Section SL1: Appendix 12 Traffic Signs

Lit Traffic Signs

1.1 Large base traffic sign posts

(a) Large base traffic sign posts shall be tubular in cross-section unless otherwise directed by the Client Officer. The base section shall be turned, forged or swaged to the smaller diameter section. Cones formed from sheet steel and welded to both sections shall not be used.

(b) Where rectangular posts are specified by the Client Officer, a separate service box may be attached using purpose made brackets or clips. This separate service box shall be mounted at the base of the post and shall be constructed of mild steel and be dimensioned as specified for tubular post housings. All external screws and hinges shall be of stainless steel. A means of protecting the service cable from the base to 450mm below ground level shall be provided.

(d) Posts and service boxes must have a minimum clearance of 150mm between the lower edge of the door and the finished ground level.

(e) Posts shall have a minimum door opening of 450mm by 105mm and a baseboard of non-hygroscopic hardwood of minimum thickness 12mm shall be securely fixed to the back of the compartment. The backboard fixing nut or screw shall be flush with the face of the backboard so as not to obstruct the mounting of equipment thereon.

(f) Each post compartment shall be fitted with an 8mm (minimum) diameter brass earth terminal complete with two plain brass washers and nuts. The terminal shall be readily accessible through the door opening.

(g) Where service boxes are attached to steel posts, a 19mm outside diameter male brass bush shall be passed through a clearance hole in the back of the box and screwed into the steel post so as to ensure earth continuity and prevent the entry of moisture.

(h) Posts and service boxes shall be hot dip galvanised in accordance with BS729 followed by a G1a coating to the base in accordance with Series 1900.

(i) Door openings and posts shall be free from irregularities and burrs.
(j) Steel posts shall be provided with a base plate and an external fit grey PVC post cap to prevent ingress of water. Stub posts shall have a cap at the top and bottom of the post.

(k) The cable entry slot which shall be positioned directly below the door opening shall have minimum dimensions of 150mm x 75mm with the lower edge of the slot 450mm below ground level.

(l) Posts shall be installed with the door openings as detailed below:

<table>
<thead>
<tr>
<th>Post Position</th>
<th>Door Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Back of footpath</td>
<td>Facing road</td>
</tr>
<tr>
<td>Near kerb edge</td>
<td>Facing away from oncoming traffic</td>
</tr>
<tr>
<td>Centre of central reserve</td>
<td>Facing oncoming traffic in a consistent direction</td>
</tr>
<tr>
<td>Near edge of central reserve</td>
<td>Facing away from oncoming traffic or facing distant side of reserve</td>
</tr>
</tbody>
</table>

(m) Foundations for planted posts shall be of concrete and be in accordance with BS873.

1.2 Post Doors

(a) Posts shall be provided with weatherproof single doors which shall be free from irregularities and burrs. Each door shall be fitted with a stainless steel tamper-proof locking device.

(b) Posts mounted on structures or in situations where there is a risk that a detached door could cause an accident if it fell onto the area below shall have their doors held captive by a brass or stainless steel chain which shall be sufficiently robust to support the door in severe gale conditions.

(c) Posts mounted on structures behind parapets shall have the bottom of the door opening 1.10m above the top of the parapet plinth.

(d) Except for doors which are required to be captive, all doors shall be interchangeable between similar types of posts without adjustment.

(e) The number of door keys to be supplied shall be 10% of the number of posts erected, subject to a minimum of six keys.

(f) Each post door shall be fitted with an 8mm (minimum) diameter brass earth terminal complete with two plain brass washers and two brass nuts.

1.3 Traffic Sign Luminaires

(a) Traffic sign luminaires shall comply with Chapters 11 and 13 of the Traffic Signs Manual and Appendix 14/4 and shall provide a light distribution in accordance with Categories 1 and 2 of Part 5, paragraph 8.2 of BS873:1993.

(b) Traffic sign luminaires shall be constructed from LM6-M cast aluminium in accordance with BS873, Part 5, Section 4.2.1 (e), (f) and (g). All fixings used for securing of the glazing panel and/or the post top bracketry shall be stainless steel and must penetrate captive stainless steel nuts and not directly into the aluminium body or bracket.
(c) Access to the interior of traffic sign luminaires shall be by a captive semi-rebated M8 male triangular headed fixing screw - which when unscrewed allows the captured lens frame to hinge vertically down allowing direct access to the lamps and fuses for routine maintenance and at the same time maintaining a weatherproof canopy to protect the exposed electrics. The captured lens frame shall be easily detachable to facilitate easy lens replacement in the event of damage and the lens frame itself shall be engineered to provide full support of the lens and compression of the gasket to form a weatherproof seal to IP56IEC 529.

(d) Traffic sign luminaires shall have a removable gear tray and supported parabolic reflector that requires no tool for removal. The reflector shall be manufactured from polished anodised aluminium to BS1470:1987.

(e) The gear tray shall be provided with a means of electrical isolation and/or disconnection by means of a plug and socket which ensures that the earth terminal is the last to disconnect and the first to reconnect without removal of the gear tray. Control gear for the lamps shall be securely attached to the gear tray, by means of stainless steel nuts, bolts and shakeproof washers and shall be independent and separately fused in order to enable any one lamp to operate in the event of the failure of the other circuit(s). Capacitors shall be fitted which shall provide a power factor of not less than 0.85 lagging and shall comply with Clause 1415 of the Specification. All control gear shall be terminated in screw-type terminals. Where photo cells are specified they shall be attached to the gear tray and activated through a clear flush fitting polycarbonate lens on the sign light head casing.

(f) Fluorescent traffic sign luminaires shall incorporate either one PL lamp or two MCF/U lamps of the correct type and wattage. Mercury vapour traffic sign luminaires shall incorporate either one or two MBF/U lamps of the correct type and wattage.

(g) Lamps and control gear shall be suitable for operation on the electrical supply described in Appendix 14/2.

(h) Overhead traffic sign luminaires shall be available with a variety of support systems which shall allow for single and back to back fixing arrangements by post top, clip or banding systems. The support bracket of overhead traffic sign luminaires shall be of a suitable length to provide the correct optical performance and ensure that the luminaire, when correctly installed, shall not obstruct or overhang the sign plate it is illuminating. All bracket retention fixings on Type A sign lights shall not be exposed and shall only be accessible from the interior of the sign light head.

(i) Support systems for Type A and Type B traffic sign luminaires shall be cast in LM6-M aluminium and engineered to form an integral part of body of the luminaire and provide a hidden fixing which is not visible from the exterior of the body or post top. All other overhead traffic sign luminaire types shall have support brackets manufactured from not less than 35mm solid drawn mild steel tube. All post top mounted traffic sign luminaires shall be suitable for mounting on a 76mm diameter post and be supplied with a three point fixing arrangement equally spaced around the socket to allow the unit to be securely fixed under a wind loading of 160Kgm/m².

(j) Ground mounted post top mercury vapour traffic sign luminaires shall be suitable for mounting on a 76mm diameter post. Mercury vapour traffic sign luminaires shall be provided with a lockable means of adjusting the beam in both the vertical and horizontal planes.

(k) Traffic sign luminaire supports shall include an arrangement to prevent the forced rotation of the luminaire in any plane.

(l) Glazing panels for fluorescent traffic sign luminaires shall be manufactured from 3mm polycarbonate. Glazing panels for mercury vapour traffic sign luminaires shall be manufactured from toughened heat resistant glass. All glazing panels shall be fitted
to the luminaire by means of a full aluminium perimeter frame to provide all round support to the glazing panel.

(m) The glazing panel shall be flat, fully framed, supported and, when closed, compress onto a part rebated one piece gasket to give the luminaires a degree of protection rating of IP56 to BS5490.

(n) All luminaires shall be supplied complete with a miniature one piece photo cell unit complying with Appendix 14/4 which is integrally fixed to the gear tray for ease of maintenance.

(o) All set screws, pins, nuts, washers, anti tamper fixings and pivot spindles shall be manufactured from stainless steel to BS6105, or equivalent.

(p) The Contractor shall provide information on the proposed traffic sign luminaires as required by Appendix 14/5.

1.4 Ground Illuminated Traffic Bollards

(a) Ground illuminated traffic bollard body shells shall be rotationally moulded from flexible, shape recoverable, U.V. stabilised polyethylene and highly resistant to tearing.

The base of the body shell may be strengthened by a 3.00mm galvanised steel or aluminium angle insert frame to achieve the correct fit to the plinth section of the base unit and provide functional stiffness and shape recovery to the body. The internal and external surfaces of the body shall be porous free and grain free to facilitate cleaning and shall be resistant to abrasion.

(b) Illuminated sign faces and panels shall form an integral part of the moulding that is UV stabilised and incapable of delamination through impact damage. The sign face shall be guaranteed against fading for 5 years. Where required, illuminated sign faces shall display the appropriate diagrams referred to in the Traffic Signs Regulations and General Directions 1994. The body shell shall be suitable for incorporating up to four prescribed sign aspects each of 270mm diameter or one prescribed sign aspect of 600mm diameter as described in the schedules of bollards.

(c) The base units of ground illuminated traffic bollards shall be constructed from either die-cast LM6-M or spun sheet steel of minimum thickness 3 gauge (s.w.g.) hot dip galvanised to BS729:1971 and shall incorporate a boxed out seating collar to denote finished ground level.

(d) The top of the base units shall incorporate a removable 5mm domed clear polycarbonate glazing panel of sufficient sizes to overlap the light aperture by a minimum of 20mm all around the aperture. A recessed seal internally affixed to the lens shall compress down onto a raised circumferential flange with a minimum width of 6mm incorporated on the base. The glazing panel shall be secured to the base unit via a hinged frame which when fully compressed onto the lens, has a seal compression control feature to protect the seal.

(e) The base unit shall have a minimum degree of protection rating IP67 to BS5490 and shall be common to and compatible with all flexible base-lit bollards offered under the Contract.
(f) Base unit shall incorporate hinged frame to allow the body of the bollard to be swung away from the base for inspection and internal fixture of the bollard top without disturbing the polycarbonate glazing panel.

The frame shall be hinged by means of a full length pivot spindle that is fully supported and incapable of seizure, across the rear of the base and shall be accessed by means of one anti-tamper tri-head fixing that is vertically positioned and accessible with the bollard top attached.

(g) Body shells shall be attached to the hinged frame by means of 4 No. M8 stainless steel set pins, washers and Nyloc nuts that shall have been designed not to tear the body shell material when the body is flexed.

(h) Base units shall incorporate a backboard of material that is bolt fixed to the base, suitable for and of sufficient size to accommodate electrical equipment, cable terminations and wiring.

(i) Base units shall be bolted down to the insitu ST2 mix concrete base using 4 No. M10 indent bolts, nuts and washers at fixing centres in accordance with BS873.

(j) Access for two cables shall be through the rear of the base. Each cable shall be individually sealed to the base by means of a nylon cable gland silicone sealed into the inside of the base during manufacture. The cable glands shall be capable of sealing onto cables with an external diameter of between 8 and 17mm. Redundant cable entries shall be fitted with a 25mm conduit thread blanking plug and locking nut.

(k) The gear tray and lighting unit shall be incorporated into the base unit and shall be removable for maintenance purposes. The gear tray and lighting unit shall be provided with a means of electrical isolation and/or disconnection on the top side of the gear tray on lens removal. The gear tray shall incorporate two 11 Watt PL lamps mounted on a true parabolic reflector to illuminate the aspects in accordance with BS873.

(l) Control gear for the lamps shall be securely attached to the gear tray by means of stainless steel nuts, bolts and washers and shall be independent and separately fused in order to enable any one lamp to operate in the event of the failure of the other circuit(s). Capacitors shall be fitted which shall provide a power factor of not less than 0.85 lagging and shall comply with Clause 1415 of the Specification. All control gear shall be terminated in screw-type terminals. Lamps and control gear shall be suitable for operation on the electrical supply described in Appendix 14/2 and shall provide a minimum of 90 cd/m$^2$ at the centre of any aspect. Lamps shall continue to operate after average conditions of vehicle impact to and flexing of the body shell.

(m) All set screws, pins, nuts, washers, anti tamper fixings and pivot spindles shall be manufactured from stainless steel to BS6105, or equivalent.

(n) The Contractor shall provide information on the proposed ground illuminated traffic bollard as required by Appendix 14/5.

1.5 Sign Construction and Assembly

(a) Unless otherwise specified by the Client Officer, sign plates shall be manufactured either from sheet aluminium of not less than 11 swg or 3mm thickness or from extruded aluminium plank sections.

(b) Non-reflective sign faces shall be covered over the whole front face with non-reflective plastic sheeting to the specified colours, for which a manufacturer’s guarantee of not less than 7 years has been obtained. Reflective sign faces shall be covered over the whole front face with the appropriate combination of reflective and non-reflective plastic sheeting to the specified colours, for which a manufacturer’s guarantee of not
less than 7 years has been obtained. In cases of Class I reflective plastic sheeting a manufacturer’s guarantee of not less than 10 years should be obtained.

(c) The whole of the back surface of all sign plates shall be covered with a grey non-reflective plastic sheeting or other grey finish for which a manufacturer’s guarantee of not less than 7 years has been obtained.

(d) All stiffening and framing to sign plates shall be in aluminium section of equivalent strength (section modulus) to that of the mild steel tabulated in Chapter 13 of the Traffic Signs Manual and coloured grey to match back to sign.

(e) All sign plates shall be provided with stiffening or framing, unless otherwise specified on the signs schedule.

(f) Signs and frames shall meet the mechanical properties and construction requirements of BS873. Puncturing of the sign face material for the purpose of affixing the stiffening shall not be permitted.

(g) Rivets shall be spaced to suit structural requirements of BS873 and shall be spaced uniformly at not more than 150mm apart.

(h) All brackets, “U” bolts and clips used in sign assemblies shall be manufactured from stainless steel or in the case of plank type signs, extruded aluminium. They shall be complete with stainless steel nuts and bolts and with 2 No. stainless steel washers and 1 No. stainless steel sprung washer for each bolt.

(i) The minimum number of clips for each sign supporting post shall be as follows:

<table>
<thead>
<tr>
<th>Depth of sign (metres)</th>
<th>Minimum number of clips</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1.0</td>
<td>2</td>
</tr>
<tr>
<td>1.0-3.0</td>
<td>3</td>
</tr>
<tr>
<td>3.0-4.5</td>
<td>4</td>
</tr>
<tr>
<td>4.5-6.0</td>
<td>5</td>
</tr>
<tr>
<td>Over 6.0</td>
<td>6</td>
</tr>
</tbody>
</table>

The above table does not apply to signs made up in a modular or plank type form.

(j) The Client Officer’s approval is to be obtained before using any steel banding.

(k) For signs mounted on a single post an arrangements to prevent forced rotation shall be provided.

(l) Where purlins are used, the sign stiffening and framing shall be continuous in the vertical direction.

(m) Purlins shall be attached to each vertical member of the sign frame and the distance of the top and bottom purlins from the parallel sign edges shall not exceed 600mm. Intermediate purlins shall be spaced equally apart at centres not exceeding 1.0m. A connection shall be made at every point where a purlin crosses a post.

(n) Clamping brackets and locating plates used for purlin to post fixings shall be made of mild steel and finished as specified for steel posts in Clause 1(h) above.

(o) Purlins shall be finished as specified for steel posts in Clause 1(h) above. The nylon strip or similar approved insulating material shall be fixed between the purlins and the aluminium framing.
The reference number of the sign assembly shall be painted or stamped on the reverse side of the sign in the bottom left hand corner. The height of the characters shall not be greater than 25mm. The number shall also be marked on the lower 150mm of each post.

1.6 Location, Erection, Covering and Uncovering of Signs

(a) Sign locations shall be agreed by the Client Officer at each Site.

(b) Except where a new sign is to be erected in exactly the same position as an existing, the new sign shall be erected and fully operational before the existing sign which it replaces is removed or masked.

(c) Cover plates shall be to the same specification as the sign face. Where signs have to be masked temporarily, the masks shall be of hardboard and shall be painted to match the background colour of the sign. Other material will require the approval of the Client Officer.

1.7 Location Marking and Numbering

(a) All illuminated traffic signs shall be provided with a location mark for inspection and maintenance on the post after erection as follows:

(i) Lit traffic sign posts mounted in the central reserve are to have 75mm high numbering on both sides of the post. Each number is to face the oncoming traffic at an angle of approximately 45°.

(ii) Verge mounted lit traffic sign posts are to have 50mm high numbering on one side of the post, facing the oncoming traffic.

(iii) The numbers shall be **BLACK** characters on a **YELLOW** background extending to 25mm beyond any character in any direction, 1.8 metres above adjacent ground level. The number shall be applied horizontally to the post. The colour of the characters and/or background may be varied by the Client Officer by written instruction.

(b) Lit traffic bollards shall be provided with a location mark for inspection and maintenance on the post after erection as follows:

(i) Lit traffic bollards are to have 50mm high numbering on each side aspect. The numbers shall be **BLACK** characters applied horizontally.

(ii) The numbering sequence shall be provided by the Client Officer.

Section SL2: Appendix 13 Road Lighting Columns and Brackets

2.1 Lighting Columns

(a) Columns and brackets shall be in accordance with the requirements of BS5449.

(b) Columns shall be tubular in cross-section with a tube thickness of no less than 5mm for the base section.

(c) Columns, brackets and baseplates shall be manufactured from steel to BS5649 Part 3 and shall be free from irregularities and burrs.
(d) Columns, brackets and baseplates shall be galvanised in accordance with Clause 1911 of the Specification and be protected in accordance with G2a basic system, Appendix 19/3.

(e) Bracket arms shall be so designed that when assembled with the column, the arm and spigot shall be at an angle of 5° above the horizontal unless otherwise specified by the Client Officer.

(f) All column brackets shall be of a similar style and appearance.

(g) The cable entry slot which shall be positioned directly below the door opening shall have minimum dimensions of 150mm x 75mm with the lower edge of the slot 500mm below ground level.

(h) Columns with separate bracket arms shall be installed with the door openings as detailed below unless otherwise directed by the Client Officer.

(i) Each column shall be fitted with an 8mm (minimum) diameter brass earth terminal complete with two plain brass washers and two brass nuts. The earth terminal shall be readily accessible through the door opening.

(j) Column door positions shall be as follows:

<table>
<thead>
<tr>
<th>Column position</th>
<th>Door position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Back of footpath</td>
<td>Facing road</td>
</tr>
<tr>
<td>Near kerb edge</td>
<td>Facing away from oncoming traffic</td>
</tr>
<tr>
<td>Centre of central reserve</td>
<td>Facing oncoming traffic in a consistent direction</td>
</tr>
<tr>
<td>Near edge of central reserve</td>
<td>Facing away from oncoming traffic or facing distant side of reserve</td>
</tr>
</tbody>
</table>

(k) All columns with integral bracket arms shall be installed with the door openings facing away from oncoming traffic.

(l) Foundations for lighting columns shall be in accordance with BS5649.

(m) Each column and bracket shall carry a unique identification mark which indicates the column manufacturer, year of production and the column and bracket data sheet reference number.

(n) A completed data sheet shall be provided for each individual column type with the completed Tender.

2.2 Column Doors

(a) Columns shall be provided with weatherproof single doors which shall be free from irregularities and burrs. Each door shall be fitted with a stainless steel tamper proof locking device.

(b) Columns mounted on structures or in situations where there is a risk that a detached door could cause an accident if it fell onto the area below shall have their doors held...
captive by a brass or stainless steel chain which shall be sufficiently robust to support
the door in severe gale conditions.

(c) Columns mounted on structures behind parapets shall have the bottom of the door
opening 1.10 above the top of the parapet plinth.

(d) Except for doors which are required to be captive, all doors are to be interchangeable
between similar types of columns without adjustment.

(e) The number of door keys to be supplied shall be 10% of the number of columns
erected subject to a minimum of three keys.

(f) Each metal column door, with the exception of the doors of concrete and GFRP
columns, shall be fitted with an 8mm (minimum) diameter brass earth terminal
complete with two plain brass washers and two brass nuts.

2.3 Column Bracket Arms

(a) Columns shall be provided with suitable projection brackets to the following
dimensions:

<table>
<thead>
<tr>
<th>Mounting Height</th>
<th>Projection Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5m</td>
<td>0.5m</td>
</tr>
<tr>
<td>6m</td>
<td>0.75m</td>
</tr>
<tr>
<td>8m</td>
<td>1.00m</td>
</tr>
<tr>
<td>10m</td>
<td>1.00m</td>
</tr>
<tr>
<td>12m</td>
<td>1.00m</td>
</tr>
</tbody>
</table>

However consideration may be given to increasing the bracket projection where the
footway width is in excess of 2 metres.

(b) “Projection” is the distance measured horizontally from the centre line of the column to
the point of entry to the lantern. The bracket shall provide for side entry lanterns and
be suitable for use with the columns and lanterns offered. The bracket fixing shall be
of such design as not to allow any movement of the bracket either horizontally or
vertically with respect to the column.

(c) Mounting height shall be measured from ground level to the shoulder of the spigot and
bracket of the spigot.

(d) The lantern fixing spigot shall, unless otherwise specified, have the following
dimensions:

<table>
<thead>
<tr>
<th>Column Type</th>
<th>Diameter</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>12, 10 and 8 metre column</td>
<td>42mm dia</td>
<td>100mm length</td>
</tr>
<tr>
<td>6 metre column</td>
<td>33mm dia</td>
<td>800mm length</td>
</tr>
<tr>
<td>5 metre post top column</td>
<td>76mm dia</td>
<td>76mm length</td>
</tr>
</tbody>
</table>

2.4 Raise and Lower Columns

(a) Construction and manufacture of raise and lower columns shall generally conform to
the specification for standard steel columns.

(b) Details of the method of raising and lowering the column shaft to be agreed with the
Client Officer.

2.5 Location Marks and Warning Notices

(a) Location marks for inspection and maintenance purposes shall be provided on the
columns after erection as follows:
(i) Columns mounted in the central reserve shall have 75mm high numbering on both sides of the columns, each number facing oncoming traffic at an angle of approximately 45°.

(ii) Verge mounted columns shall have 50mm high numbering on one side of the columns facing oncoming traffic.

(iii) The numbers shall be **BLACK** characters on a **YELLOW** background extending to 25mm beyond any character in any direction, 1.8 metres above adjacent ground level. The numbers shall be applied horizontally to the post. The road name shall be printed below the number.

(iv) The colour of the characters and/or background may be varied by the Client Officer by written instruction.

(b) The numbering sequence shall be provided by the Client Officer.

(c) Warning notices, where required, shall be installed immediately above the column number, as directed by the Client Officer.

(d) Existing numbers shall be removed or painted out, the paint used matching the colour of the respective column or post.

**Section SL3: Appendix 14/1 Site Records**

3.1 The Contractor shall on the completion of any Works, show on a set of drawings or transparencies supplied by the Client Officer, or schedule, as appropriate, site records including details of all lighting units, lit traffic sign units, lit traffic bollards, pedestrian refuge and/or crossing beacons, cables and joints installed, together with schematic details of private cable networks.

3.2 The completed drawings shall be in accordance with Clause 1402 of the Specification and:

(a) shall incorporate the maintenance or operating manuals for installed equipment;

(b) as far as is practicable cable records shall be determined from kerb lines or edge of carriageway;

(c) a cable schematic shall be provided for each feeder pillar and shall show in schematic form the following information:

   (i) each individual circuit
   (ii) individual cable size and configuration
   (iii) all columns, lit traffic signs, lit traffic bollards per circuit
   (iv) all columns, lit traffic signs and lit traffic bollards which shall be identified by their individual painted identification number/ letter
   (v) all cable joints.
Section SL4: Appendix 14/3 Temporary Lighting

4.1 Existing road lighting units and lit sign units shall be fully maintained until the new installations have been commissioned as detailed in 4(i), (ii) and (iii) below except where existing units are moved or altered under the Contract.

4.2 Temporary lighting shall be provided at no expense to the Client Officer where there is a delay of more than 24 hours between the disconnection and reconnection of any existing plant which is moved or altered under the Contract.

4.3 Temporary lighting to Clause 1405 of the Specification and to a similar standard as the existing lighting may be provided at no expense to the Client Officer in lieu of maintenance of the existing installation.

4.4 Temporary lighting shall not be removed or switched off until:

(i) the permanent installation is in full operation
(ii) an inspection has been carried out on the operation of the permanent installation not less than 24 hours or more than 7 days after commissioning
(iii) any adjustments, remedial work or replacements found necessary have been carried out
(iv) the system has been re-inspected as (ii) above.

4.5 Temporary overhead feeds to lighting units shall comply with Clause 1475AR of the Specification.

4.6 The lighting of any temporary traffic signs and temporary lighting of the Works must conform to Chapter 8 of the Traffic Signs Manual.

4.7 The Contractor shall ensure that any temporary lighting does not cause glare to traffic using the highway or annoyance to occupants of surrounding property.

Section SL5: Appendix 14/4 Electrical Equipment for Road Lighting

5.1 General

(a) The positioning of equipment within the base compartment of columns shall be as directed by the Client Officer.

(b) All fixings, clips, screws, nuts and bolts shall be manufactured from austenitic stainless steel to BS6105.

5.2 Luminaires

a) The luminaire shall be fitted with the quantity of LED’s stated in the performance specification.

b) The LED junction temperature shall be independently tested to provide an L70 operating period for the LED’s in excess of 180,000 hours and the lumen depreciation at 100,000 hours shall be no more than 15% (L85, 100,000 hours) at 350mA, including allowance for LED mortality.

c) Colour temperature of the LEDs shall be 5700K with CRI 75 or above.

d) Each LED shall be mounted beneath an individual lens providing photometric footprint based on superposition (overlay) methodology and a glare index of at least G2 for the standard lens.

e) Lenses shall be manufactured from optical grade PMMA acrylic thermoplastic.

f) Glass material shall not be used to form any part of the luminaire or optical structure.
g) The LED’s shall be CREE type XP-G, producing 140 lumens at 350mA and the installed circuit efficacy of the complete luminaire and driver shall exceed 110 lumens per watt.

h) The LED driver, operating at 350mA constant current shall be housed in separate gear compartment to the LED PCB. The driver shall have a minimum operating efficiency of 90%.

i) It shall be possible to replace an LED driver without opening the compartment containing the LED circuit board assembly.

j) The gear compartment shall be secured with A4 grade stainless steel torx pin head security screws.

k) The LED circuit board shall be accessed via a separate enclosure to the LED driver by means of torx pin security screws of A4 stainless steel arranged around the perimeter of the cover.

l) The luminaire shall be constructed from LM6 marine grade aluminium or equal, shall utilise a minimum of 98% of recycled aluminium and shall be finished in Akzo Nobel Futura Sable 900 powder coating.

m) The complete luminaire shall be at least 98% recyclable at end of life.

n) The post top version shall accept column spigots up to 76mm without an adaptor.

o) The side entry version shall have a detachable spigot entry casting that will accept up to 60mm diameter brackets without an adaptor. The tilt angle shall be adjustable from zero degrees to plus twenty degrees.

p) The luminaire head shall either incorporate a fixed tilt angle of 10 degrees when post top mounted or be adjustable to allow a 10 degree tile angle for the LEDs. The G2 classification shall be maintained at this angle.

q) The luminaire shall be fixed to the column with 2 x M10 A4 stainless steel hex pin security grub screws.

r) The luminaire shall provide a light output ratio in excess of 90% with an upward light output ratio of no more than 0.5%.

s) Photometry files shall be published within Lighting Reality.

t) Elexon codes for each luminaire shall be published prior to the date of this enquiry. Luminaires awaiting issue of codes shall not be accepted.

u) The luminaire shall be a minimum of IP66 rated in accordance with IEC-529.

v) The complete luminaire assembly shall be independently tested and EN-EC certified in accordance with EN60598-1:2008 and EN 60598-2-3:2003 by an independent approval body recognised by the European Community.

w) The luminaire shall be tested in accordance with NEN-EN-IEC62471 (2006-07) for Photobiological Safety and shall comply with Group 1 classification.

x) Luminaires with removable LED lamps or modules shall not be accepted.

y) The luminaire shall be manufactured within the European Union to reduce environmental impact of their transport. The luminaire manufacturer shall maintain a significant European presence and a UK distribution network. The luminaire manufacturer shall provide a competent UK based technical support team for lighting design, product support and after sales support.

5.3 Photo Electric Control Units (P.E.C.U’s)

(a) Photo electric cell units shall be fully electronic incorporating a solid state switching circuit with zero cross-over. The photo electric cell units shall be guaranteed for 6 years which shall not be insurance based but based on testing and component mean time between failure and the Contractor shall provide supporting testing records to support life expectancy claims.

(b) Photo electric cell units shall have a switch on illuminance of 70 Lux. The actual switch on level shall be advised by the Client Officer.

(c) Photo electric cell units shall have a switch on/off ratio of 1-0.5.

(d) Photo electric cell unit one part mounting sockets shall be NEMA type with double sided contacts.
(e) Photo electric cell units shall be capable of switching not less than 2 x 250W HPS lamps except in the case of miniature units which shall be capable of switching not less than 200W inductive load.

(f) Photo electric cell unit multiple luminaire assemblies shall be controlled by separate P.E.C.U.’s individually wired.

(g) Photo electric cell unit switch settings must not be sensitive within the temperature range of -20°C to +80°C.

(h) Photo electric cell units shall have a minimum degree of protection rating IP67 to BS5490. The method of fixing to the lantern body shall also ensure a minimum degree of protection of rating IP65 to BS5490.

(i) Photo electric cell units shall have electro magnetic interference levels in compliance with:

- (a) BS EN 50081-1 for emission levels
- (b) BS EN 50082-1 for immunity levels

(j) Photo electric cell units shall be designed and installed to be resistant to vibration in accordance with BS2011.

(k) Photo electric cell units shall be provided with a means of protecting against mains-borne surges or spikes.

(l) The light detector, which shall be either a photo transistor or a photo diode shall be filtered to have a spectral response that closely matches the CIE photopic curve and shall not drift by more than 1% over the guaranteed life of the product.

(m) Photo electric cell units shall have a maximum 24 hour power consumption of 30 Watts.

(n) The electronics must be isolated from the mains by means of a full encapsulated high quality transformer and the circuit so designed as to comply with all European directives and regulations on electro magnetic interference.

(o) To further reduce electro magnetic interference a system must be employed to prevent arcing at the switching contacts used when activating or de-activating a reactive lighting load. Furthermore, if a semi conductor device is used for load control, it must not radiate heat into the electronics enclosure while the lighting load is switched on. If a semi conductor device is fitted, a method of ensuring that the load remains switched to the “on” state must be provided in the event of an overload destroying the device.

(p) In order to achieve these requirements either a combination of relay and trial operating in parallel mode or equivalent shall be employed.

P.E.C.U.’s shall be:

**ONE-PART UNIT (for street lighting)** In which the photo electric sensor and the load switching components are housed in the same enclosure, suitable for insertion into a NEMA type socket to obtain mechanical and electrical connection.

**ONE-PART MINIATURE (for sign lighting)** In which the photo electric sensor and the load switching components are housed in the same enclosure, suitable for direct mounting to luminaire canopies or other equipment by means of a 20mm threaded conduit fixing complete with rubber seals, plastic washers, lock nuts and cable tails, suitable hard wiring into the lamp circuit. The unit shall be provided with connecting leads 300mm long (minimum) and incorporate a time delay of 10 seconds to prevent inadvertent operation.
5.4 Control Gear

(a) Control gear including shall be integrally mounted.

(b) Control gear replaced during maintenance shall be installed integrally within the lantern

5.5 Cut-outs, Fuse Units and Miniature - Circuit Breakers (MCB’s)

(a) A double pole, 25 amp fused cut-out shall be provided in the base compartment of all new, rewired or converted columns and posts, when connected to Local Authority cables. Where an existing single pole cut-out is fitted a double pole 32 amp “lock off” isolator shall be provided in addition.

(b) Fused cut-outs and isolators shall be in accordance with the following:

(i) A double pole 32 amp “lock off” isolator shall be provided in the base compartment of all new and/or replacement lighting and lit traffic sign units when instructed by the Client Officer.

(ii) Where a lighting unit is being required a double pole 32 amp “lock off” isolator shall be provided in the base compartment.

(iii) The double pole isolator shall be fully enclosed within an IP65 GRP enclosure fitted with a hinged door for access to the switch.

(iv) All double pole isolators shall comply with BS.EN.60947.3 and provide visible means of identifying the switch position (ie on/off) other than the position of the toggle.

(v) Cut-outs shall comply with electricity supply industry (ESI) standard 12-19.

(vi) Terminals shall be sufficient for conductors up to 25mm². They shall be clearly labelled to differentiate circuits and phases.

(vii) Miniature circuit breakers short circuit current rating and type shall be M9, Type 2.

(c) Bollards/ signs in central reservations shall be fed by a Local Authority cable looped from the nearest column via a double pole cut-out. A suitable double pole cut-out will be provided in the base of each bollard into which the incoming cable shall be terminated.

(d) Signs in footways shall be fed by either the local DNO or an IDNO as agreed with the Client Officer.

(e) Terminals shall be of sufficient size to terminate 2 x 25 sq.mm conductors.

(f) Single pole fuse units shall have a substantial moulded plastic drip proof enclosure and the terminals shall be of sufficient size to terminate 1 x 16 sq.mm conductors.

(g) The short circuit ratings and types of MCB’s shall be as directed by the Client Officer for each particular application.

(h) The positioning of electrical equipment in the base compartment of columns or posts shall be as directed by the Client Officer on site.

5.6 Fuses

Fused links shall comply with BS88 category of duty 240 AC 16 rating Class Q1.

5.7 Feeder Pillars and Mini Pillars

(a) Feeder pillars shall be manufactured out of cast iron, galvanised sheet steel or stainless steel and shall be fitted with a hinged, lockable door. Four sets of keys shall
be supplied to the Client Officer. Cast iron hinges will be permitted on cast iron doors.

(b) Mini pillars shall be manufactured from galvanised sheet steel and shall be fitted with a lockable door. The pillar shall be fitted with standard triangular locks.

(c) Feeder pillars shall comply with and be suitable for the layouts shown on Drawing No. 12.24 as appropriate. A label with 15mm high black lettering on a white background shall be fixed to the front of the feeder pillar door to identify the feeder pillar number.

(d) A diagram identifying the circuits shall be fixed to the inside of each feeder pillar door. This diagram shall show in schematic form the following information:

(i) the electricity supply source for the pillar
(ii) identification of each individual outgoing circuit including the cable reference
(iii) cable details including types and conductor sizes
(iv) all columns, lit traffic signs, lit traffic bollards per circuit
(v) all columns, lit traffic signs, lit traffic bollards shall be identified by their individual painted identification number/letter
(vi) all cable joints.
(vii) The diagram shall have 3.5mm high black lettering on a white background.

(e) The cables and MCB’s shall also be suitably identified.

(f) A durable warning sign as indicated in Clause 1418.8 of the Specification shall be fixed to the front of each pillar. The sign shall be manufactured from 3mm (minimum) Traffolyte and shall be fixed using four stainless steel screws. Lettering shall be 20mm red on a white background.

(g) The pillar door shall have a notice as detailed below attached by means of stainless steel bolts adjacent to the warning sign indicated in Clause 1414.8 of the Specification:

```
PROPERTY OF CITY OF WOLVERHAMPTON COUNCIL

In case of emergency please contact:
Assistant Director City Services
Civic Centre, St Peter’s Square
Wolverhampton WV1 1RP
Telephone (01902) 555784
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It shall be manufactured from 3mm (minimum) Traffolyte or similar material. Lettering shall be 6mm red on a white background.

(h) Foundation details shall be in accordance with the drawings listed in 9(c) above.

(i) Feeder pillars shall be provided with a brass earth stud which shall be bonded to the main earthing terminal. The C.S.A. of the main earthing conductor shall be in accordance with sub-clause 12.

(j) Feeder pillars shall have a hardstanding on the door side of 1000mm x 650mm approximately and any joins shall be sealed with bitumen to stop weed growth.

(k) A suitable supply will be provided, installed and terminated in each feeder pillar by the DNO or IDNO.
5.8 Earth Electrodes
(a) When directed by the Client Officer a copper earth rod shall be installed complete with concrete inspection pit. The concrete pit shall have a minimum size of 345mm x 345mm x 165mm.
(b) Connection to the earth electrode shall be made by means of a 16 sq.mm PVC insulated copper cable or tape.

5.9 Internal Wiring
(a) The use of joints to wires shall not be permitted.
(b) Internal wiring from fused cut-outs to the control gear and luminaires shall be single or multi core copper conductor cables 600/1000 volt grade, PVC insulated and sheathed complying with BS6004.
(c) The minimum cross sectional area of conductors for 5 and 6 metre mounting height columns shall be 1.5mm². The minimum cross sectional area of conductors for 8, 10 and 12 metre mounting height columns shall be 2.5mm².
(d) The minimum cross sectional area of conductors for PECU circuits shall be 1.5mm².

5.10 Earthing
(a) The main earth terminal block to which the terminals of all equipment shall be separately bonded shall be connected to the incoming supply earth by the main earthing conductor. The main earthing conductor shall be of copper and be in accordance with the following Table:

<table>
<thead>
<tr>
<th>C.S.A. of Phase Conductor (S)</th>
<th>Min. C.S.A. of Corresponding Main Earthing Conductor (Sp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6sq.mm</td>
<td>6 sq.mm</td>
</tr>
<tr>
<td>10 sq.mm</td>
<td>10 sq.mm</td>
</tr>
<tr>
<td>16 sq.mm</td>
<td>16 sq.mm</td>
</tr>
<tr>
<td>25 sq.mm</td>
<td>16 sq.mm</td>
</tr>
</tbody>
</table>

(b) An earth block made of brass shall be fixed to the backboard using two brass screws. The block shall incorporate 6 ways of which 2 ways shall be suitable for terminating 16 sq.mm copper conductors and the remaining 4 ways, 6 sq.mm conductors.
(c) All metallic columns and posts shall be bonded to the main earth terminal block. Metallic doors on metallic columns shall be bonded to the column earth bonding terminal. Metallic column doors and metallic frames of concrete or other non-metallic columns and posts fed by a combined neutral and earth (CNE) service shall not be bonded.
(d) Bonding conductors shall be of 6 sq.mm stranded copper, with the exception of the bonding conductor to the door which shall be 6 sq.mm. tri-rated flexible copper.
(e) Where the C.S.A. of the incoming phase conductor is greater than 35 sq.mm. the Client Officer shall be consulted regarding the size of the main earthing and bonding conductors.
All earth connections shall be made between two plain brass washers and bare earth conductors shall be sleeved with green and yellow PVC sheathing.

5.11 Underground and ducted cable

(a) Cables shall be laid in a straight line between lighting points unless otherwise directed by the Client Officer.

(b) Cable trenches shall be left open for inspection after the cable has been laid and shall not be backfilled without the Client Officer’s permission.

(c) Where directed by the Client Officer, cable covers shall be installed in a continuous length approximately 250mm and directly above the cable.

(d) All columns shall be serviced by either the local DNO or an IDNO as agreed with the Client Officer.

5.12 Cables Clipped to Buildings

(a) Cable shall be clipped to buildings as directed by the Client Officer.

(b) The cable shall be discreetly located to follow the natural lines of the building and shall be securely clipped/cleated at 300mm centres along its length. All clips/cleats shall be fastened with stainless steel screws and plastic plugs.

(c) No holes shall be drilled into any horizontal surfaces or through any waterproof flashings or membranes.

5.13 Cable Joints

(a) No cable shall be jointed underground unless specifically called for by the Client Officer.

(b) The joint mould shall be made of transparent material.

(c) The joint filling compound shall not contain filler material other than that required to improve the characteristics of the compound.

(d) Joints shall be left open for inspection and filler shall not be poured without the Client Officer’s permission.

5.14 Armoured Cable Terminations

Armoured cables shall be terminated by means of a 3 part compression gland comprising armour locking ring, lock-nut, earth terminal and shroud. The gland shall be of a type approved by the Client Officer.

Section SL6: Appendix 14/5 Electrical Equipment for Traffic Signs

6.1 Electrical equipment for traffic signs shall be as described in Appendices 12/1 and 14/4.

6.2 The positioning of equipment within the base compartment of posts shall be as directed by the Client Officer.
Section SL7: Appendix 14/71 Inspection and Testing

7.1 Test Instruments

(a) Test instruments shall be correctly calibrated.
(b) Test instruments shall possess a unique serial number.

7.2 Initial Verification/Visual Inspection

(a) A polarity test shall be carried out at the incoming terminals.
(b) A visual inspection shall be carried out to verify that:

(i) the installation complies with the Specification
(ii) earthing arrangements are of an approved type
(iii) protection against indirect contact is provided by equipotential bonding and automatic disconnection of supply
(iv) protective devices eg fuses, are fitted in the phase conductor of the circuit only
(v) fuses are to BS88 and are correctly rated
(vi) conductors are correctly identified, colour coded and sleeved accordingly
(vii) terminations are correctly made and secure
(viii) conductors are correctly selected for current carrying capacity
(ix) equipment is not visibly damaged
(x) appropriate power factor correction capacitors are fitted
(xi) shrouds, enclosures and doors are securely fitted
(xii) appropriate labels and danger notices are fitted.

7.3 Continuity Test of Protective Conductors

(a) This test shall be carried out using a Digital DC Ohm Meter with a sufficiently long insulated copper wander lead. All extraneous metal parts of the installation shall be tested to confirm that they are bonded to the incoming earth terminal of the installation and are at Earth potential. Extraneous metal parts includes cubicles, enclosures, columns, poles, doors, bracket arms, lanterns and the metal casings of transformers, capacitors and igniters etc.

(b) The resistance of the test leads should be noted before tests are carried out and this resistance deducted from each test result to obtain the correct value.

(c) A corrected test result of negligible resistance (less than 1.0 Ohm) is a satisfactory reading.

(d) No earthing must be disconnected during this test.

7.4 Insulation Resistance of Internal Wiring

(a) This test shall be carried out using a Digital 500 volt DC Insulation Tester and a minimum value of 1.0 Megohm is required for a satisfactory test result, unless otherwise directed by the Client Officer. Short, single wires used for inter-wiring between components can be inspected visually, but sheathed cables or cables within column/pole shafts must be tested.

(b) Tests shall be carried out between each conductor and each other conductor in the cable as follows:

(i) for two core + E.C.C. cables between P-N, P-E and N-E
(ii) for three core + E.C.C. cables between P-Sw, P-N, P-E, Sw-N, SW-E and N-E
Lamps and PECU's must be removed (or disconnected) and any other appropriate conductors disconnected before any tests are carried out.

7.5 Insulation Resistance of Cables

(a) This test shall be carried out using a Digital 500 Volt DC Insulation Tester and a minimum value of 6.0 Megohm is required for a satisfactory test result, unless otherwise directed by the Client Officer.

(b) The tests shall be carried out as in 4 above.

(c) In addition, all phases shall be temporarily connected together and a further test carried out between Phases-N and Phases-E.

7.6 Polarity Test of Installation

(a) This test shall be carried out using a Digital DC Ohm Meter with a sufficiently long insulated copper wander lead and should confirm that:

(i) every fuse and single-pole control and protective device is connected in the phase conductor only
(ii) centre contact bayonet and Edison screw lampholders have their outer or screwed contacts connected to the neutral conductor
(iii) wiring has been correctly connected throughout the installation.

(b) The resistance of the test leads should be noted before the tests are carried out and this resistance deducted from each test result to obtain the corrected value.

(c) A corrected test result of negligible resistance (less than 1.0 Ohm) is a satisfactory reading.

7.7 Earth Fault Loop Impedance Test

(a) This test should confirm that the Phase-Earth Fault Loop is of sufficiently low impedance to trip the protective device within 5 seconds for fixed equipment (0.4 seconds for socket outlets) and automatically disconnect the supply should a Phase to Earth fault of negligible resistance occur anywhere in the circuit.

(b) Following each test the Contractor shall ascertain the type and size of the protective device and refer to the appropriate tables contained in the current edition of BS761 Requirements for Electrical Installation, to confirm whether or not the test result is satisfactory.

(c) At each installation with an REC service, the External Earth Fault Loop Impedance (Ze) shall be measured. It will be necessary to temporarily disconnect the Earthing Conductor of the particular installation while this test is carried out.

(d) In the case of Local Authority cable networks, a test must also be carried out at the final installation on each loop to ensure that the Earth Fault Loop Impedance (Zs) is satisfactory at this point. No earthing conductors must be disconnected anywhere in the circuit during these tests.

7.8 Voltage Test

Where appropriate the voltage at each column shall be measured with the lighting in operation and the transformer then connected onto the appropriate tapping.

7.9 Certification
(a) Following the inspection and testing of new and altered installations, a test and inspection certificate shall be submitted to the Client Officer. The certificate shall include the serial numbers of the instruments used for the tests.

(b) Any defects or omissions revealed by the tests shall be reported to the Client Officer without delay and no certificate will be issued until the defects or omissions have been made good.

(c) In the event of any test indicating failure to comply, that test and those preceding, the results of which may have been influenced by the fault indicated, shall be repeated after the fault has been rectified.

Section SL8: Appendix 19/3 Protection of Steelwork against Corrosion

8.1 Requirements for Lighting Columns and Brackets

(a) All new and/or replacement steel lighting columns shall be protected against corrosion by the following protective system:

- System Type “G2a” (Modified Alkyd) for new galvanised columns.

(b) All existing steel columns which require to be protected against corrosion shall as instructed by the Client Officer have the following protective system applied:

- System Type “P2M1” for existing lighting columns painted with Alkyd Paint.

8.2 System type “G2a” for new galvanised columns (MODIFIED ALKYD)

(a) Environment : Inland “B”

(b) Accessibility : Difficult access.

(c) Required durability

- No maintenance up to 8 years
- Minor maintenance from 8 years
- Major maintenance after 15 years

(d) “Ground level” shall be taken as being 600mm below the door opening unless otherwise instructed by the Client Officer.

(e) Type of Columns : Planted root or flange mounted.

(f) Surface preparation and protective system G2a (Modified Alkyd)

(a) External Surface

(i) Additional overall coats


(ii) Upper section only, additional coats

1st coat : Item 15, Zinc Phosphate Epoxy Ester Undercoat, AS mdfth 40um.
2nd coat : Item 74 Silicone Alkyd Undercoat B mdfth 50um. 3rd coat : Item 72 Silicone Alkyd Finish B mdfth 50um.
Minimum total dry film thickness, including primer, 200um.
Planted column ground section, additional coat
Item 150 Pitch Epoxy (2 pack) as mdfth 100um.
Minimum total dry film thickness including primer 150um.

(b) Application Instructions

(i) “T” wash, all shop paint coats on external surfaces and site paint coats where access permits shall be returned on edges and 25mm inside at ends, at door and other openings.

(ii) All paint coats except item 72 shall be applied in the shop.

(iii) Item 110 shall be overcoated within 96 hours.

(iv) Item 150 shall be applied over item 110 from the bottom to 150mm above ground level.

(v) Item 74 as a shop coat shall be applied down to 100mm below ground level, overlapping item 150.

(vi) Item 72 shall be applied on site unless otherwise agreed by the Client Officer and shall be applied down to ground level.

(vii) Brushing grade paints may be used at the option of the Contractor.

(viii) Paints for any one system shall be obtained from the same manufacturer.

NOTE: Final colour coat is to be BS 18.B.21.