS	Central Light Source
DfT	Department for Transport
ELV	Extra Low Voltage (up to 50v)
ESCC	East Sussex County Council
FT	Fixed Time
LED	Light Emitting Diode
LTN	Local Transport Note
LV	Low Voltage (50 to 1000v)
MOVA	Microprocessor Optimised Vehicle Activation
MVD	Microwave Vehicle Detector
NJUG	National Joint Utilities Group
OCD	On-crossing detector
OMU	Outstation Monitoring Unit
OTU	Outstation Transmission Unit
RMS	Remote Monitoring System
SCOOT	Split Cycle Offset Optimisation Technique
TRL	Transport Research Laboratory
UTC	Urban Traffic Control
VA	Vehicle Activated

2.3. Reference Documentation

REFERENCES

TA 84/06 Code of Practice for Traffic Control and Information Systems for All-purpose Roads (formerly MCH 1869A Code of Practice for Traffic Control and Information Systems)

Design Manual Roads and Bridges

TRG 0600 Statutory Type Approval of Equipment

TR 0102A Standard Traffic Signals

TR 2029D Inductive Loop Cable for Vehicle Detection Systems

TR 2031E Feeder Cable for Inductive Loop Detectors

TR 2206A Specification for Road Traffic Signals

TR 2500A Traffic Signal Controller Specification Ver 4 (2016)

TR 2505A Above Ground Vehicle Detection Systems at Permanent Traffic Signals v5 11/03/16

TR 2506A Performance Specification for Above Ground On Crossing Pedestrian Detection Systems v5 11/03/16

TR 2507A Performance Specification for Kerbside Detections Systems for use with Nearside Signals and Demand Units 20/10/2011

TR 2508A Performance Specification for Tactile Equipment for use at Pedestrian Crossings v4 17/04/15

TR 2509A Performance Specification for Audible Equipment for use at Pedestrian Crossings

TR 2511A Performance Specification for Nearside Signals and Demand Units v5 11/03/16

TR 2512A Inductive Loop Vehicle Detection Equipment v327/03/15

TR 2523A Traffic Control Equipment Interfacing Specification v5 11/03/16

TCUG Standard Signal Outer Case

GAMBICA 1023 'New GAMBICA/EITAC Tag Encoding Structure'

Department for Transport 'Puffin Crossings: Good Practice Guide- Release 1' 2006

3. Signal Design

3.1. Documentation

3.1.1. Presentation of Designs

1. All designs shall be prepared using AutoCAD. On completion of works, a copy of the "as built" drawing shall be supplied in AutoCAD format. The file may be 'zipped' when supplied on disk. All files supplied in electronic format shall be certified as virus checked and the software used with generation number, shall be quoted.
2. The drawing shall include a cable drawing and a staging drawing (if appropriate).
3. The drawing shall show the orientation of the design with reference to a north point.
4. The drawing shall include road names for approaches (where they exist)
5. The drawing shall show to an appropriate scale all signals equipment and related ducting requirements.
6. All signal heads should be labelled with the associated phase letter.
7. All detection (including loops, MVDs, OCDs and kerb-sides) should be labelled appropriately with the detector name to include the relevant phase and pole number (where applicable)
8. Special requirements relating to street furniture and signalling detail (special mounting arrangements, four-in-line heads, long cowls, louvers etc.) shall be outlined on the drawings and within notes accompanying the drawings.
9. Standard BS:EN12368 (formerly BS 505) symbols shall be used.
10. A key shall be provided on the drawing and should include only equipment related to the design and depict all the symbols shown on the drawing.
11. The drawing shall be accompanied by notes, as dictated by the Code of Practice, detailing all alternative signal designs that have been considered and reasons for choosing the design presented.
12. Specific reference shall be made to any design detail that does not comply with these standards or the appropriate DfT Advice Notes etc.
13. All signal poles shall be numbered, starting with the pole closest to the controller and proceeding in a clockwise direction around the facility. Numbers should be clearly marked on the poles on site in Black text.

3.1.2. Design File

1. A Design File should be submitted as part of the signal design scheme. This should include information as specified in TA 84/06 Part 2.
2. It is recommended that additional to the TA 84/06 guidelines the document is inclusive of the following information (where appropriate);
 - a) Scheme overview (with relevance to the signal design aspect)
 - b) Proposed Method of Control
 - c) Proposed Timings Data
 - d) Any special facilities at the junction and/or any linking
 - e) Communication requirements for the site
 - f) Any evidence for staging of the junction derived from LINSIG / TRANSYT analysis (only the final results need be included).
 - g) Any reason for deviation from standards (if they exist) in the design
 - h) Any safety critical calculations or assumptions that have been made for the junction (including audit trail to support risk assessment documentation) e.g. intergreen measurements / turning path analysis.

3.2. Traffic Engineering Considerations

3.2.1. Method of Control

1. The method of control to be adopted will be determined by the location of the signal installation having specific regard to its proximity to other installations and to the operational envelope, traffic patterns etc, the site is required to serve. In all cases the proposed method should be agreed with ESCC at an early stage.
2. The methods of control used for signals are:-

UTC (Urban Traffic Control) normally SCOOT.

MOVA – latest software specification

VA (Vehicle Actuated)

The methods of control used for standalone pedestrian crossings are:-

UTC (Urban Traffic Control) normally SCOOT.

MOVA – latest software specification

VA (Vehicle Actuated)
3. UTC/SCOOT will normally be adopted for all signal installations which relate to existing areas of UTC/SCOOT control, for new installations where proposals to implement the use of UTC/SCOOT exist, or where proposals form part of or create a natural UTC/SCOOT region.
4. MOVA is the method of control of choice for sites, which do not form part of the UTC network.

5. VA shall be used as a fall back at all standalone sites. Where sites are in close proximity or require critical linking then CLF plans should be considered.
6. VA may be adopted as the main method of operation for sites which have characteristics, which will not be best served by the adoption of MOVA. Such proposals will need to be agreed in advance with ESCC.
7. UTC is adopted for pedestrian crossings using the same criteria as for signals, with the additional rider that there may be circumstances where linking to adjacent signals, rather than direct control by UTC is appropriate.
8. Bus priority and Real Time Passenger Information systems are already in operation in parts of East Sussex and further expansion may follow. Appropriate facilities will need to be included, and equipment provided, at any new installation that falls within an area identified for such systems.

3.2.2. Signal Staging

1. The staging of the signals should be as simple as possible to avoid confusion and to maximise flexibility in control.
2. In all cases the need for pedestrian, cycle, emergency vehicle and bus priority facilities should be considered and included where appropriate. The consultant will be responsible for carrying out local consultation to determine the need for such facilities.
3. In the absence of demand, the signals shall normally revert to all-red after a pre-set delay.
4. The Practical Reserve Capacity (or similar economics) for the junction should be determined via formal analysis methods (LINSIG/TRANSYT/P2) from relevant/proposed traffic flow data.
5. Where high pedestrian flow is expected at signalled junctions, which cannot be accommodated by 'walk-with-traffic' phases, consideration should be given to providing a pedestrian only stage

3.2.3. Signal Timings

1. Minimum green times shall be 7 seconds for normal traffic phases, 4 seconds for indicative right turn green arrows. Dummy phases shall be given minima appropriate to their purpose. Minimum timings for pedestrian crossings shall be determined using the methodology prescribed in the Puffin Good Practice Guide.
2. The maximum green to traffic at stand-alone crossings will be 30 seconds, except with the prior approval of ESCC.
3. Intergreens to pedestrian phases shall be calculated on the basis of the conflict point being just past the most remote pedestrian movement of the pedestrian phase that gains right of way.
4. Any phase intergreen less than 5 seconds will be subject to audit, unless the phase gaining right of way is an indicative green arrow phase.
5. Phase delays shall be used to minimise overall delay, whilst having regard to safety and interpretation of movements on other phases by drivers. On occasion it may be

necessary to sacrifice a few seconds of theoretical capacity in the interest of safety e.g. where two or more traffic phases should sensibly start together. The excessive use of multiple, short phase delays should also be avoided as this can make on-site alterations difficult to achieve.

3.2.4. Detection

1. Stages that are not always required shall be demand dependant. It is recommended that all stages are set to appear in Manual mode.
2. Pedestrian phases shall be demand dependent except in the case of an all round pedestrian stage where all pedestrian phases should appear.
3. Where "on crossing" detection is provided, each crossing shall be a separate phase and monitored accordingly.
4. The need for selective detection of vehicles shall be checked at an early stage with, and agreed by, ESCC.
5. Detection may be by any approved standard method with the exception of WIMAGs. The use of above ground detection is preferred, providing the detection characteristics are appropriate for the application. The type of detection should be agreed with ESCC traffic signals before submitting designs.
6. Pedestrian detection shall use the appropriate device for both on crossing and footway detection and shall be agreed with ESCC. It will be necessary to justify the adoption of a specific type or model, if it is not in common use in East Sussex.
7. Footway detection for pedestrians is not mandatory, but omission shall be justified. It is the responsibility of the designer to ensure that the coverage of the detection is appropriate for the width of the crossing.
8. All AGD devices (Above ground detection, not the specific company) shall be connected using standard plug and sockets and not wired directly.
9. All detector feeder cables laid in the carriageway, which exceed 5m, shall be armoured. The joint between the loop cable and the armoured feeder shall be made in a footway chamber.

3.2.5. Loop Design

1. All loops shall be installed in accordance with MCH1540 issue F or later unless modified below.
2. Typically, slot cutting requires 50mm of cover, with single part backfill. Any deviation from this will require prior approval from ESCC. All slots shall be air dried before the backfill is poured. Loops may be laid in the base course of the carriageway, providing that the finished depth of cover does not exceed 60mm.
3. All loops shall be cut per lane. The only exception to this is the Y and Z loops of the system D loops, which may have their loop cables joined in the loop pits. Otherwise where a multiple lane approach is encountered, loops shall be cut individually and if necessary can then be joined at a terminal block within the controller.
4. The need for unidirectional detection shall form part of the detector design and be used where appropriate.

5. The need for exit loops and short link lengths, may be dictated by site performance, vehicle pathways and the junction design.
6. On MOVA sites each vehicle phase shall have separate stopline detection.
7. Where existing sites are being upgraded to MOVA control the loops should be positioned following a cruise speed survey for the site.
8. On MOVA sites where the loop positions are determined by vehicle speed, which cannot be measured before the site is operational, permission can be sought from ESCC to cut the loops post-commissioning. In these circumstances the duct network shall extend to positions agreed with ESCC.

3.2.6. SCOOT Loop Design

1. SCOOT Loops are to be placed by a suitably qualified engineer following a site survey. The loop positions should be confirmed by ESCC prior to slot cutting.
2. SCOOT loop design shall take account of:-

Adjacent signal installations. (This may include requirements for the modification of adjacent installations, required as a consequence of the addition of the new site.)

Sinks and sources between nodes.

Lane use and width.

Opposing flows, including the need for uni-directional detection link journey time.

The need to separately identify vehicles for different phases as necessary.

Good reflection of journey times and '**MAX**' queues,

Where compromises to the above are necessary, the reasons shall be recorded with any special requirements for system operation.

3. The use of soft loops to adjust the saturated flow, shall be considered at all SCOOT UTC sites and their omission will require justification.

3.2.7. Cable and Duct Requirements

1. Each signal pole shall be cabled directly to the controller. The looping of any signal cables between signal poles will not be accepted, ONLY in exceptional circumstances, as directed by the Engineer, will alternative means of cabling be acceptable.
2. A cable drawing shall be incorporated within the construction drawing, showing clear distinction between LV and ELV.
3. The designer shall ensure that the voltage drop on ELV installations is within acceptable limits.
4. Signal cables shall not pass through ducts or boxes used for any other service.
5. Mains and extra low voltage shall not be mixed in the same cable.
6. There shall be a minimum of 4 spare cores to each pole.
7. A length of duct (minimum 50mm diameter) should run from each loop jointing chamber to 50mm below the surface at the back of the kerb line at the point where the loops will enter. This should ideally be a kerb joint.

8. Where the mis-use of the footway by goods vehicles is anticipated, heavy-duty frames and lids shall be used.
9. Chambers should be of a twin-wall self-supporting construction and the following sizes (mm) should generally be used:-
 - (a) Immediately by a pelican controller, 600 x 450
 - (b) Immediately by a junction controller, 600 x 450
 - (c) At the end of road crossings, intermediate chambers in runs, 600 x 450
 - (d) For detector jointing, 300 x 300

Any variations from these sizes shall be noted on the drawing.

Chamber base sections are shown on the drawings no: TS_ACA, TS_ACB and TS_SD, Service ducts Types A, B, C & E.

10. Chamber covers should be of a composite anti-slip type with adequate load-bearing capacity for the intended location. Recessed covers should be avoided if possible, but if not they should be in two halves to minimise the weight to be raised for maintenance.

Ducts shall be orange, 100mm diameter with 'traffic signals' stamped at regular intervals. Draw cords shall be left in ducts on completion of cable installation. No straight run should exceed 50m between chambers and each road crossing should terminate in a chamber. A minimum of one spare duct should be supplied at each road crossing.

3.2.8. Controller Requirements

1. The controller shall be to the latest specification of TR 2500A and related appendices.
2. There shall be provision for the supply of a second EPROM within six months of commissioning, or following the date that the associated development is opened and the initial impact of the full traffic and pedestrian flows are realised, whichever is the later, to embody detail changes to timings and set up found necessary in the post-commissioning phase.
3. The mains input shall normally be to a feeder pillar positioned close to the controller, in a position where the chance of impact by vehicles leaving the road is minimised.
4. Controller should where possible incorporate remote monitoring capability and be able to link directly via GSM to the current operational system.
5. Deleted
6. Deleted

3.2.9. Signal Layout

1. ESCC standard details shall be used where appropriate. Any variation to these shall be noted on the drawing.
2. On all two lane carriageways, the normal minimum shall be a Primary and a Secondary signal head on each approach.
3. Separately signalled phases facing in the same direction shall not be included unless there is sufficient physical separation to allow the inclusion of a nearside primary signal on both phases.
4. Where an early cut off is used, the secondary for the phase which is terminated early, shall normally be on the approach side of the junction.
5. Where opposing phases on a junction appear simultaneously, arrows shall not be used for the ahead or right turn movements, because drivers expect to have right of way, when these are used. They may be used for segregated left turn movements.
6. Specific attention shall be given to the presentation of the signals to both drivers and pedestrians, to maximise the effective presentation of the signals and minimise the risk of confusion. In particular the potential for 'see through' for pedestrian optics shall be considered. Where appropriate, special cowls, tunnels, cut away louvers, narrow field of vision displays etc may be used. Each shall be specified in detail. Where long tunnel cowls are used, any louvers shall be mounted at the outer end only (100 mm) and not for the whole length to minimise reflection within the cowl. In appropriate situations, cut away cowls will give better performance than louvers because there can be no reflection from the cut away side.
7. On routes subject to regular use by special loads, any necessary provision shall be included in the design. This shall include requirements for removable poles or special clearances.
8. Where appropriate, grass or hard surfaces shall be used to preserve sightlines. Shrubs that obstruct sight lines shall be removed. Each tree within the sight lines shall be considered on its merits and checked for tree preservation orders.

3.2.10. Pedestrian Crossings

1. The width of pedestrian crossings shall be consistent throughout and shall normally be a minimum of 2.8m unless it is to be shared with cyclists when it should be a minimum of 4.0 m. 400mm increments should be used to avoid cutting of the tactile paving slabs.
2. Crossing should be installed to comply with BVPI 165.
3. The footway slope to the dropped kerb shall be preferably 1 in 20 and no steeper than 1 in 12.
4. An absolute minimum of 1.2m unobstructed footway should be retained adjacent to any signal equipment in areas subject to pedestrian traffic unless an exception is agreed by ESCC.
5. An absolute minimum clear width of 2.0m shall exist throughout the pedestrian area within the cage created by the guardrail of a central island. This should be increased to 3.0m if cyclists share the facility

6. The drop kerb shall be flush with the carriageway surface with an absolute maximum permissible up-stand of 6mm. It is the designer's responsibility to address any issues that may arise due to surface water run off, and to include for them in the design.
7. Tactile devices shall be fitted at all push button units. In addition, audible devices should be fitted where allowed.
8. Staggered pedestrian facilities should be considered on all crossings over 11m wide. The stagger shall normally be to the left. Only in exceptional circumstances will a right hand stagger be accepted. In these circumstances the designer shall fully justify the use of right hand stagger, and shall demonstrate that full care has been taken to ensure that pedestrian indications cannot be wrongly interpreted.
9. On non-staggered nearside crossings with central islands the provision of pedestrian push buttons and detection should be agreed in advance with ESCC.
10. The distance between the limits of crossings at a staggered facility shall be at least 3m. Only in exceptional circumstances will a distance less than this be accepted. In these circumstances the designer shall fully justify the departure and include sufficient measures, e.g. louvers, to ensure that issues such as see-through have been addressed.
11. There should be a minimum of 3.0 m between the stop line and the studs on all approaches unless otherwise agreed with ESCC. Primary signal posts should be 2.5m beyond the stop line.
12. Each design shall include an area of hard standing, typically in the form of grasscrete, to allow for a maintenance vehicle to park. This area shall be accessed by 45 degree kerb units or similar. Where this is not achievable the designer shall carry out a risk assessment to assess if any measures are required to enable safe access by the maintenance engineer, which shall include identifying a suitable parking location that allows easy access to the controller.
13. The designer should consider ease and safety of maintenance when determining the arrangement of signal heads, types of pole and the location and dimensions of traffic islands. In all circumstances the ESCC signals maintenance team should be consulted.
14. The use of High Friction surfacing is to be considered on all high speed approaches and approaches to pedestrian facilities.
15. Where high friction surfacing is specified it should be laid for a minimum distance of 50m from the vehicle stopline. Where high friction surfacing is used on the approach to a signalised crossing (stand alone or at a junction) the surfacing should be extended to the pedestrian studs. Under no circumstances should high friction surfacing be laid across the pedestrian crossing.
16. Where high friction surfacing is laid any loops should be protected during this process so as they remain visible after the surface has been laid.
17. Equipment Layout for crossings should be prepared in line with standard detail drawings no; HWC 034 Footway Construction Type F22 and F23 – Tactile paving layout type A and B and TS_SA Traffic Signal Siting Arrangements.
18. All tactile units should be integrally monitored and when a fault is found should reply with an identified detector fault in RMS.

3.2.11. Controller interface

1. The mode priority on a controller shall normally be:

Selected Manual Control	1
Selected FT/VA	2
MOVA	3
Priority	4
CLF	5
VA/FT	6

A hurry call shall be priority 4 if used.

2. An AUX (auxiliary) lamp shall be labelled and light when the controller is under MOVA control
3. The Manual Panel Signal On/Off switch shall be set to 'Immediate Signals On'.
4. Deleted
5. Deleted
6. Deleted
7. Deleted
8. Deleted

3.2.12. Street Lighting and Signing Considerations

1. The signals design element should make reference to and be compatible with the overall design with respect to street lighting, street furniture, road markings and appropriate scheme signage.

4. Installation

4.1. *Equipment*

4.1.1. **General**

1. All signals shall be monitored using the Remote Monitoring system as agreed with ESCC traffic signals maintenance team.
2. The Contractor is to store, deliver to the Site at a time specified, install, test and commission the equipment unless otherwise agreed with ESCC.
3. All street furniture shall be fully type-approved and in accordance with the latest standards. 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. Telent are the preferred supplier of traffic signal equipment within East Sussex but others may be used with the prior written agreement of ESCC traffic signals maintenance team. The current requirements for above ground detection equipment shall be confirmed with ESCC.
4. Any equipment not to ESCC's approval identified up to the signing and acceptance of final Taking Over Certificates shall be replaced by the Contractor at his own expense.
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. During this time the Contractor shall be responsible for rectifying any failure due to the equipment, materials or workmanship, with the exception of lamp failures.
6. All street furniture shall be set out at the positions shown on the drawings and in accordance with ESCC's siting instructions. ESCC 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 ESCC prior to installing the furniture and provide amended drawings to show all new positions.
7. Unless otherwise specified, the installation of ducts, drawpits, controller bases and pole retention sockets, will be undertaken by the main civil engineering Contractor for the Works.
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.

4.1.2. **Controller and Controller Functions**

1. Telent are the preferred controller manufacturer for East Sussex.
2. The controller supplied shall be equipped with approved and compatible Red Lamp / Lamp monitoring facilities.

3. If the controller type supplied is new to ESCC then a full set of documentation (and spares) shall be supplied free of charge and facilities offered for the training of Engineers from ESCC and their Maintenance Contractors.
4. The operation of traffic signal installations shall be in accordance with TR2500A - General Specification Form and all relevant appendices.
5. The Controller shall be fitted as a minimum with a 20-amp double pole switch fuse.
6. 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 made stable prior to installation of the controller cabinet, refer to the drawing no: TS_CBA Controller Base Type A Controller Base Installation Details. Mounting on a NAL base is preferred where possible.
7. 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.
8. The Contractor shall provide up to 2 EPROM reconfigurations at ESCC's request within 12 months of the issuing of the final Taking Over Certificate. The reconfigurations shall not result from a non-compliance at the Factory Acceptance Test nor subsequently from the equipment failure. The Contractor should allow for the Factory Acceptance Test to be undertaken but not for the Contractor's time on site.
9. Controllers are to be installed so that all normal maintenance and checking can be readily carried out without encroachment on the carriageway by equipment or personnel and with the minimum of obstruction to pedestrians.
10. Controllers mounted on a root-based plinth shall be sealed at base level. 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.
11. 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.
12. The Contractor shall ensure that a separate 50mm diameter duct for a telemetry connection has been provided where necessary before sealing the base. The duct 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.
13. The controller to be supplied shall conform fully to the type approval requirements of TR2500A and all relevant appendices and provide compatible interfaces in accordance with TR2523 where appropriate.
14. The controller shall include a Master Time Clock System (MTCS) to permit the use of alternative maximum timings, fixed time plans etc.
15. The controller shall have a back up power supply for all detector commands, timing details and MTCS.

16. The controller shall be capable of interrogation using a 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.
17. Manual push buttons shall be labelled to indicate the stage number/letter using the facility panel's standard lettering.
18. The controller shall include a 3U equipment rack(s) with sufficient void space to accommodate a Remote Monitoring Unit, 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.
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.
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.
21. Provision shall be available within the controller to supply two devices via a separately fused auxiliary supply.
22. Sufficient terminals and termination points are required at the controller to accommodate all Neutral and Earth connections.
23. Two complete sets of keys to all parts of the apparatus, including 'T' bars, as required, shall be provided at the time of commissioning.
24. The controller access door(s) shall be fitted with a door stay.
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 ESCC.
26. Where practical a scheme drawing shall be laminated and attached to the door inside the controller.
27. Where applicable the MOVA link diagram shall be laminated and attached to the door inside the controller.
28. 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.
29. The controller shall include a location at which to securely fix a telemetry termination unit.

4.1.3. Signal Heads General

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.
2. All entry points into signal heads for cables shall have a secure and permanent watertight seal.
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.
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 ESCC immediately.
5. Pelican/Puffin/Toucan crossings, unless otherwise agreed and shown on the design, all vehicle signal head cowls shall be Primary, to maximise the angle of view of the optics.
6. The Contractor shall align all signal heads in accordance with the Contract drawing and as required by ESCC at the site commissioning.
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.
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 ESCC'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.
9. Fixed vertically louvered cowls designed to reduce the driver's visibility to the opposing secondary aspect shall be used on all the aspects of the secondary signals. 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.
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.
11. All signal aspects, unless otherwise agreed, should be monitored CLS-type LED's.
12. 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, if an ELV controller is not appropriate, and both the door and column shall be earthed to current IEE wiring regulations.
13. 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.

4.1.4. Pedestrian Nearside Signal Heads

1. Near side pedestrian aspects and combined units shall be Type Approved and shall comply with the Zebra, Pelican and Puffin Pedestrian Crossings Regulations and General Directions 1997 Schedule 3 Part I.
2. Narrow field of view display units should be considered to minimise the risk of 'see-through'.

4.1.5. Pedestrian Demand Units

1. Push button units shall include both an audible and tactile device unless specified elsewhere in the Contract. If an audible device cannot be fitted for safety reasons then just a tactile device need be supplied. The facility shall exist to adjust the volume of the audible signal and to inhibit it between 22:00 and 07:00 each day or at any other times as required by ESCC.
2. Pedestrian push button units shall be positioned in accordance with the orientation shown on the Contract drawing.
3. All entry points into pedestrian demand units for cables shall have a secure and watertight seal.
4. Push-button units shall not contain cables carrying mains or any other low voltage.
5. The centre of all push button units shall be positioned between 1.0 and 1.1 metres above the finished ground level. The push button units shall be securely fixed to the signal pole so that no movement occurs.
6. Where tactile devices are to be installed in pedestrian push-button units as specified on the drawing they shall be of a type approved by ESCC.
7. All pedestrian aspects shall be fitted with anti-phantom screens and hoods.
8. The Contractor shall align all pedestrian signal heads in accordance with the Contract drawing and as required by ESCC at the site commissioning.

4.1.6. Signal Heads for Cyclists

1. The lowest part of any cycle signal head assembly including brackets shall have a minimum clearance of 2.4 metres above the finished ground level unless specifically designed to be installed at a lower level.
2. All entry points into cycle signal heads for cables shall have a secure and watertight seal.
3. All cycle signals shall be fitted with primary or secondary cowls and shall be fitted with anti-phantom screens and hoods.

4.1.7. Additional Signals

1. Internally illuminated 'box' signs shall be provided as specified on the drawing. The configuration shall be as specified on the drawing signal head schedule.
2. The lowest part of the signal head assembly including any additional signs and brackets shall have a minimum clearance of 2.1 metres above the finished ground level.
3. Regulatory signs on signal heads shall comply with BS 873: Part 5: 1983 "Specification for Internally Illuminated Signs and External Lighting Luminaires".
4. Regulatory signs on signal heads shall be individually fused within the head.
5. Green arrows and regulatory signs, which are side mounted on signal heads, shall be secured, after alignment, with stay bars.
6. There shall be a minimum lateral clearance of 450mm between the outer edge of all additional signs including backing board and the edge of the carriageway.
7. Backing boards shall be securely attached to all additional signs to form a composite signal head.
8. If an ELV controller is being used consideration should be given to the need for additional power conversion units where the scheme specifies 8 or more box signs.
9. Where box signs are used at a junction their use should be consistent by approach where appropriate (e.g. if a 4 in line arrangement is used on the primary the same 4 in line arrangement should be used for the secondary).

4.1.8. Traffic Signal Poles

1. All traffic poles shall be installed using the NAL pole retention system, or a similar system that has ESCC approval, to allow the pole to be removed following a knockdown. The pole retention system is to have at least two bolts to securely fix the pole in place, to reduce the risk of rotation, refer to the drawing no: TS_RS, Retention Socket.
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 using in-situ concrete, refer to the drawing no: TS_PD, Traffic Signal Post Detail.
3. All poles are to be set to ensure that the centres of the ambers are at 3.2metres above finished ground level.
4. All traffic signal poles shall be galvanised prior to the application of a grey plastic coating, unless otherwise specified by ESCC for a specific location (e.g. in a conservation area). 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 ESCC. All poles must be low access types.
5. Stub poles shall be of a one-piece, welded top, construction.
6. Signal head extension brackets ('D' type) shall only be used where specified (in position and length) on the relevant site drawings, or following approval from ESCC.

7. Signal head mounting brackets ('L' type) shall be long enough to provide sufficient rotational movement to allow correct alignment of heads, with a minimum movement of 120 degrees.
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 ESCC immediately if any signal poles fail to satisfy the aforementioned requirements.
9. Where necessary to achieve an acceptable location for the pedestrian push buttons and achieve not less than 450mm clearance to the side of the signal head/heads, swan-neck signal poles may be used. Only the formed type shall be used, as the welded cranked type will not be acceptable. Consideration to matching other poles for cosmetic reasons shall be made.
10. Subject to the prior approval of ESCC, poles carrying pedestrian push buttons may be set back 700mm from the kerb face to avoid the use of swan-neck poles, provided a minimum unobstructed footway width of 1.2m remains.
11. Dual Infrastructure columns may be used where no other alternative exists. All use of such equipment must be justified at the design stage and approval for use is only with express permission of ESCC signals team.

4.1.9. Vehicle Detection

1. Unless otherwise specified all detector packs shall be housed within the controller cabinet.
2. Detection shall be supplied as 2 or 4 channel detection cards. Speed loops are not to be mixed on the same detector card.
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 01/08.
4. System D and Stop line detector loops are shown schematically on the relevant site drawings and shall be cut to the standard configuration. The location of detector loops shall conform with the latest issue of MCE 108C "Siting of Inductive Loops for Vehicle Detecting Equipments at Permanent Road Traffic Signal Installations", incorporating all released amendments.
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 ESCC traffic signals engineer. Where this is necessary, the position and size of loops shall be agreed on site prior to slot cutting work commencing.
6. Speed discrimination and speed assessment equipment shall be capable of being monitored both on site and remotely.
7. Where the use of Microwave Vehicle Detectors and infra-red detectors are specified these shall be Type Approved and shall comply with TR2505. The use of the above ground detection shall be in accordance with the manufacturer's instructions. The alignment of all above ground detection shall be set up as required by ESCC at the site commissioning.

8. Subject to the prior approval of ESCC, the use of suitable wireless linking equipment may be considered where there would be practical difficulties with the installation or maintenance of hard-wired links.

4.1.10. Pedestrian Detection

1. The requirements for kerbside and on-crossing equipment for the detection of pedestrians shall be agreed with ESCC and supplied as per the relevant site drawings.
2. Requirements for any test and configuration equipment for programmable devices shall be agreed with ESCC and the appropriate number of test units supplied. Any relevant training shall be part of the training requirements.

4.1.11. Loop detection installation

1. All detector channels shall be labelled to indicate the detector name. The label shall be waterproof and marked adjacent to the detector channel.
2. Loop feeder cables shall be kept clear of main switch and maintenance sockets within the cabinet.
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. Where a surface comprises black top overlaying concrete, the installer shall ensure that all loops are laid within one material, subject to a minimum depth of cover, which may be discussed with ESCC.
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).
6. Detector loops are to be connected via individual pairs of feeder cables.
7. No feeder cable shall be jointed unless it is to connect a detector loop.
8. Joints may be chemically sealed or mechanical. They shall be made in accordance with the manufacturer's instructions and recommendations.
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 ESCC 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.
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.

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.
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 ESCC.
 - 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 supplier's 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 ESCC 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, from the back of the kerb, preferably adjacent to a kerb joint 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 kerb shall be 50mm. If practical constraints prevent this any alternative arrangement must be agreed with ESCC.
 - 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.

4.1.12. Cabling

1. Pedestrian push button units and all other extra low voltage equipment on all non-ELV installations are to be wired on a separate core cable(s) to the vehicle signal cables.
2. Cables shall be terminated in the controller at the appropriate terminal block and in the correct terminal position.
3. 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.
4. 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. All labels shall be permanent and marked in ink.
6. Cable sheath and cable core identification is to be undertaken on all signal cables within the controller as per APPENDIX D.
7. Cable sheath identification only is to be undertaken on all signal cables, at the pole connection points as per APPENDIX D.
8. 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.
9. All loop conductor wire pairs shall be connected together with zip ties or similar, and labelled as close to the point they enter the drawpit as possible.
10. All cables shall be armoured in multibanded steel and covered in an outer sheath of orange coloured PVC.
11. All Cables including loop feeder cables shall comply with or exceed the ESCC specification shown in Appendix A and comply with the requirements of BS 505 as amended by TR0102.
12. Signals from detector loops shall not be brought back on the same cable carrying the supply to signal heads or push buttons.
13. There shall be a minimum of 4 spare cores to each pole.
14. 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, and with the prior approval of ESCC, will alternative means of cabling be acceptable.

15. Unused cores at the controller shall be left for future expansion, but isolated to ensure no earth loops can be created.
16. Unused cores between poles shall be connected to Earth at one pole connection unit.
17. Unused cores between the pole and the controller shall be connected to Earth at the pole connection unit.
18. Signal cables shall not pass through ducts or boxes used for any other service and no other services may utilize the traffic signal ducts or boxes.
19. Duct shall be in accordance with NJUG Standards, Orange 100 mm diameter with 'traffic signals' stamped at regular intervals.
20. A mixture of extra low voltage (ELV) and low voltage (LV) circuits in multicore cables is not acceptable in any circumstances.
21. Cables carrying 240v lamp power shall occupy separate ducts from cables carrying extra low voltage (push button/audible, detection etc) although they will use the same chambers. This will not apply to the individual duct directly feeding each pole.
22. One duct shall be left empty on all road crossing.
23. The main civil engineering contractor will provide draw-cords in all duct runs. The Contractor shall be responsible for ensuring that a draw-cord is retained in each duct run following the installation of the cables.
24. Pulling of cables will be the responsibility of the Contractor. All cabling shall be installed as shown on the relevant site drawing
25. 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.

4.1.13. Electricity Supply

1. The mains input shall normally be to a separate 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 230v 50Hz.
2. The pillar shall be installed in accordance with the manufacturer's specification. ESCC's preferred pillar is a 150mm wide stainless steel unit manufactured by Ritherdon. Any alternative must be agreed with ESCC.
3. The supply may be fed from an existing ESCC private network, in which case a separate, marked and identified secondary cut-out must be provided within the existing equipment. With the prior agreement of ESCC signals team, a separate power supply pillar may not be required in these circumstances.
4. A double pole isolator switch should be provided in the feeder pillar and connected to the Electricity Board's supply by the Electricity Board's authorised staff or to ESCC's private network by ESCC 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 2.2.

5. Signals installation should normally not commence on site until the feeder pillar has been installed and serviced.

4.1.14. Testing of Installed Cables and Marking of Cable Drawing

1. The Contractor shall supply to ESCC 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.
2. The electrical test certificates shall be in accordance with the forms shown in APPENDICES B & C.
3. The Contractor shall notify ESCC prior to tests being undertaken so that they, or their contractor, may be present to verify the tests.
4. The following tests shall be carried out:
 - a) Series resistance of loop and feeder. The total resistance shall not exceed 8.5 ohms.
 - b) 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.
 - c) Impedance to earth of cable armouring after the armouring has been connected to earth. The reading shall not exceed 0.5 ohms.
 - d) Impedance to earth of loop and feeder conductors with both feeder conductors connected together, using at least 500v DC applied for at least one minute.
 - e) Impedance to earth of connecting cable conductors with all conductors connected together, using at least 500v 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.

Any loop or feeder or connectable cable which fails any of the tests shall be replaced by the Contractor before the site is commissioned.

5. 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 ESCC. This work shall be carried out for all detectors which have been affected by the Works.
6. Measurement of linear meterage may be carried out with a measuring wheel that has been calibrated within the previous 12 months. ESCC shall have the right to check any measurement and request that any electrical test be repeated at the contractor's expense during commissioning.

4.1.15. Testing and Commissioning

1. The client or client's design consultants shall give ESCC at least ten working days notice of the controller(s) being ready for Factory Acceptance Testing (FAT) and shall allow for attendance at those tests by ESCC's representative.
2. The installer shall supply ESCC with a copy of the controller specification prior to or at the above tests.
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 ESCC shall be rectified by the Contractor at his own expense.
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.
5. All signal poles shall be numbered, starting with the pole closest to the controller and proceeding in a clockwise direction around the facility.
6. On completion of the installation the site shall be left clean and tidy and all rubbish shall be removed.
7. 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 ESCC be asked to attend the installation in order that it may be commissioned. The Contractor shall supply all equipment necessary for testing purposes.
8. The Contractor shall give at least one week's advance notice to ESCC to attend the commissioning tests. ESCC reserve the right to invite their maintenance contractor to attend the site commissioning.
9. Any non-compliances identified by ESCC or their maintenance contractor 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 ESCC consider 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 ESCC 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 provided at the Contractor's own expense.
10. Following a successful site commissioning the installation will be handed over to ESCC'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 ESCC who will then decide what action is to be taken. Either ESCC 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.

11. 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 ESCC until final Taking-Over Certificates have been signed and accepted by ESCC. If during this period a fault develops, ESCC's maintenance contractor shall attend the site, to rectify the fault at the Contractor's expense.

4.1.16. Documentation

1. The following documents are to be supplied by the Contractor and retained in the controller at commissioning:
 - a) A Log Book
 - b) A copy of the controller specification and Site Layout Diagram.
2. The Contractor shall supply to ESCC 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.
3. Within 30 days of the commissioning the contractor is to supply three "as constructed" cable and signal drawings. One shall be retained within the controller, the remaining two shall be sent to ESCC. The Contractor is in addition to supply the "as constructed" drawing in AutoCAD format. The file may be 'zipped' when supplied on disk.
4. Within 7 days of the commissioning the contractor is to supply a further two sets of the EPROM specification and/or the MOVA Dataset files.

4.1.17. CCTV Requirements

1. All junctions will be equipped with CCTV equipment capable of transmitting via Remote Monitoring System. Number of cameras, positions and view angles to be agreed with ESCC and recorded on design drawings.
2. Pedestrian Crossings are subject to site specific requirements, enquiry must be made prior to submitting design.

7.

4.1.18. Connecting to Remote Monitoring System

1. Unless specified otherwise by ESCC in writing the installation will be connected to East Sussex County Council's Remote Monitoring System currently Telent. The following requirements are to be met.
2. A standard 3U rack is to be provided for fitting of equipment suitable for connecting to Telent RMS.
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 if network coverage will not support a GSM unit or if so required by ESCC.
4. All controller detector inputs shall be capable of being remotely monitored.
5. A separately fused supply shall be provided solely for use of the OTU/OMU where it is not integral to the controller.
6. The OMU equipment shall be of a type approved by ESCC to ensure compatibility with the Installation operating system.
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.

4.1.19. Connecting to Microprocessor Optimised Vehicle Activation (MOVA)

1. Unless specified otherwise by ESCC in writing the installation will be connected to MOVA and the following requirements are to be met.
2. A standard 3U rack is to be provided for a MOVA/Outstation Monitoring Unit to be fitted in the controller cabinet containing a 300mm wide by 300mm deep void space.
3. A UTC interface is provided inside the controller for MOVA control. The Contractor shall test the output of all UTC bits at the Site commissioning.
4. All controller detector inputs shall be capable of being remotely monitored. All control and reply bits shall be capable of being wired to the MOVA unit.

5. The manual panel shall include a 'computer on' LED which shall indicate when the controller is operating under MOVA control. The LED shall be labelled 'MOVA on-line' or as identified within the specification.
6. The MOVA equipment shall be of a type approved by ESCC to ensure compatibility with the Site interrogation software and Instation operating system.
7. The latest version of the MOVA software shall be supplied, including all relevant licences to operate MOVA.
8. The Contractor will be required to validate the system post-commissioning and provide ESCC with a validation report and final MOVA dataset. ESCC may, at their discretion, require an independent validation at the Contractor's expense.

4.1.20. ELV installations

1. Care should be taken when designing ELV installations. The manufacturer's notes on suitable cable lengths and their associated voltage drops should be consulted prior to the design being submitted.
2. Where there is no standard specification for cable and cable core identification for ELV installations. The arrangement made should be logical and approved by ESCC before install.

5. Appendices

5.1. Appendix A – Cable Specification

A) Loop Cable

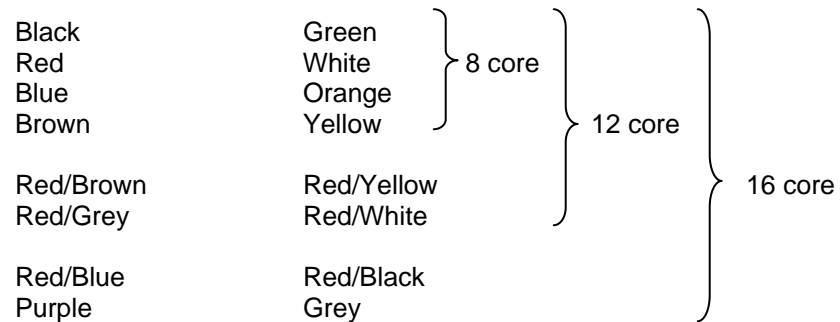
2.5mm² 30/0.25 tinned annealed copper conductor, insulated with 0.8 mm radial thickness of EPR and sheathed with 1.4 mm radial thickness of PCP. Overall diameter 6.8 mm (minimum), 7.2mm (maximum)

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:-



5.2. Appendix B – Test Certificate for Detector Cabling

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)

5.3. Appendix C – Earthing and Insulation Test Certificate

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

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

Printed

Signed Name acting as

(Position) for (Company)

5.4. **Appendix D - Specification for Cable and Cable Core Identification – LV**

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

CABLE IDENTIFICATION

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.

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.

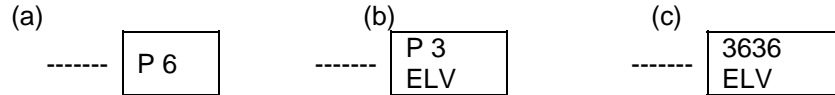
(b) Extra Low Voltage Cables (Pedestrian Push Buttons, etc)

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:-



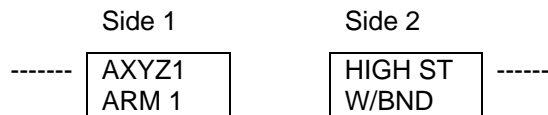
Note: The pole numbers referred to above are as shown on the contract drawing.

(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:-



CABLE CORE IDENTIFICATION

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.

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 i.e. 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.

The colours, numbers, function, letters and arrangement of the markers shall be as follows:-

- (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 (Pole)		Second Marker (Function)			Third Marker (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				

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 i.e. the Second and Third marker as in 2.3.1 (a) above.

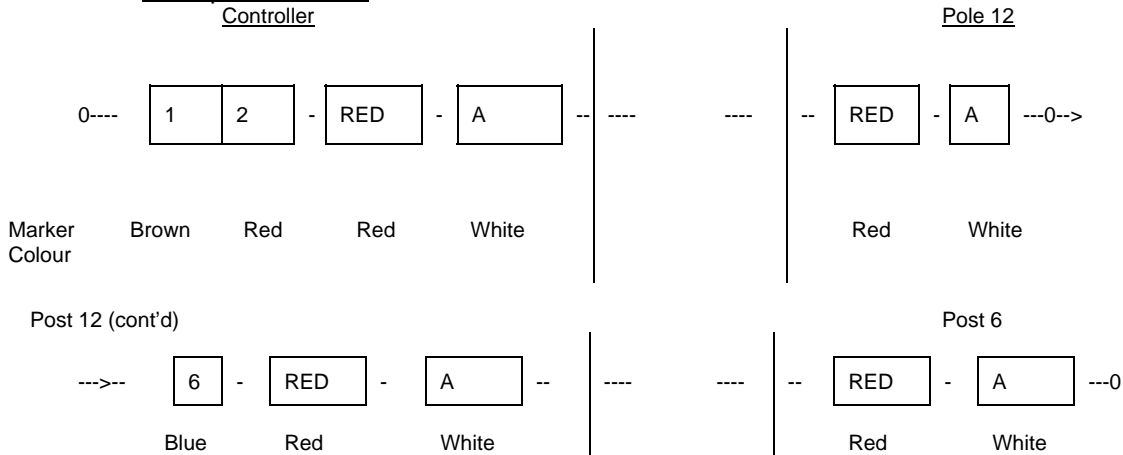
- (b) Extra Low Voltage Cables - This arrangement shall be used for all cables in the controller and for all cables leaving a signal pole.

First Marker (Pole)	Second Marker (Function)	Third Marker (Phase)
Colour:- Colour Coded	Yellow	White
1 Brown	PUSH/B	TACT
2 Red	COMM	LINK
3 Orange	T/O	
4 Yellow	DET+	DET-
5 Green	MVD	IRD
6 Blue		SPARE
7 Violet	Note:- Functions not covered by the above to be written onto blank markers with an approved pen. (Two Markers)	A
8 Slate (Grey)		B
9 White		C
10 Brown and Black		D
		E
		F
		G
		H
		etc

(c) 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 i.e. the Second and Third marker as in 2.3.2 (a) above.

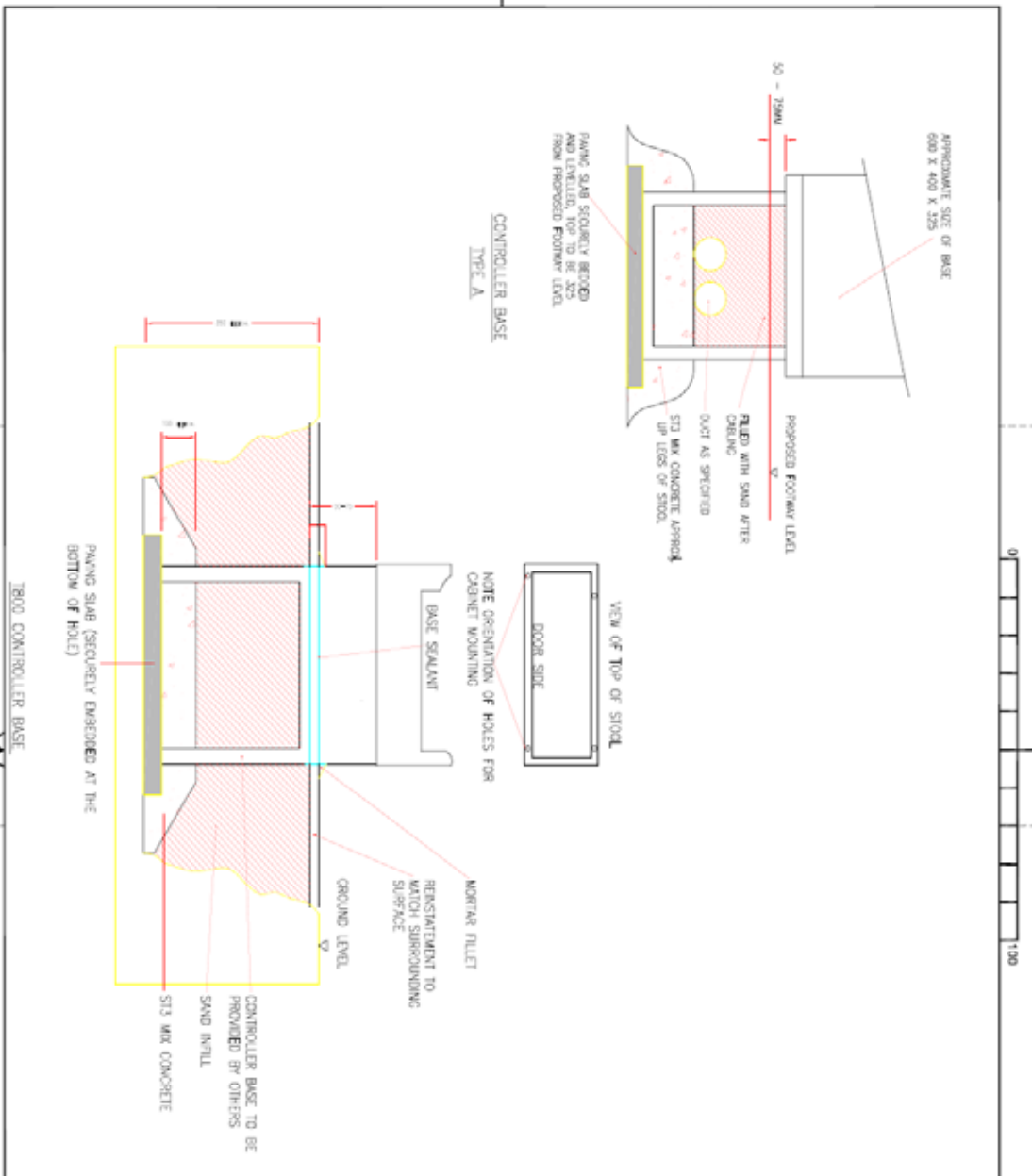
Examples of above:-
Controller



5.5. Appendix E – ESCC standard drawings

TS_PD	Traffic signal post detail
TS_CBA	Traffic signal controller base type A
TS_RS	Traffic signal retention socket
TS_SD	Traffic signal service ducts
TS_ACA	Traffic signal access chamber type A
TS_ACB	Traffic signal access chamber type B

Drawing deleted as no longer meets specification.



Rev	Revision details	Chkd	Apprd	Date
	Desig. designed	✓		For comment
	Chkd: checked			For tender
	Apprd: approved			For construction
	Date: date			As constructed
	File no: WSP\SLT\SIDE SHOW\STANDARD DETAILS\TS CONTROLLER BASE TYPE A.dwg			

<p>East Sussex County Council Transport & Environment</p>	
<p>Client: EAST SUSSEX COUNTY COUNCIL TRANSPORT & ENVIRONMENT</p>	
<p>Project Name: STANDARD DETAIL DRAWINGS</p>	
<p>Drawing Title: CONTROLLER BASE TYPE A T800 CONTROLLER BASE INSTALLATION DETAILS</p>	
<p>Original Drawing Size: A3 Scale: NOT TO SCALE Dimensions: -</p>	
Drawing No:	TS_C10A
Rev	



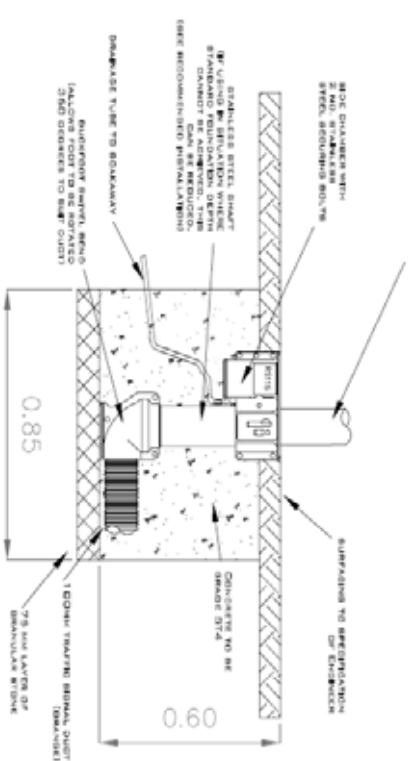
**RECOMMENDED BASE SPECIFICATION FOR RETENTION SOCKETS IN LOW SPEED / SOLID GROUND AREAS
114 MM DIA POST IN LOW RISK ARE WITH 600MM ROOT**

CIVILS INSTALLATION OF RS115 D/F RETENTION SOCKET

1. CONNECT DUCTING FROM REMOTE CHAMBER TO SWIVEL BEND ON SOCKET BY TIGHTENING THE TWO WELD BOLT FLANGES. LEAVE GRAY GORD IN BASE OF SOCKET BEND.
2. TWIST THE HEAD OF SOCKET TO THE REQUIRED ORIENTATION LEVEL.
3. LAY THE DRAINAGE TUBE TO DOWNPOURED HARDWARE (SLOPE AWAY).
4. IF POLE IS ON A TRANSITIONAL SLOPE SEE DRAWING NAL013 AND NAL014

2. LEVELLING USING RS 115 STUMP POLE

REMOVE THE PEDESTALIAN PLUG
MADE THE STUMP POLE INTO THE SOCKET (ENSURE THE TWO STAINLESS STEEL BOLTS DO NOT OBSTRUCT THE STUMP POLE FROM ENTERING THE SOCKET).
TIGHTEN THE TWO 16MM STAINLESS STEEL BOLTS AGAINST THE STUMP POLE MAKING SURE THAT THE STUMP POLE IS IN A VERTICAL POSITION.
USE THE STUMP POLE TO ACHIEVE A VERTICAL LEVEL.
NEVER LEVEL THE SOCKET FROM THE HEAD OF THE SOCKET OR USING A PIECE OF DUCTING.
ONCE VERTICAL LEVEL IS ACHIEVED COMPACT THE CONCRETE.
ONCE CONCRETE HAS BEEN COMPACTED AND HAS BEGUN TO CURE CAREFULLY REMOVE STUMP POLE AND LOCK THE CIRCULAR DUCTILE IRON PLUG IN PLACE BY TIGHTENING THE 16 MM BOLTS IN THE LOCKING CHAMBER.
REPLACE THE LOCKING CHAMBER LID AND SECURE IN POSITION.
FINISH FOOTWAY WITH REQUIRED SURFACE WHEN CONCRETE HAS CURED.
FOR FURTHER ASSISTANCE PLEASE CONTACT NAL LTD.
01903 7449 714 OR info@nal.co.uk



114MM DIAMETER TRAFFIC SIGNAL POST
NOTE: A STEEL POLE MUST BE USED OUNDO
INSTALLATION OF THE LID
TO PREVENT THE SIGNAL POST FROM
MOVING.

Revision	Author	Checked	Date

Design	developed	✓	For comment
Drawn	checked		For tender
Approved	approved		For construction
Other	date		As constructed

File ref: WSP\ALTS\DESIGN\STANDARD DETAILS\TS RETENTION SOCKET.dwg

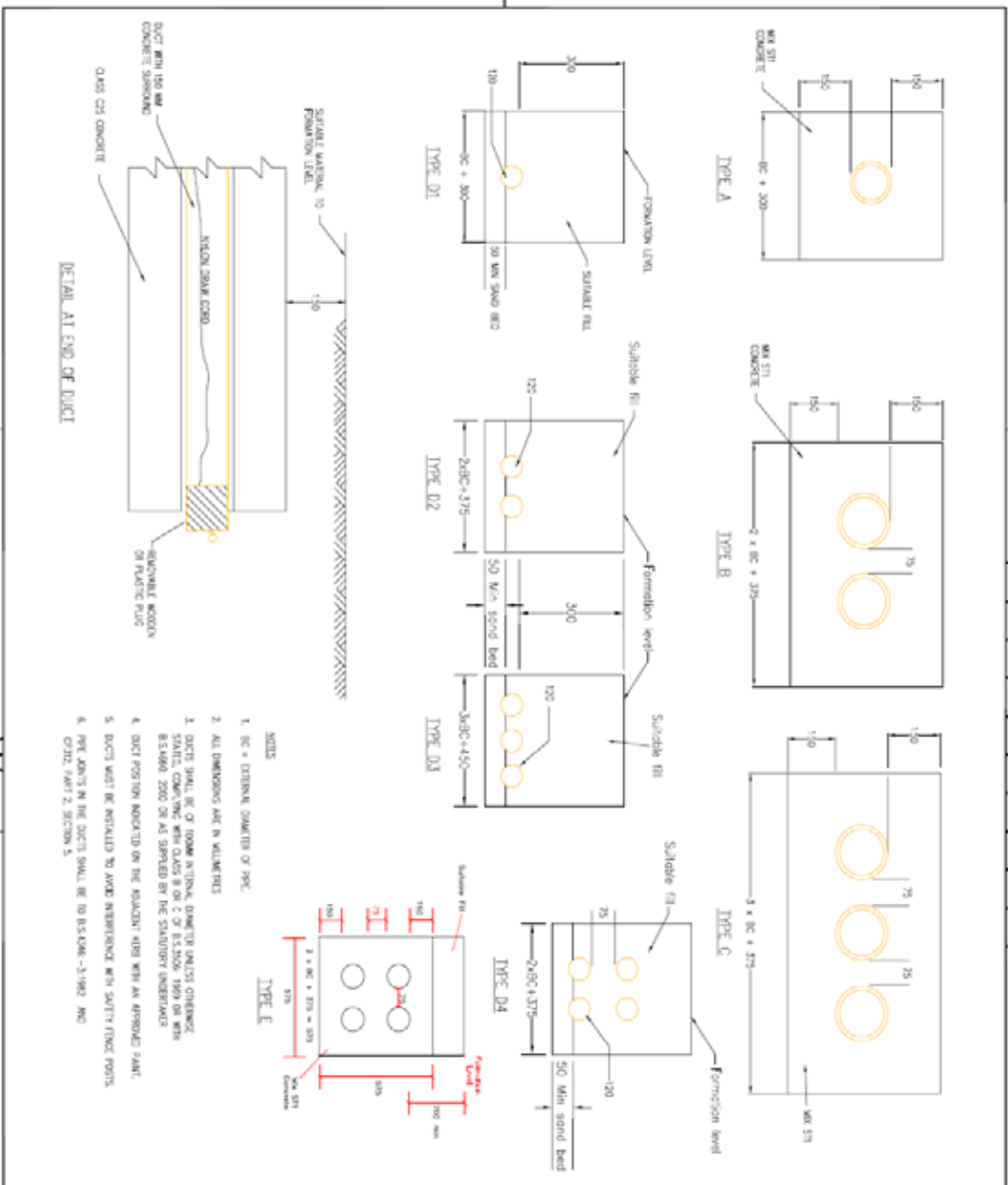


Client:
EAST SUSSEX COUNTY COUNCIL
TRANSPORT & ENVIRONMENT

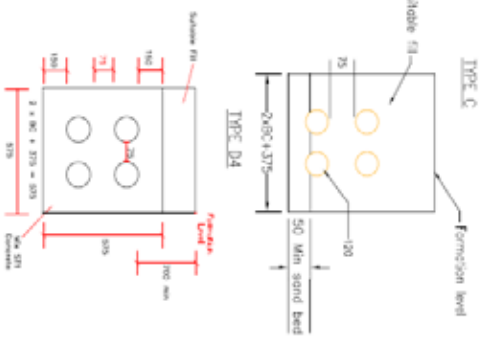
Project Name:
STANDARD DETAILS

Drawing Title:
RETENTION SOCKET

Original Drawing Size: A3
Scale: NOT TO SCALE
Dimensions: -
Drawing No: TS_RS
Rev



- NOTES**
1. ALL DIMENSIONS ARE IN MILLIMETRES
 2. ALL DIMENSIONS ARE IN MILLIMETRES
 3. DUCTS SHALL BE OF 150MM INTERNAL DIAMETER UNLESS OTHERWISE STATED. CHAMFER WITH CLASS B OR C OF BS.5400.7:1993 OR WITH BS.4469.2:2000 OR AS SPECIFIED BY THE STATIONERY UNDERWRITER.
 4. DUCT POSITION INDICATED ON THE ROADWAY OVER WITH AN APPROVED PAINT.
 5. DUCTS MUST BE INSTALLED TO AVOID INTERFERENCE WITH SAFETY TRIANG POINTS.
 6. PER JOINTS IN THE DUCTS SHALL BE TO BS.5406.-1:1992 AND CONZ. PART 2, SECTION 5.



Rev	Revision details	Chkd	Appd	Date

Design	checked	For comment
Check	approved	For tender
Drawn	approved	For construction
Drawn	date	As constructed

File name: W:\SUSSEX\SKINS\STANDARD DETAILS\TS SERVICE DUCTS.dwg

T.S. SERVICE DUCTS.dwg

East Sussex
Surrey
Infrastructure Group


Client:
EAST SUSSEX COUNTY COUNCIL,
TRANSPORT & ENVIRONMENT

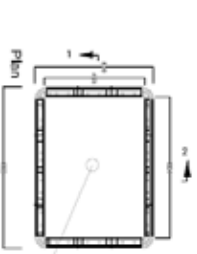
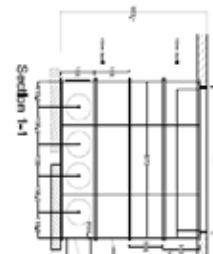
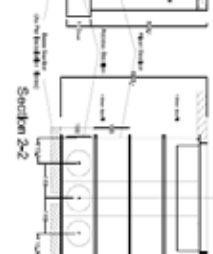
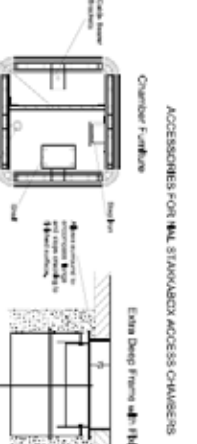
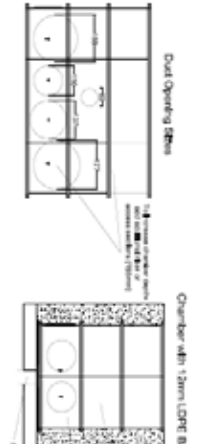
Project Name:
STANDARD DETAIL DRAWINGS

Drawing Title:
SERVICE DUCTS
TYPES A, B, C, D & E

Original Drawing Size: A3
Scale: NOT TO SCALE
Dimensions: -

Drawing No	Rev
TS_310	



ACCESSORIES FOR FULL STANDARD ACCESS CHAMBERS

Chamber Furniture

Extra Deep Frame with 12mm LDPE Base

Chamber with 12mm LDPE Base

Out-Opening Detail

Rev	Revision details	Checked	App'd	Date

Drawn	checked	For comment
Checked	approved	For tender
Approved	drawn	For construction
Drawn	drawn	As constructed

File name: WSAULTSDESIGNSTANDARD DETAILS TS ACCESS CHAMBERS TYPE A & B.dwg



Client:
EAST SUSSEX COUNTY COUNCIL
TRANSPORT & ENVIRONMENT

Project Name:
STANDARD DETAIL DRAWINGS

Drawing Title:
ACCESS CHAMBER TYPE A

Original Drawing Size: A3
Scale: NOT TO SCALE **Dimensions:** -

Drawing No: TS_ACA **Rev:**

STANDARD ACCESS CHAMBERS

These chambers are designed to accommodate a range of traffic signals and are available in two sizes: 1.5m x 1.5m and 1.5m x 2.0m. They are constructed from heavy-duty steel and are designed to be durable and long-lasting.

1.5m x 1.5m Chamber

1.5m x 2.0m Chamber

Accessories:

- Chamber Furniture
- Extra Deep Frame with 12mm LDPE Base
- Chamber with 12mm LDPE Base
- Out-Opening Detail

STANDARD ACCESS CHAMBERS

These chambers are designed to accommodate a range of traffic signals and are available in two sizes: 1.5m x 1.5m and 1.5m x 2.0m. They are constructed from heavy-duty steel and are designed to be durable and long-lasting.

1.5m x 1.5m Chamber

1.5m x 2.0m Chamber

Accessories:

- Chamber Furniture
- Extra Deep Frame with 12mm LDPE Base
- Chamber with 12mm LDPE Base
- Out-Opening Detail

STANDARD ACCESS CHAMBERS

These chambers are designed to accommodate a range of traffic signals and are available in two sizes: 1.5m x 1.5m and 1.5m x 2.0m. They are constructed from heavy-duty steel and are designed to be durable and long-lasting.

1.5m x 1.5m Chamber

1.5m x 2.0m Chamber

Accessories:

- Chamber Furniture
- Extra Deep Frame with 12mm LDPE Base
- Chamber with 12mm LDPE Base
- Out-Opening Detail

STANDARD ACCESS CHAMBERS

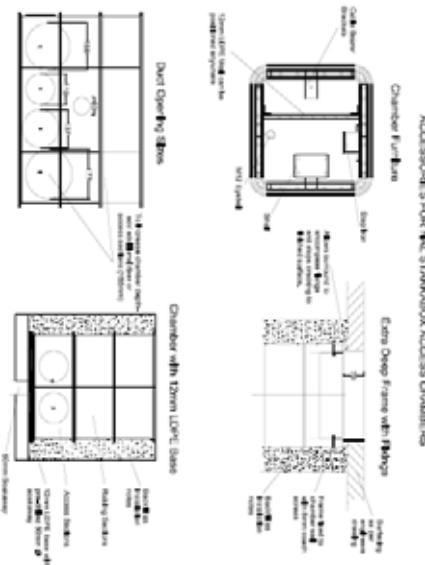
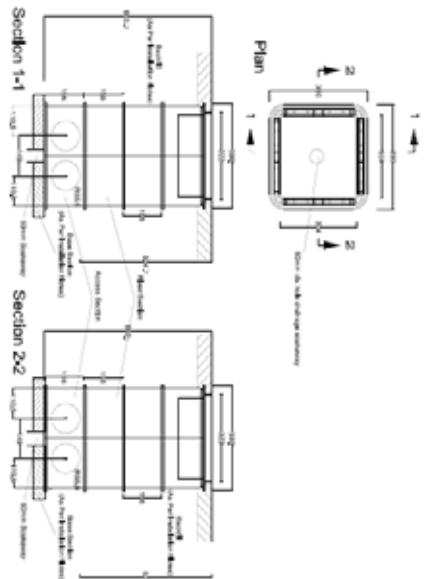
These chambers are designed to accommodate a range of traffic signals and are available in two sizes: 1.5m x 1.5m and 1.5m x 2.0m. They are constructed from heavy-duty steel and are designed to be durable and long-lasting.

1.5m x 1.5m Chamber

1.5m x 2.0m Chamber

Accessories:

- Chamber Furniture
- Extra Deep Frame with 12mm LDPE Base
- Chamber with 12mm LDPE Base
- Out-Opening Detail



STANDARD "S" Specifications
 The following items are specified for use in the design and construction of the standard "S" access chamber.
 1) Chamber shall be constructed of galvanized steel with a minimum thickness of 1.6mm.
 2) Chamber shall be painted with a minimum of two coats of epoxy primer and paint.
 3) Chamber shall be designed to provide a minimum of 1.5m² of access area.
 4) Chamber shall be designed to provide a minimum of 1.5m² of access area.
 5) Chamber shall be designed to provide a minimum of 1.5m² of access area.
 6) Chamber shall be designed to provide a minimum of 1.5m² of access area.
 7) Chamber shall be designed to provide a minimum of 1.5m² of access area.
 8) Chamber shall be designed to provide a minimum of 1.5m² of access area.
 9) Chamber shall be designed to provide a minimum of 1.5m² of access area.
 10) Chamber shall be designed to provide a minimum of 1.5m² of access area.

STANDARD "M" Material List
 1) Chamber shall be constructed of galvanized steel with a minimum thickness of 1.6mm.
 2) Chamber shall be painted with a minimum of two coats of epoxy primer and paint.
 3) Chamber shall be designed to provide a minimum of 1.5m² of access area.
 4) Chamber shall be designed to provide a minimum of 1.5m² of access area.
 5) Chamber shall be designed to provide a minimum of 1.5m² of access area.
 6) Chamber shall be designed to provide a minimum of 1.5m² of access area.
 7) Chamber shall be designed to provide a minimum of 1.5m² of access area.
 8) Chamber shall be designed to provide a minimum of 1.5m² of access area.
 9) Chamber shall be designed to provide a minimum of 1.5m² of access area.
 10) Chamber shall be designed to provide a minimum of 1.5m² of access area.

STANDARD "M" Material Access
 1) Chamber shall be constructed of galvanized steel with a minimum thickness of 1.6mm.
 2) Chamber shall be painted with a minimum of two coats of epoxy primer and paint.
 3) Chamber shall be designed to provide a minimum of 1.5m² of access area.
 4) Chamber shall be designed to provide a minimum of 1.5m² of access area.
 5) Chamber shall be designed to provide a minimum of 1.5m² of access area.
 6) Chamber shall be designed to provide a minimum of 1.5m² of access area.
 7) Chamber shall be designed to provide a minimum of 1.5m² of access area.
 8) Chamber shall be designed to provide a minimum of 1.5m² of access area.
 9) Chamber shall be designed to provide a minimum of 1.5m² of access area.
 10) Chamber shall be designed to provide a minimum of 1.5m² of access area.

Standard Colors & Finishes
 The standard colors and finishes for the access chamber are:
 1) Chamber shall be painted with a minimum of two coats of epoxy primer and paint.
 2) Chamber shall be painted with a minimum of two coats of epoxy primer and paint.
 3) Chamber shall be painted with a minimum of two coats of epoxy primer and paint.
 4) Chamber shall be painted with a minimum of two coats of epoxy primer and paint.
 5) Chamber shall be painted with a minimum of two coats of epoxy primer and paint.

Rev	Revision details	CHSL	Appd	Date
001	Design developed			
002	CHSL checked	✓		For tender
003	Approved			For construction
004	Drawn			As constructed

Client:
 EAST SUSSEX COUNTY COUNCIL
 TRANSPORT & ENVIRONMENT

Project Name:
 STANDARD DETAIL DRAWINGS

Drawing Title:
 ACCESS CHAMBER TYPE B

Original Drawing Size: A3
Scale: NOT TO SCALE
Dimensions: -

Drawing No: TS_ACB
Rev:

0 100