FOREWORD

Whilst this revised edition has retained the specification written around natural materials, Lancashire County Council wishes to encourage the use and development of recycled materials in Estate Roads and other local highways.

Recycled aggregates and reclaimed products will be the preferred choice over natural aggregates and products where it can be demonstrated that the reclaimed materials will prove no detriment to the in service performance of the highway and the surrounding development.

Further guidance together with advice on testing facilities can be obtained from the County Council's Asset Manager in Transport & Strategic Highways, Environment Directorate, County Hall, Preston on 01772 533718.

Jo Turton (Executive Director Environment)
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1. General

1.1 Specification

The attached Specification is based on extracts from the Highways Agency Specification for Highway Works and the Code of Practice for Highway Maintenance Management together with additional Lancashire County Council requirements. Reference may have to be made to British and European Standards for complete descriptions of the work and materials. Where a development includes any new or existing highway structures as defined in Clause 1.18 then the Developer shall obtain from the Environment Director the current requirements for such structures which include not only the Specification but procedures for obtaining the approval of the Environment Director to the Developer's proposals.

1.2 Nomenclature

The nomenclature on this Specification is that contained in the Glossary of Building and Civil Engineering terms BS6100; sub section Highway Engineering. The term 'The Engineer' means the Environment Director, the Chief Engineering Officer of a County District and/or their representatives.

1.3 Quality Assurance and Standards

Unless otherwise specified all materials shall comply with the current edition of the appropriate British or European Standard and shall be transported, stored and incorporated in the works in accordance with the requirements or recommendations of that Standard. Any tests on materials and workmanship which are carried out will be conducted in accordance with the British or European Standard. Where a British Standard has been superseded by a Harmonised European Standard or a European Standard, then such Harmonised European Standard or a European Standard shall be substituted for the British Standard.

Where work or materials required are covered by a Quality Assurance Scheme only work or materials provided through such a scheme shall be used.

The requirement for any goods or materials to be manufactured or supplied subject to a quality management scheme or product certification scheme shall be satisfied by compliance with an equivalent quality management scheme or product certification scheme of any state of the European Economic Area, provided that the proposed scheme is designed to ensure in use levels of safety, suitability and fitness for purpose equivalent to those provided for by the scheme specified.

Any requirement of this Specification to use goods or materials which are defined by reference to a named supplier or manufacturer shall be construed as referring to those goods or materials or equivalent. Equivalent goods or materials are those supplied from within the European Economic Area which provide in use levels of safety, suitability and fitness for purpose equivalent to those provided by the specified goods or materials in so far as they are not consistent with the "Essential Requirements" of the Construction Products Directive (89/106/EEC).

1.4 Adoption

This Specification shall apply to any carriageway, footway, footpath, margin, verge, paved area, highway structure, highway drainage system or highway equipment and street lighting system being constructed or installed as part of a development and which it is desired to adopt for maintenance at public expense. Advice on the requirements and procedures for adoption is given in the Lancashire County Council Residential Road Design Guide “Creating Civilised Streets”.

Immediately before adoption the Developer shall provide the maintaining highway authority with copies of plans showing areas agreed for adoption and easements for maintenance of structures together with details of construction, drainage and lighting. Street lighting may be taken over in advance of the adoption of road works in accordance with clause 9.10.

Surplus areas of land adjacent to an adopted road, and particularly between a service road and other adopted highway must be agreed with the District Council as an amenity area, or other ownership defined.

1.5 General

Work of construction of all roads, footways, highway drainage, street lighting systems or highway structures shall be carried out to the complete satisfaction of the Engineer; facilities shall be given to him at all stages of construction for the inspection, checking and testing of the works in progress. The whole of the works shall be constructed in accordance with the drawings, unless otherwise agreed with the Engineer. The works shall be maintained by the Developer for a period of twelve months from the date of completion, as certified in writing, by the Engineer.

Revised September 2011
1. General (Cont’d)

1.5 General (Cont.)

The Developer shall restore to the satisfaction of the Engineer, any streets, roads, fences and other existing surfaces or highway furniture which may be interfered with by the construction of the works. All services, pipes and culverts or other property which may be interfered with in the progress of the works or any existing sewers to be retained shall be carefully supported, protected or re-laid where necessary and in such a manner as the Statutory Authority may direct. Any damage done to services, sewers, etc. must be reported to the appropriate Authority immediately.

All surplus materials shall be disposed of off site by the Developer and the site left to the approval of the Engineer. During building operations all highways and drains adjacent to the site used by the Developer for transporting materials to and from the site shall be kept clean and free from debris by the Developer. A satisfactory access to all existing property bordering the site must be maintained throughout the construction period.

The Developer shall submit for the Engineer’s approval details of access routes for construction traffic prior to commencement of work.

1.6 Work on existing highways

Where work has to be carried out on or adjacent to an existing public highway or a highway to which the public has access, the work shall be executed in accordance with Chapter 8 of the Traffic Signs Manual published by The Stationery Office.

Where one-way traffic is unavoidable, traffic shall be controlled by a proper system of vehicle-actuated light signals or other means to be approved by the Engineer.

Where the works involve the obstruction of a footway the Developer shall provide an alternative safe footway properly signed, guarded and lit. Reference shall be made to chapter 8 of the Lancashire County Council Code of Practice on Mobility.

Approval of the Engineer must be obtained before excavation is undertaken in any embankment or existing ground providing support to the highway. The Developer shall agree arrangements for the design of any structure with the Engineer.

The Engineer must be informed before any works commence in an existing public highway. Excavation in and reinstatement of existing highway surfaces shall be in accordance with the requirements of the relevant Application for Permission to Open Highways of the Local Authority. The application form shall be completed and approved by the Engineer prior to work commencing

1.7 Mud, debris and dust on the public highways

Highways in the vicinity of the works must be kept free from mud, debris and dust resulting from the works and measures shall be taken to protect the public from nuisance arising there from.

Warning signs must be exhibited whilst work is in progress and carriageways, footways and drains affected must be regularly cleaned.

1.8 Control of noise

The best practicable means to prevent or reduce noise during the execution of work shall be used including the use of effective silencers on power-operated plant and equipment and the use of a purpose-made muffler on any pneumatic breaker or drill.

1.9 Prohibition of the use of the highway

Existing public highways shall not be used as sites for stock-piling and storing plant, vehicles, materials or equipment. The Contractor shall be liable for the cost of reinstatement if damage has been caused to highways.

1.10 Order of work

The programme for construction shall cater for the following requirements:

All work within the area of carriageway construction such as drainage and sewerage works, installation of statutory undertakers’ mains and any service cross connections, ducts and manholes for future cabling and street-lighting cross connections should be complete wherever possible before highway construction is commenced.
1. General (Cont’d)

1.10 Order of work (Cont.)

Highway construction shall then be carried out in two stages:

**Stage 1**
Formation preparation, sub-base, roadbase, kerbs, channels and gullies. All pipe duct and cable connections shall be marked.

Install street lighting prior to occupation of dwellings.
Then follows site development and making service connections.

**Stage 2**
Make good as necessary all faults including settlement, and apply binder course regulating layer.

Complete footway construction and carriageway surfacing.

1.11 Street name plates

The Developer shall provide and erect street name plates to the specification and satisfaction of the District Council.

1.12 Health and Safety at Work

The Developer shall comply with the requirements of the Health and Safety at Work etc. Act. 1974.

1.13 Cutting off and filling of abandoned sewers

1. Before commencing work on any abandoned sewers, approval shall be obtained from the Water Company or its sewerage agent. Existing sewers and drains within the bounds of the site which are to be abandoned shall be completely filled with 10:1 Pulverised Fuel Ash/Ordinary Portland Cement grout (proportioned by dry mass) as described below.

2. Water shall first be placed in the grout mixer, followed by the cement and mixed for a period of at least one minute. The pulverised fuel ash shall then be added and mixed for a further period of at least one minute. The grout shall be of a creamy consistency to promote an adequate velocity of flow through the pipes, without resulting in the discharge of fuel ash or cement beyond the weir plug at the lower end.

3. The sewers shall be divided into convenient short lengths to enable complete filling of each length to take place during the course of one working day. Generally the sewers shall be filled from manhole to manhole but where the distance between adjacent manholes is over 80m intermediate shafts shall be provided.

4. Before commencing filling the Developer must ensure that there are no blockages or obstructions in each length to be filled.

5. Filling shall commence from the higher end of each section to be filled and weir plugs of variable depth shall be provided at the lower end to drain off surplus water as grout filling proceeds.

6. A minimum head of 1.5m shall be provided at the point of application.

7. After filling of the pipes the existing manholes which are to be abandoned shall be reduced in height to at least 1m below proposed surface levels, filled with grout and covered with a concrete slab at least 200mm thick.

8. Where a sewer is to be abandoned up to its junction with a ‘live’ sewer it shall be filled up to the junction and the Engineer given an order by the Developer for the permanent sealing-off at that point.

9. Existing sewers and drains within the bounds of the site, which are to be abandoned and which are less than 1m depth below Formation Level, shall, where practicable, be cut off and removed. The excavation shall be backfilled in accordance with Clause 3.26 and the ends of the remaining pipes sealed with concrete for a length of 0.5m.

1.14 Statutory Undertakers Equipment

Layout details are shown in Appendix 1 with regard to the recommended positioning of Undertakers’ Equipment. All proposals relating to the positioning of such Equipment in structures shall be submitted to the Engineer for approval.
1. **General (Cont’d)**

1.15 **Design Criteria**

Development proposals shall satisfy the principles of the Lancashire County Council Residential Road Design Guide “Creating Civilised Streets”.

Reference shall be made to Transport in the Urban Environment 1997 (published by the Institution of Highways and Transportation) as amended by Technical Memoranda for details of widths, alignments, gradients, crossfalls and intersections for all traditional housing layouts.

The Developer must adhere to the Lancashire County Council Code of Practice on Mobility. Variations must be agreed with the Engineer and will only be approved in exceptional circumstance where external factors such as topography make the requirements impossible to meet.

Lighting designs shall be in accordance with the requirements of the Lancashire County Council Code of Practice on Road Lighting and Highway Electrical Systems Design and any specific design requirements of the Engineer.

1.16 **Supervision**

The Developer shall appoint a competent representative on the site and the Engineer shall have the right to ask for the removal of an unsatisfactory representative.

1.17 **Materials and Workmanship**

Prior to incorporating any material into the permanent works, the Developer shall submit to the Engineer for his approval a list of his proposed suppliers and of the sources of materials to be used. Where required the Developer shall also submit samples of materials to the Engineer for approval, the quality of such samples being representative of those to be used. The source of materials shall not be changed without the approval of the Engineer.

During construction, testing of materials will be carried out by the Engineer at his discretion. The Developer shall afford to the Engineer full power to test, at the expense of the Developer, all components, materials, tackle or workmanship and to reject any which in his absolute discretion shall appear to be unsatisfactory. In the event of any rejection, the Developer shall replace the rejected parts with such replacements as shall be acceptable to the Engineer. In this regard the Developer shall permit the Engineer to have access (in so far as is practicable) to all components, materials or tackle intended for use in the carrying out of the Highway Works whether on Site or the Highway Land and shall permit the taking up and removal of any part or parts for analysis and testing.

1.18 **Highway Structures**

Highway structures referred to in Clauses 1.1, 1.4, 1.5, 1.16 and 1.18 are defined as bridges or culverts having a span of 1.5 metres or more or, in the case of multiple pipe or multiple box section culverts, any structure having a total cross sectional area of waterway exceeding 2.2 square metres or retaining walls irrespective of height supporting or necessary for the support of roads, footpaths or bridleways and retaining walls irrespective of height supporting land or property above roads, footpaths or bridleways and within 3.65 metres of the edge of the road, footpath or bridleway.

(Note: Span refers to the distance between centre of supports and not the clear distance between supports)
2. Concrete, Mortar and Grout

2.1 General

Unless otherwise stated, any reference to a concrete mix in this Specification shall be deemed to be a reference to concrete to this Clause.

When a concrete mix is specified it shall be a mix complying with BS5328 and may be purchased from an approved ready-mixed concrete supplier or site batched and mixed.

2.2 Materials

(a) Cement for Concrete

Cement shall comply with BSEN197 or shall comprise portland cement to BS12 combined with ground granulated blastfurnace slag to BSEN15167 or combined with pulverised-fuel ash to BSEN154 as permitted in BS8500 for each concrete mix.

Suitable provision for the storage of cement and for its protection against atmospheric influences shall be made by the Developer to the satisfaction of the Engineer.

The use of bulk cement will be permitted only after the Engineer has approved:

(i) the method of transport and containers to be used.
(ii) the method of discharge and storage.

(b) Aggregate for Concrete

 Aggregate shall be obtained from sources to be approved by the Engineer and shall comply with BSEN12620.

(c) Water

Only fresh, clean water from a public utility undertaking mains supply or other source approved by the Engineer shall be used for mixing cement mortar, grout or concrete. A Developer not using a public utility undertaking water supply will be required to provide, at three monthly intervals, a certificate of compliance with BSEN1008, water being sampled and tested by a testing organisation approved by the Engineer.

2.3 Mortar

(a) Cement mortar shall consist of Ordinary Portland Cement complying with BSEN197 and sand complying with BSEN13139 mixed in the following nominal volume proportions:

Where used for pipe joints: 1 part of cement to 3 parts of sand
For rendering, fillets, grouting and margins: 1 part of cement to 2 parts of sand
For brickwork, kerbs and manholes: 1 part of cement to 3 parts of sand.

(b) Polyester resin bedding mortars shall be based on thermosetting organic polymers consisting of stable fluid and/or solid components which on mixing react chemically to form a hardened solid mass.

Fillers or aggregates to be incorporated in accordance with the manufacturer's recommendations, to extend or modify the properties of the resinous composition, shall be pre-bagged, dry and factory proportioned. The addition of other fillers or aggregates shall not be permitted.

Mixing, placing and curing shall be carried out in accordance with the manufacturer's written instructions.

(c) All mortar shall be conveyed fresh to the work as required for use.

No mortar shall be used or re-mixed for use after it has set or commenced to set.

2.4 Cement Grout

Cement Grout shall consist of Portland cement and water thoroughly mixed in the proportion of one part by volume of cement to one and a half by volume of water. The grout shall be used within one hour of mixing. Where required by the Engineer, sulfate resisting Portland cement shall be used.
2. Concrete, Mortar and Grout (Cont’d)

2.5 Steel Reinforcement

All steel used in reinforced concrete shall comply with the requirements of the appropriate British Standard as set out below.

<table>
<thead>
<tr>
<th>Type</th>
<th>BS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot Rolled Steel Bars</td>
<td>4449</td>
</tr>
<tr>
<td>Cold Worked Steel Bars</td>
<td>4449</td>
</tr>
<tr>
<td>Hard Drawn Mild Steel Wire</td>
<td>4482</td>
</tr>
<tr>
<td>Steel Fabric</td>
<td>4483</td>
</tr>
</tbody>
</table>

Steel fabric reinforcement shall be welded at the intersections, and delivered to the site in flat mats.

2.6 Tying Wire

Tying wire for steel reinforcement shall be 1.6mm diameter soft annealed iron wire for unexposed surfaces and 1.2mm diameter stainless steel wire for exposed surfaces and throughout bridge decks.

2.7 Cover Blocks and Spacers for Reinforcement

Cover blocks and spacers shall be as small as possible consistent with their purpose, of a shape acceptable to the Engineer and designed so that they will not overturn when the concrete is placed.

Concrete cover blocks shall be manufactured with a 10mm maximum aggregate size and produced to the same strength as the surrounding concrete. Wire cast in the block for the purpose of tying it to the reinforcement, shall comply with Clause 2.6.

Other proprietary spacers may be used with the approval of the Engineer.

2.8 Formwork

All formwork shall be rigid and tight to prevent loss of grout or mortar and to maintain the wet concrete in its correct position to the required shape and profile until hardened. The surface finish of any exposed concrete shall be not less than that which can be obtained from formwork properly constructed from wrought thicknessed square edged boards arranged in a uniform pattern. Internal metal ties which require to be withdrawn through hardened concrete shall not be used where either face is permanently exposed.

2.9 Structures - Additional Requirements

Additional scheme specific requirements may apply to structures (See Clause 1.1).
3. Highway Drainage

Notes

1. This section of the Specification is applicable to highway drains. For the construction of sewers, advice should be sought from North West Water or Yorkshire Water as appropriate.

2. Concrete or precast concrete products which are exposed to sulfates in the ground or ground water should accord to the requirements of Building Research Establishment Special Digest SD1.

3. Proposals to divert, modify or culvert any watercourse passing through the Developer's site shall have the consent of the Environment Agency.

3.1 General

Highway drains shall be located in roads and public areas and not within curtilages. They shall be constructed in straight lines between manholes which shall be provided at intervals not exceeding 100 metres and at all changes of direction, gradient or at junctions with sewers or other drains. Changes of direction shall be accommodated within manholes.

The structural design of pipelines shall be carried out in accordance with the recommendations of the Building Research Station publication 'Simplified Tables of External Loads on Buried Pipelines'.

The erection of buildings directly over highway drains intended for adoption will not be permitted.

No highway drain less than 150mm diameter will be considered for adoption. The area of carriageway draining to one gully shall not exceed 250 square metres.

All drainage works shall be completed and all trenches and pits backfilled before carriageway construction commences.

3.2 Sub-soil drainage

1. Where deemed necessary by the Engineer, sub-soil drains shall be used to prevent infiltration of water into footway and carriageway formation in situations such as where roads are constructed on sidelong ground. They shall consist of porous concrete, perforated earthenware, perforated PVC, or open-jointed pipes complying with the appropriate British Standard laid accurately to straight gradients and alignments in trenches (Appendix 3 sheet 3). The gradients shall be to the satisfaction of the Engineer.

Any sub-soil drainage provided shall not be connected directly into the highway drain but shall be properly linked with junction pipes to discharge into catchpit manholes (Appendix 3 sheet 2) and outfall into the surface-water drainage system.

2. Existing land drains and springs severed by the work shall be made good and similarly connected into the surface water drainage system and not into a foul sewer, subject to the approval of the Engineer. All such connections shall be recorded and a plan kept up to date for the Engineer's inspection. Upon completion of the drainage works a plan shall be provided for the Engineer's retention,

3. Sub-soil, cut-off, formation and pond drains (Appendix 3 sheet 3) shall be filled with an approved free-draining (Type B) material. The LA Value shall be more than 50kN when tested in accordance with BSEN13242. The material shall also comply with the following requirements:

(a) Grading

<table>
<thead>
<tr>
<th>BS Sieve Size</th>
<th>Percentage by mass passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>80mm</td>
<td>100</td>
</tr>
<tr>
<td>63mm</td>
<td>98 to 100</td>
</tr>
<tr>
<td>40mm</td>
<td>80 to 99</td>
</tr>
<tr>
<td>20mm</td>
<td>0 to 20</td>
</tr>
<tr>
<td>10mm</td>
<td>0-5</td>
</tr>
</tbody>
</table>

(b) The material shall have a water-soluble sulfate content of less than 0.38% of sulfate (as SO₄) when tested in accordance with BS EN 1744-1, clause 10.
3. **Highway Drainage (Cont'd)**

### 3.3 Sewers, drains and apparatus

1. When excavating within a highway, drains, sewers, cables and other highway apparatus together with statutory undertakers’ apparatus must be located by hand in advance of machine excavation in accordance with HSG 47.

2. If any apparatus is encountered the highway authority and the statutory undertaker shall be notified immediately and no pipe or cable shall be disturbed without their approval.

3. Excavation in and reinstatement of existing highway surfaces shall be in accordance with the requirements of the relevant Application for Permission to Open Highways of the Local Authority. The application form shall be completed and approved by the Engineer prior to work commencing.

### 3.4 Pipes

1. Clay pipes and fittings shall comply in every respect with BS EN 295 and shall be supplied with an approved spigot and socket flexible joint sealed with a rubber ring. Manufacturers specialist flexible joints may be used with the approval of the Engineer. Pipes shall be British Standard, British Standard Extra Strength or British Standard Super Strength as appropriate. Cement mortar joints may be used only in special cases and must be subject to the approval of the Engineer.

2. Concrete pipes and fittings shall comply in every respect with BS5911 part 1: 2002 and shall be supplied with an approved spigot and socket flexible joint sealed with a rubber ring. Components with sizes or strengths outside the ranges covered by BS5911 shall comply with the requirements of that standard where appropriate.

Where the Developer proposes to use concrete pipes he must produce to the Engineer evidence of the chemical properties of the sub-soil and ground water. Where adverse conditions occur the Developer must submit for approval details of protective measures to be taken.

3. Plastic pipes shall be used in gully connections only and not as highway carrier drains. They shall be un-perforated with watertight joints and with a pipe stiffness in excess of 1400N/m², when tested in accordance with BS4962, and a resistance to impact complying with BS4962 except that the striker used in the test shall have a mass of 1kg and a hemispherical radius of 25mm.

### 3.5 Pipe Bedding Material

1. **Granular Bedding Material.**

Granular material used as bedding for pipes shall consist of gravel or crushed stone. It shall be hard durable crushed limestone, igneous rock or gravel free from clay and other extraneous matter and shall be from an approved source. The LA Value shall be more than 50kN when tested in accordance with BS EN 13242. The material shall also comply with the following requirements:

(a) Grading (PD 6682 – 1:2003 Table C.1 10/20 single-sized)

<table>
<thead>
<tr>
<th>BS Sieve Size</th>
<th>Percentage by mass passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>40mm</td>
<td>100</td>
</tr>
<tr>
<td>31.5mm</td>
<td>98 to 100</td>
</tr>
<tr>
<td>20mm</td>
<td>85 to 99</td>
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<tr>
<td>10mm</td>
<td>0 to 20</td>
</tr>
<tr>
<td>4mm</td>
<td>0 to 5</td>
</tr>
</tbody>
</table>

(b) The material to be used for bedding and surround for concrete pipes shall have a a water-soluble sulfate content of less than 0.38% of sulfate (as SO₃) when tested in accordance with BS EN 1744-1, clause 10.
### 3. Highway Drainage (Cont’d)

#### 3.5 Pipe Bedding Material (Cont.)

2. **Concrete Bedding Material.**

   Concrete for pipe bedding shall be mix ST4, medium workability.

#### 3.6 Manhole covers and frames

1. Manhole covers and frames shall have a minimum 600mm square clear opening and shall comply with (BS) EN 124 : 1994 and shall be marked with the BS Kitemark or LRQA. All covers shall be to Class D400 and shall provide a permanent non rock performance whilst in operation. All covers shall be made from ductile iron with no infilling.

   Manhole covers in carriageways shall have a minimum depth of frame of 150mm and shall be capable of supporting without fracture an additional test load of 400kN with the 250mm diameter test load bearing block placed in any position wholly within the perimeter of the cover section.

   Manhole covers in footways and verges shall have a minimum depth of frame of 100mm and shall be capable of supporting without fracture an additional test load of 350kN with the 300mm diameter test load bearing block placed in any position wholly within the perimeter of the cover section.

2. Manhole covers and frames shall be bedded on polyester resin mortar to Clause 2.3(b). They shall be accurately set for level and position as necessary on a maximum depth of 225mm Class B engineering brickwork.

#### 3.7 Fibre Board

Fibre board for use at pipe joints to preserve the flexibility of concrete protected pipelines shall be bitumen impregnated fibre building board complying with BS1142 part 2 or other similar material approved by the Engineer.

#### 3.8 Puddle Clay

1. Puddle clay shall be produced from a clay with a liquid limit between 30 and 60 and a plasticity index which is greater than the difference between 0.73 times the liquid limit and 15. It shall be free from top soil, roots, peat and any other organic soluble material. It shall also be free from boulders, cobbles and gravel exceeding 20mm in size and shall have a clay fraction, as measured in accordance with BS1377, greater than 30%.

2. Water shall be added as required and the clay worked by a manual or a mechanical method (such as a pugmill or repeated working over by tracked plant) to produce a homogeneous watertight material of a suitable consistency for placing in the Works.

3. After working and immediately prior to placing, the material shall be subject to the approval of the Engineer.

#### 3.9 Precast Concrete Setting Blocks or Pipes

Blocks shall have rectangular faces and have sufficient plan area to prevent punching of the blinding concrete or formation. They shall be cast in an approved mould and shall not be used until they have achieved a crushing strength of 13.5MN/m² determined from 150mm cubes cast and cured under identical conditions.

#### 3.10 Types of Gully Chambers (Appendix 3 Sheet 6)

1. Gully chambers for carriageways shall be

   (i) Clay round street gullies with rodding eye 450mm nominal bore and 760mm deep with 150mm nominal bore outlet to BSEN295, complete with rodding eye stopper.

   (ii) Concrete to BS5911 Part 6 unreinforced street gully with rodding eye, Fig 2(a) Table 3, 450mm diameter x 760mm deep with 150mm diameter outlet. Complete with rodding eye stopper and galvanised chain.

2. Gully chambers for footways shall be vitrified clay yard gullies to BS EN295, 225mm nominal diameter, effective height 550mm with square top.

3. Plastic gully chambers of equivalent size obtained from an approved manufacturer may be used as permanent formwork to in-situ concrete gullies with the Engineer's prior approval. Trapped plastic gully chambers may be used with the Engineer's prior approval.
3. Highway Drainage (Cont’d)

3.10 Types of Gully Chambers (Appendix 3 Sheet 6) (Cont.)

4. Carriageway gully chambers of 375mm nominal bore may be used with the Engineer's prior approval.

5. Gully chambers shall have external traps, unless the Engineer approves untrapped chambers where the connection is to a surface water drain and not to a foul sewer.

3.11 Gully Grates and Frames

1. All gully gratings shall be end hinged at the end nearest the oncoming traffic and shall be captive within the frame.

2. Gully gratings and frames shall comply with (BS) EN 124 Class D400 and shall be marked with the BS Kitemark or LRQA and shall provide a permanent non rock performance whilst in operation. All gully grates and frames shall be made from ductile iron and shall have a minimum depth of frame of 100mm and a minimum waterway area of 1020 cm².

3. The grating and frame shall be capable of supporting without fracture an additional test load of 350kN with the 300mm x 235mm test load bearing block placed at any position wholly within the perimeter of the grating section.

4. Gully grates and frames for footways shall be 225mm square, hinged to BS EN 124.

3.12 Excavation for Pipelines and Manholes (Appendix 3 Sheets 4 and 5)

1. Excavation in trenches and pits within the boundaries of highways to be adopted shall be made with vertical sides unless the specific approval of the Engineer is obtained to use battered sides.

2. Trenches shall be true to line and gradient as shown on the drawings approved by the Engineer and the width and depth shall not exceed that required to contain the permanent work except where special provision is made for additional excavation for working space or the Engineer orders extra width or depth for the proper construction of the work or for inspections or tests.

3. The width of pipe trench shall be as shown in Appendix 3 Sheets 4 and 5 unless stated otherwise.

4. Where trenches are cut with stepped or battered sides the steps or batters shall commence a minimum distance of 300mm measured vertically above the crown of the pipe when laid in its correct position. Below this position trenches shall be cut with vertical sides in accordance with the dimensions given in sub-clause 3 above.

5. The last 150mm of excavation to formation level shall not be removed until the Developer is ready to commence construction of the permanent works.

3.13 Support of Excavation

The Developer shall supply and fix outside the limits of the permanent work sufficient timbering and other support necessary to permit the proper construction of the permanent work. The Developer shall give reasonable notice of intention to withdraw support of any kind and shall not proceed with the withdrawal until the excavation and permanent works have been inspected by the Engineer. Support shall conform to BS6031.

3.14 Treatment of Over-break and slips

In the event of an over break or slip occurring or the Developer allowing material at or below the trench or pit bottom to become unsuitable, all the loose, disturbed or unsuitable material shall be removed, the excavation trimmed back to vertical faces and the excess excavation treated as follows:

(i) In the bottom of the trench or pit the excess excavation shall be filled with mix ST2 concrete, medium workability. Where in the opinion of the Engineer satisfactory support can be achieved, pipe bedding material Clause 3.5 may be used as an alternative.

(ii) Where the trench or pit is to contain a pipe or manhole which is to have a concrete protection, any excess width of excavation shall be filled with extra concrete as part of the surround or protection.

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3. Highway Drainage (Cont'd)

3.14 Treatment of Over-break and slips (Cont.)

(iii) Where the pipe or manhole is not to have a concrete protection the excess width of excavation shall be filled with mix ST2 concrete, medium workability, or filled in the same manner as the trench or pit of which the overbreak is part, as directed by the Engineer.

(iv) Excess excavation above the pipe or surround shall be filled in the same manner as the trench or pit of which the excess is part with the prior approval of the Engineer.

3.15 Separation and Protection of Excavated Material for Re-use

Excavated material for re-use as fill shall be protected from weathering action or damage which would cause an increase or decrease in the natural moisture content or physical deterioration.

The measures which should be undertaken for protection are:

(i) The amount of excavated soil stockpiled on the surface shall be kept to a minimum. Excavated material if suitable for re-use as backfilling shall be used as soon after excavation as possible.

(ii) Excavated materials for re-use must not be allowed to become contaminated with unsuitable material.

(iii) Excavated material for re-use must be stockpiled clear of any water channel, or low spot in which water may collect.

(iv) Excavated material must be stacked in a compact, ridged heap which will shed water.

3.16 Dewatering Trenches and Pits

1. Adequate arrangements shall be made to prevent water collecting in excavations.

2. The formation and excavations shall be kept free from water during the progress of the works and the Developer shall make provision for all labour, materials, pumps and maintenance thereof necessary for the purpose.

3. Where sump holes are found to be necessary below the formation of the trenches their positions shall be approved by the Engineer, and the Developer shall form such sumps, and on completion fill up to the formation level of the trench with mix ST2 concrete, medium workability. Pumping operations shall be conducted so as not to endanger the foundation or stability of any of the adjoining structures. Moreover, flow shall not be discharged into new or existing sewers or watercourse without the approval of the Engineer and the Environment Agency, such approval being conditional upon the provision of adequate measures for silt removal.

4. In the event of the Developer requiring drainage grips, channels or sub-drains, the Engineer will permit these to be constructed below the level of and within the width limits of the permanent work, provided the Engineer has approved the details of the Developer's proposals.

5. Any sub-drainage that the Developer constructs below the permanent works shall, if left in place, be made to provide support at least equal to the permanent support. Ballast filled sub-drains underneath permanent in situ concrete shall be covered with a waterproof membrane.

6. No sub-drainage pipes shall be left in unless they are filled with mix ST2 concrete or other approved material.

3.17 Bedding and Laying Pipes

1. The laying of all pipes shall be commenced at point of outfall unless otherwise agreed with the Engineer, and any necessary junctions shall be inserted as the work proceeds and shall be laid true and to lines and levels as shown on the drawings approved by the Engineer. Each pipe shall be properly boned-in so that the invert is to a true and even gradient with the spigot end towards the outfall.
3. Highway Drainage (Cont'd)

3.17 Bedding and Laying Pipes (Cont.)

2. Each pipe immediately before being laid shall be carefully brushed out and tested for soundness. Each pipe shall be laid accurately to line and gradient so that except where otherwise specified or ordered by the Engineer the finished pipeline shall be in straight lines both in the horizontal and vertical planes. Where lines of pipes are to be constructed in trench the Developer shall provide, fix and maintain at a maximum spacing of 50m and at such points as may be directed by the Engineer, properly painted sight rails. With the consent of the Engineer pipelines may be laid using a laser.

3. In trenches, pipes shall be laid and jointed immediately following excavation.

4. For all pipelines the nearest joint to any chamber shall be not more than 500mm from the inner face of the wall and shall not be restricted by any concrete. Between this and the next joint, the length of the articulated pipe shall be

   (i) for pipe diameters 450mm and less, 500mm to 750mm.
   (ii) for pipe diameters greater than 450mm, 750mm to 1000mm.

5. Where a granular bed to pipes is to be used the pipes shall be laid upon and worked into a well compacted bed of granular material extending the whole width of the trench. Before laying the pipes the granular bed shall be thoroughly compacted by mechanical means to the satisfaction of the Engineer. Socket holes shall then be formed in the bedding to ensure that pipes, when laid, shall be firmly supported for the full length of their barrels.

6. The thickness of the granular material below the barrel of the pipes shall be as shown in Appendix 3.

7. When pipes of up to 1.2m diameter are laid in ground which may result in irregular hard spots beneath the pipes, the depth of granular bed shall be increased by 100mm.

8. After the pipes have been tested and approved by the Engineer the trench shall be carefully filled to the level of the horizontal diameter of the pipe with granular material. This filling shall be carefully compacted by a method approved by the Engineer and the trench width shall be such that adequate compaction can be achieved.

3.18 Concrete Protection for Pipelines (Appendix 3 Sheet 5)

1. Where a Developer elects to provide a concrete protection it shall be as follows:

   (i) Concrete surround shall be provided for:
       (a) All pipes with less than 1.0m of cover under carriageways, footways, or footpaths or verges adjacent to them.
       (b) All pipes with over 6m of cover no matter where.
       (c) All pipes in highways where the Engineer requires a surround to be provided for engineering purposes.
       (d) All pipes in made up or filled ground.
       (e) All pipes in heading.
       (f) Gully connections as Clause 3.25.

   (ii) Concrete bed and haunch shall be provided for:
       (a) All pipes with over 4.5m of cover no matter where.

2. Concrete for concrete protection shall be mix ST4 concrete, medium workability, and shall be made with sulfate-resisting cement where necessary.

3. The minimum thickness of concrete protection; under the pipes in the case of bed, haunch and surround; at the sides of the pipes in the case of haunch and surround; and over the pipes in the case of surround shall be as detailed in Appendix 3 Sheet 5.

The overall width of concrete protection shall be the width of the trench. Haunch shall be carried up the sides of the pipe from the bed to a horizontal surface midway between the maximum external horizontal diameter and highest point of the pipe.
3. Highway Drainage (Cont’d)

3.18 Concrete Protection for Pipelines (Appendix 3 Sheet 5) (Cont.)

4. Where required by the Engineer, the Developer shall submit designs for pipelines for the Engineer’s approval. These designs shall be based on the National Building Studies Special Report No.37.

5. Where a concrete bed and haunch or other concrete protection is to be used a concrete blinding mix ST2, medium workability, of 75mm thickness shall be laid over the full width of the trench below the underside of the concrete protection.

All pipes shall be supported on precast concrete blocks of sufficient area to prevent punching of the blinding course, and shall be prevented from lateral movement by the insertion of suitable wooden wedges. After the pipeline has been tested and approved by the Engineer the concrete blinding shall be thoroughly cleaned off and mix ST4 concrete, medium workability, shall be carefully placed and compacted thereon, care being taken to avoid disturbing the pipes until the appropriate profile for the type of protection required has been reached. The concrete placed on the blinding course shall be properly shuttered to form the correct profile as shown on the Drawings, or alternatively the concrete shall be extended over the full width of the trench at the Developer’s discretion.

Concrete as protection to pipes over 300mm diameter shall be compacted by mechanical vibrator to the satisfaction of the Engineer.

6. The Developer shall form a flexible joint in the concrete protection at each pipe joint. The joint shall be formed with fibreboard (Clause 3.7) or other material approved by the Engineer. The joint shall extend from formation level over the profile of concrete to be placed.

The joint material shall be shaped to the cross-section of the concrete and the outside diameter of the pipe and shall be placed against the face of the collar of the pipes and be fully supported in a manner approved by the Engineer, so that the resulting joint is truly vertical and set at right angles to the line of the pipeline.

The joints shall be of the following thickness:

- 12mm for pipes up to 300mm diameter.
- 25mm for pipes from 375mm to 600mm diameter.
- 40mm for pipes from 675 to 1.2m diameter.
- 50mm for pipes from 1.275m diameter upwards.

3.19 Jointing Pipes

1. Type 1 flexible joints shall be fitted in the manner recommended by the manufacturer of the pipe.

Type 2 cement mortar joints will only be permitted in exceptional circumstances and only with the approval of the Engineer and they shall be formed by soundly caulking with gaskin and pointed with 1 part cement to 3 parts sand mortar (Clause 2.3) to fill the joint completely and form a 45° fillet to the outer periphery of the socket.

2. Pipes required to be laid with open joints shall be laid and supported concentrically with a space of 13mm between the spigot and socket. Open-jointed porous concrete pipes and perforated clay pipes with rebated joints shall have dry joints.

3. Upon completion of laying and jointing all pipelines shall be free from obstruction and a spherical mandrel 10mm less than the nominal bore of the pipeline shall be drawn through all pipelines less than 350mm diameter.

4. For pipes over 600mm diameter the Developer shall comply with the additional requirements of the Engineer.

3.20 Connections to Existing and New Sewers and Culverts

1. Existing sewers, drains and culverts affected by the works shall be properly connected and jointed to the respective new sewers drains and culverts as construction proceeds. The Developer shall carry out any searches, tests and trial holes necessary to locate existing sewers, drains and culverts.
3. Highway Drainage (Cont'd)

3.20 Connections to Existing and New Sewers and Culverts (Cont.)

1. Before breaking into an existing sewer, drain or culvert, the Developer shall give notice of his intention and receive the approval of the Authority responsible for the sewer, drain or culvert. The right is reserved to require connections to existing sewers to be made by the Water Company, or District or County Council, who will recharge the Developer for this work.

Connections will normally be made at manhole positions and if there is not an existing manhole at the proposed point of connection then the Developer shall at his own expense construct a new manhole at the point of connection.

The treatment of connections to deep or large diameter sewers will be the subject of individual consideration in each case.

2. For existing and future connections, junction pipes shall be inserted as necessary during construction, the jointing being carried out as specified for the type of pipe. Any branches which are not immediately connected up in sewers shall be sealed with vitrified clay stoppers set in puddle clay, Clause 3.8. Where shown on the approved Drawings existing sewers and drains shall be properly extended, connected and jointed to new sewers, culverts, drains or channels. All such connections shall be made during the construction of the main sewer, drain or other work and their positions recorded at that time by the Developer all in accordance with Clause 3.2.2.

3. Where pipe connections are to be made to a brick sewer, brick or concrete, culvert, stone built or lined channel the pipes shall be built into the wall of the sewer, culvert or channel and aligned so as to discharge at an angle not greater than 60° to the direction of flow of the main sewer, culvert or channel. The existing pipe shall be cut using a diamond cutter or other approved means. A purpose made saddle or junction pipe is to be used wherever possible. Where this is not possible the junction pipe is to be neatly cut to the correct skew angle, the end of the pipe carefully cut flush with the wall and made good to the satisfaction of the Engineer. For pipes in excess of 825mm diameter the junction is to be made good from the inside.

4. The Developer shall to the satisfaction of the Engineer, provide suitable and sufficient pumps, construct all necessary temporary works including dams, chutes, troughs and pipes to maintain the flow in existing sewers and drains during construction and whilst connecting the new works to the existing sewers and drains and making good on completion to the satisfaction of the Engineer.

3.21 Manholes and Catchpits, General

1. Manholes and catchpits shall be constructed of precast concrete sections in accordance with the details and drawings included in Appendix 3. All manholes exceeding 4m in depth shall be designed to the Engineer's special requirements.

2. Sulfate-resisting cement shall be used in all precast concrete sections and insitu concrete, mortar or grout where this is necessary because of the sulfate content of the ground water or water carried.

3. Foundations and bases to manholes and catchpits shall be in mix ST4 concrete, medium workability. All insitu concrete in manholes shall conform to the clauses of this specification relating to concrete, reinforcement, shuttering etc., pipes being built in where shown or directed.

4. Channels and inverts
Channels and inverts shall be formed in prefabricated half-round channels bedded in mix ST4 concrete, medium workability, or formed insitu in mix ST4 concrete, medium workability, which shall be made with sulfate-resistant cement where necessary. Inverts shall be carefully formed and where pipes of different radii enter or leave the manhole the inverts shall be semicircular and evenly tapered to suit the dimensions of the pipes or tubes and in accordance with the details shown on the drawings. Inverts and benching shall be formed to the shapes and dimensions shown upon the approved drawings. Purpose made shutters shall be used.
3. Highway Drainage (Cont’d)

3.21 Manholes and Catchpits, General (Cont.)

4. All pipes and tubes entering or leaving the manholes shall, unless otherwise specifically directed by the Engineer have level soffits. Under no circumstances should pipes or connections discharge over or above benchings.

Manholes with outlet pipes of 600mm or over shall be fitted with a stainless steel close link safety chain 10mm diameter with a 30mm diameter hook and eye bolted to the benching across the outlet pipe and 25mm diameter stainless steel holding bar complete with fixing eye.

5. Step irons
Step irons complying with BSEN 13101 shall be provided where the invert depth below finished surface (cover) level exceeds 1m. They shall be built in at a vertical interval of 300mm with alternate steps in line vertically and at 225mm centre to centre horizontally. The mortar used in building-in shall be that used in constructing the manhole.

6. Connections
Where pipes are required to be built into manholes for future connections these are to be closed with vitrified clay stoppers of appropriate sizes which shall be provided and fixed with puddle clay and cement filled. For larger sizes 525mm diameter and above, a 102.5mm brick wall in weak mortar shall be built in them.

3.22 Precast Concrete Manholes

1. Precast concrete manholes shall be constructed generally in accordance with Appendix sheet 1 attached to this Specification. The precast concrete manhole units shall comply with the requirements of BS5911 Part 3 and BSEN 1917.

2. On 75mm of concrete blinding mix ST2, medium workability, a 225mm thick, mix ST4, medium workability, insitu concrete base shall be placed, on which the invert formed from half-round clay or concrete channel, pipes, tapers, bends and junctions as appropriate shall be laid. Alternatively, with the approval of the Engineer, inverts may be shuttered and cast insitu.

3. The limit of the mix ST4 medium workability concrete stooling shall be 50mm above the seating level of the bottom chamber ring as shown in Appendix 3 Sheet 1.

4. The precast concrete rings shall sit on the concrete stooling and be bedded in cement mortar. Each joint shall be carefully cleaned and flush pointed with 2.3 cement mortar and when completed the inner faces of the manholes shall be true and smooth throughout. Pipes extending into manholes shall be trimmed flush with the inside walls and shall be neatly pointed in 2.3 cement mortar. Galvanised malleable iron step irons Clause 3.21.5 shall be built in the manhole.

5. Alternatively in manholes deeper than 3.0m to top of benching stainless steel ladders shall be provided.

6. The manhole chambers and shafts shall be surrounded with 150mm of mix ST4, high workability, concrete.

7. The chamber rings shall be at least 900mm in diameter for pipes up to and including 300mm diameter. For 375mm diameter pipes and over the minimum diameter for chamber rings shall be not less than 600mm greater than the largest pipe diameter. A reducing slab may be fitted to a manhole to reduce the chamber to a shaft size of 900mm diameter provided that a minimum height of 2m is obtained from the benching to the base of the slab.

8. All manhole chamber and shaft rings shall be provided with lifting holes and on no account shall step irons be used for lifting.

9. The pipe shafts to drop manholes shall be formed with earthenware or concrete pipes and bends completely surrounded with 150mm concrete, mix ST4, high workability. All manholes shall be watertight on completion and to the satisfaction of the Engineer. The space between the new construction and the face of the excavation shall be filled with mix ST4, high workability, concrete or with the approved material, see Clause 3.26.3.
3. Highway Drainage (Cont’d)

3.23 Brick Manholes

Brick manholes shall only be used where precast concrete manholes are considered inappropriate and must have the approval of the Engineer.

3.24 Construction of Gullies

1. Gully chambers shall be set on and surrounded with 150mm minimum thickness of concrete, mix ST4, medium workability, up to the top of the chamber and finished level.

2. A purpose made precast concrete gully cover slab shall be bedded on polyester resin mortar Clause 2.3 on top of the gully chamber. Gully frames shall be set accurately for level and position bedded on polyester resin mortar. Where necessary a concrete mix ST4 cast insitu raising piece shall be used to attain the correct level as Appendix 3 Sheet 6. As an alternative to the insitu concrete not less than 2 nor more than 4 courses of Class B Engineering brickwork with fully mortared joints shall be used with the approval of the Engineer. The brickwork shall be corbelled as necessary to provide a full bed for the frame and shall be 225mm thick in carriageways and 102.5mm thick in footways.

3.25 Gully Connections

1. Gully connections shall be 150mm diameter surrounded with 150mm thick mix ST4, medium workability, concrete.

2. Junction pipes for gully connections which are laid but not immediately connected shall be fitted with vitrified clay stoppers fixed with puddled clay and a cement fillet and the position of all such connections shall be clearly defined by means of stakes or tracing wires properly marked, labelled and recorded.

3.26 Filling of Trenches, Pits and around Manholes and Chambers

1. Trenches, pits and the space around manholes and chambers shall be filled immediately after the construction is sufficiently completed and tested and approved by the Engineer, but not until 36 hours after the placing of any concrete or brickwork. No filling shall commence until the permanent works have been approved by the Engineer.

2. Backfilling to pipelines:

Backfill material shall consist of any one of the materials listed in paragraph 4 below. Up to a height of 300mm above the crown of the pipe the largest pieces of filling shall have a maximum dimension not exceeding 40mm. The backfill shall be brought up equally on both sides of the pipe first to the level of the centre line of the pipeline and then in layers not more than 150mm thickness to height of 300mm above the crown of the pipe and shall be carefully compacted for the full width of the trench with hand tools. The remainder of the filling shall be placed in even layers not exceeding 225mm thick after compaction, and fully compacted over the whole width of the trench.

3. Backfilling of pits and around manholes:

The backfill material shall consist of any one of the materials listed in paragraph 4 below. The filling shall be placed evenly over the whole area of the excavation in layers not exceeding 225mm thick after compaction and fully compacted using mechanical plant.

Where the space around a manhole or chamber does not allow access for compaction plant, concrete as item 4 (iv) below shall be used as fill and compacted by hand punning or vibration in layers not exceeding 225mm thick.

For surface areas under carriageways of less than 6m2 the excavated material should not be re-used in backfilling unless otherwise instructed by the Engineer. At major roads backfilling should be carried out with concrete as item 4 (iv) below and at minor roads with Type 1 sub-base material as item 4 (iii) below.

4. Types of fill material:

The fill material to be used shall be any one of the materials in the schedule below.

(i) Suitable excavated sub-soil material accepted by the Engineer for use in the works which has been separated and protected in the manner given in paragraph 3.15. The largest pieces shall have a maximum dimension not exceeding 100mm.
3. **Highway Drainage (Cont'd)**

3.26 **Filling of Trenches, Pits and around Manholes and Chambers (Cont.)**

4. (ii) Granular filling material which may be excavated material but shall be well graded, crushed or broken sandstone or limestone rock, or sand/gravel. The largest pieces shall have a maximum dimension not exceeding 100mm.

(iii) Type 1 sub-base material to Clause 5.4.

(iv) Mix ST2, high workability concrete.

3.27 **Excavation Supports**

Excavation supports shall be carefully removed as filling proceeds except where such support is required to be left in position but stability of the trench sides and adjacent ground must be maintained. The space left by the withdrawal of support shall be filled in the manner of the main fill.

3.28 **Acceptability of fill**

The completed fill should have a bearing capacity and stability at least equal to that of the adjacent undisturbed sub-grade.

Where settlement, deterioration, inspection or test results indicate that the fill is not equal to the adjacent sub-grade such additional work necessary to produce a final reinstatement equal in capacity performance and condition to that which existed before disturbance shall be carried out to the satisfaction of the Engineer.

3.29 **Testing and Cleaning of Pipelines**

1. Water or air tests shall be carried out on all sealed and jointed pipelines up to 750mm diameter with apparatus, materials and labour supplied by the Developer, under the directions and in the presence of the Engineer. The drains shall be tested for the full length between manholes, or in exceptional circumstances for such lesser distance as may be approved by the Engineer. Air tests shall only be applied with the approval of the Engineer.

   Whichever form of test is used a first test shall be made on the naked pipes as laid after the jointing material has had proper time to act. A second test shall be carried out in the same length when the trench has been filled to a depth of 450mm over the collars of the pipes; after the filling has been properly compacted. In some cases where the pipes are surrounded with concrete the filling for the second test (i.e. the test after compaction) need be only 225mm.

   Notwithstanding the favourable result of these tests the Engineer may make any further tests and subsequent examination of the materials and workmanship that the Engineer considers to be necessary.

   Storm water drains of 900mm diameter and greater will be tested by visual inspection from the inside.

   Reasonable and proper notice must be given to the Engineer when any length requires testing.

2. **Water Test**

   For the pipeline water test, the pipes shall be filled with water under a head of not less than 1.2m above the crown of the pipe at the high end and not more than 6m above the pipe at the low end. Steeply graded pipelines shall be tested in sections so that the above maximum shall not be exceeded. Unless otherwise agreed by the Engineer the test shall commence two hours after filling the test section at which time the level of water at the vertical feed pipe shall be made up to produce the required 1.2m minimum test head. The loss of water over a 30 minute period shall be measured by adding water at regular 10 minute intervals to maintain the original water level and recording the amounts so added. The drain will have passed the test if the volume of water added does not exceed one litre per hour per linear metre of drain per nominal internal diameter.

3. **Air Test**

   For the pipeline air test, air shall be pumped in by suitable means until a stable pressure of 100mm head of water is indicated in a U-tube connected to the system. The air pressure shall not fall to less than 75mm head of water during a period of 5 minutes without further pumping, after an initial period to allow stabilization. Drains with traps shall be tested to 50mm head of water and the permissible loss shall then be no more than 13mm head of water in 5 minutes without further pumping after the initial stabilization period.
3. Highway Drainage (Cont’d)

3.29 Testing and Cleaning of Pipelines (Cont.)
3. The Developer shall provide, fix and work the force pump, pressure gauge and all other apparatus required, including expanding stoppers to the approval of the Engineer.

4. Smoke Test
Sealed and jointed pipes over 900mm diameter may be tested by means of the smoke test where directed by the Engineer. Both ends of the pipeline shall be sealed and smoke shall be pumped in from an approved smoke machine. Should any joint show an escape of smoke the defects shall be made good and the pipeline re-tested.

5. Manholes
Manholes and inspection chambers shall be tested for watertightness by the inspection for infiltration and weeps shall be stopped by caulking and pointing.

6. Flushing on Completion
On completion of the works, or earlier if the Engineer agrees, all manholes and pipelines other than french drains shall be completely cleaned and flushed from end to end with water and all pipelines shall be left clean and free from obstruction. Any jetting shall take place from a manhole in an upstream direction. The pipe shall be plugged below the jetting point to prevent contaminants flowing to any watercourse.

7. CCTV Survey
All drains and culverts shall be surveyed by a video camera and a recording and a report shall be supplied to the Engineer.

3.30 Design Guides
The Developer’s attention is drawn to the following publications to which reference can be made concerning the design and construction of highway drains.

(a) Transport and Road Research Laboratory Road Note No.35
(b) Design Manual for Roads and Bridges.
(c) Simplified tables of external loads on buried pipelines.

3.31 Drawings and Calculations
The Developer shall submit to the Engineer for approval layout plans, sections, calculations and such other information as shall be reasonably required to check the validity of the Developer’s proposals.

3.32 Hydraulic Design
1. Highway drains shall be designed in accordance with the TRRL Road Note 35 using the Rational (Lloyd-Davies) Method. Unless otherwise required by the Engineer a storm frequency of once in one year shall be used together with a time of entry of 3 minutes.

2. For large developments or where the time of concentration exceeds 20 minutes the Developer should consult the Engineer for advice.

3. The carrying capacities and flow velocities shall be determined from Hydraulic Research Paper No.4; Tables for the Design of Storm Drains, Sewers and Pipelines, using a roughness value (Ks) of 0.6mm.

4. All highway drains shall be designed with a minimum full bore flow velocity of 1.0 metres/second.

5. Highway drains should normally be laid soffits level at manhole intersections.
4. **Earthworks**

4.1 **Bulk Excavation and Filling**
Excavation and filling shall be carried out in accordance with the drawings approved by the Engineer.

4.2 **Turf and Topsoil**
All turf and topsoil over the whole width of the carriageway and footways or from the underside of any proposed embankments shall be removed.

4.3 **Unsuitable Material**
The following materials are unsuitable for highway works and shall be disposed of clear of the site.

(a) peat, material from swamps, marshes and bogs;
(b) logs, stumps and perishable material;
(c) materials in a frozen condition;
(d) wet clay or silt;
(e) chemical and industrial organic waste;
(f) materials susceptible to spontaneous combustion;
(g) any material not acceptable to the Engineer for incorporation in the highway works;

For clarification of material classification, the contractor shall follow the Notes for Guidance on the Specification for Highway Works NG601, which outlines the accepted classification procedure for disposal of materials off site.

4.4 **Filling Material**
1. Material intended for filling shall be kept separate from other materials and shall be protected from damage by contamination, weathering or an increase or decrease in moisture content.

2. Filling materials shall be:

(i) Suitable excavated material being sub-soil materials accepted by the Engineer for use as fill.
(ii) Granular filling material being well graded broken rock or weathered upper rock, overburden, sand gravel or broken hardcore approved by the Engineer. The largest pieces of filling material shall have a maximum dimension less than 125mm.
(iii) Rock fill material, being quarried from a source approved by the Engineer, 125mm maximum size.
(iv) Hardcore. All hardcore shall be clean, angular in shape, free from dust, refuse or organic matter, and shall be of a size no greater than 125mm and shall consist of broken stone or bricks from an approved source. In the event of demolition material being used for hardcore the material shall be selected and free from lime, plaster, timber or other rubbish, and should be approved by the Engineer before use.
(v) Subgrade improvement (capping) layer material shall be approved crushed rock, broken brick, broken concrete or gravel. It shall be well graded from 125mm down to a 63µm sieve.

4.5 **Treatment of Unsound Ground-Rockfill / Hardcore**
1. With the agreement of the Engineer rockfill/hardcore shall be placed:

(i) Where the naturally occurring material beneath highway works is unsuitable as a subgrade;
(ii) Where unsuitable material has been excavated and disposed of leaving a local depression in ground which may be unsound;
(iii) Where it is necessary to fill waterlogged or unsound ground.

2. Rockfill / hardcore shall be spread in layers not exceeding 400mm thick each adequately compacted until stabilisation is accomplished.
4. Earthworks (Cont’d)

4.5 Treatment of Unsound Ground-Rockfill / Hardcore (Cont.)

3. Where in the opinion of the Engineer, further excavation will result in extension of the soft area, the use of a fabric filter sheet, of a type approved by the Engineer, laid on the sub-grade material at formation level may be required.

4.6 Sub-soil Drainage

Where the winter height of the water table is within 600mm of formation level;

or where the sub-soil is unstable because of being waterlogged;

or where there is likelihood of water running off or out of adjacent ground;

or where springs, drains or watercourses are encountered;

then a proper system of sub-soil drainage connected via catchpits to the surface water system or to a suitable outfall shall be constructed to the satisfaction of the Engineer.

4.7 Fill

1. Fill shall be suitable excavated material or granular filling material as previously described in Clause 4.4.2.

2. Fill shall be spread and compacted in layers not greater than 225mm thick after compaction with a minimum of 8 complete passes by a smooth-wheel roller weighing at least 8 tonnes or a vibratory roller of at least 3 tonnes mass.

3. Embankments shall be built up evenly over the full width and the surface shall be given a camber or fall so that surface water does not collect. Site traffic shall be directed over the whole of the surface of the embankment so that no area is overstressed.

4. Any fill which deteriorates during construction shall be removed.

4.8 Sub-Formation Preparation

Where a sub-grade improvement (capping) layer is to be used, the surface of the embankment fill or the bottom of the excavation taken out below formation in cutting shall be trimmed to a tolerance of ±25mm immediately before the material is placed.

4.9 Formation Preparation

Immediately prior to the laying of the sub-base the formation shall be prepared as follows:

(i) All surfaces shall be cleaned and any wet material, mud, slurry, etc removed from site.

(ii) The surface shall be brought to the formation level given on the approved drawings by the addition of suitable fill material or by grading-off high spots.

The surface shall be regulated by grading to within a tolerance between plus zero and minus 50mm from true level.

(iii) The formation shall be finished by a light rolling with a smooth wheel roller of at least 2.5 tonnes mass.
5. Carriageway Construction

5.1 Order of Work

All drains, sewers, mains, service cross connections and ducting for street lighting service connections shall be installed before the carriageway construction is commenced. Statutory Undertakers’ work which, with the agreement of the Engineer, cannot be completed at the initial stage must be completed before any bituminous surfacing materials are laid. All trenches and pits shall be filled in accordance with Clauses 3.26 to 3.28.

5.2 General

1. IMPORTANT NOTE: The U.K. British Standards for blacktop specifications, BS 594 and BS 4987 have been replaced by the new European Standard Specification BS EN 13108 from the 01 January 2008, the laying and compaction of blacktop will be covered by a new, amalgamated BS 594987.

The implementation of the new European Standard has resulted in a number of changes to the way bituminous materials are specified and described. The major change is that BS 4987 materials, i.e. coated macadam, are now called asphalt concrete.

The way penetration grades of bitumen are expressed has also changed and are listed below:

<table>
<thead>
<tr>
<th>Prior to 2008</th>
<th>BS EN 13108</th>
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<tbody>
<tr>
<td>35</td>
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<tr>
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<td>100/150</td>
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<td>190</td>
<td>160/220</td>
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<tr>
<td>290</td>
<td>250/330</td>
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</tbody>
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Guidance on the use of materials and materials testing can be obtained from the County Council's Principal Materials Engineer on 01772 538562.

The layers of construction are shown below in a diagrammatic representation of a flexible road. See Appendix 5.

<table>
<thead>
<tr>
<th>Final Surface</th>
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<tbody>
<tr>
<td>Surface Course</td>
</tr>
<tr>
<td>Binder Course</td>
</tr>
<tr>
<td>Temporary Running Surface</td>
</tr>
<tr>
<td>Base (Roadbase)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Formation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-base</td>
</tr>
<tr>
<td>Sub-grade Improvement (capping) layer (if used)</td>
</tr>
<tr>
<td>Sub-formation</td>
</tr>
</tbody>
</table>

Sub-grade

It is possible to have a road structure of sufficient strength for the base to be used as a 'temporary running surface' during the construction phase of the estate. Subsequently, the binder course layer will serve as a 'regulating layer' beneath the final surface course material.
5. Carriageway Construction (Cont’d)

5.2 General (Cont.)  2. Construction Depths
The construction depth will vary depending on the category of road and the nature of the sub-grade soil, in accordance with Table 1 below.

The upper 450mm of construction shall consist entirely of frost resistant material.

Category 1. Residential Access Roads
Culs de Sac and Minor Residential Roads.

Category 2. Local Distributors
Spine roads carrying estate traffic and infrequent local bus services.

Category 3. Industrial Estate Roads
Roads carrying commercial traffic.

Further guidance on the design of residential roads is provided in "Creating Civilised Streets" which is available on the LCC intranet website.

The base (roadbase) thickness for Industrial Estate Roads shall be designed for the expected traffic loading and the design shall be subject to the Engineer's approval.

<table>
<thead>
<tr>
<th>Construction Layer</th>
<th>Thickness of Layer (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Course</td>
<td>45 (HRASC) 40 40</td>
</tr>
<tr>
<td>Binder Course</td>
<td>70 70 70</td>
</tr>
<tr>
<td>Base (roadbase)</td>
<td>70 100 130</td>
</tr>
</tbody>
</table>

Sub-base & Capping

Sub-grade I
Compact, non plastic, granular soil, e.g. gravel, sands and weathered rock with a CBR of greater than 8%

300mm of Type 1 sub-base

Sub-grade II
Firm cohesive soils e.g. firm sandy or silty clays with a CBR between 2% and 8%

150mm of Type 1 sub-base over 400mm of 6F2 capping

Sub-grade III
Poorly drained fine granular or soft cohesive soils, e.g. heavy plastic clays, wet silty fine sands with a CBR less than 2%

150mm Type 1 sub-base over 600mm of 6F2 capping

Notes: When the sub-grade is particularly weak the Engineer may require either the sub-base thickness to be increased or, if the formation is in a poorly drained fine granular soil (e.g. silt or silty fine sand), a fabric filter sheet to be laid on the formation prior to placing the initial layer of capping material.
5. Carriageway Construction (Cont’d)

5.3 Formation Preparation
Where the laying of sub-base does not immediately follow the preparation of the formation as in Clause 4.9 the formation shall be prepared again by removing any wet, dusty, loose or deteriorated material, regrading with granular fill material and compacting by rolling.

5.4 Sub-base Material
The sub-base shall be granular sub-base Type 1 comprising crushed limestone rock or an LCC approved recycled material complying with the following grading envelope prior to compaction.

<table>
<thead>
<tr>
<th>BS Sieve Size</th>
<th>% by Weight Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>63mm</td>
<td>100</td>
</tr>
<tr>
<td>31.5mm</td>
<td>75 – 99</td>
</tr>
<tr>
<td>16mm</td>
<td>43 - 81</td>
</tr>
<tr>
<td>8mm</td>
<td>23 - 66</td>
</tr>
<tr>
<td>4mm</td>
<td>12 – 53</td>
</tr>
<tr>
<td>2mm</td>
<td>6 - 42</td>
</tr>
<tr>
<td>1mm</td>
<td>3 - 32</td>
</tr>
<tr>
<td>63µm</td>
<td>0 - 9</td>
</tr>
</tbody>
</table>

The material passing 425 micron sieve shall have a Liquid Limit not greater than 25 and a Plasticity Index not greater than 6 when tested in accordance with BS1377.

5.5 Laying Sub-base
1. Granular sub-base material shall be spread by mechanical plant to an even depth which after compaction will produce a layer thickness not less than 100mm or greater than 150mm.

2. Compaction of each layer shall be by a 6 - 8 tonnes roller and shall be continued until the surface is well closed and free from movement under the roller. The final layer shall be compacted to a smooth and even surface with not less than 8 passes of the roller, free from irregularities and loose material and true to cross section line and such that the surface shall be within a tolerance of +10mm and -30mm of the true level.

Note: Sub-grade Type III (Table 1)

When the sub-grade material is Type III and where the Engineer requires either the sub-base thickness to be increased, or a fabric filter sheet to be laid on the formation prior to placing the initial layer of sub-base material, the thickness of the initial layer shall be increased from 100mm - 150mm after compaction, to 200mm - 250mm after compaction.

5.6 Base (roadbase) Material
The base (roadbase) shall comprise 20mm or 32mm size dense base to BS EN 13108: Part 1 with 100/150 pen.

5.7 Laying Base (roadbase)
The base shall comprise dense macadam as specified in Clause 906 machine laid. The finished surface shall be within the tolerance specified in Clause 5.12.

Note: It is intended that the base will be used as a temporary running surface during the construction of the estate.

5.8 Binder Course Material
The binder course regulating layer shall consist of 20mm size HDM binder course to BS EN 13108: Part 1 with 100/150 pen bitumen.

5.9 Laying Binder Course Regulating Layer
1. Before the binder course is laid on the base, the base shall be thoroughly cleaned by scraping and brushing and, if necessary, by power washing. When the surface is dry and immediately before the binder course is laid, a bond coat of 50% polymer modified binder shall be applied uniformly to the base at a rate of 0.35 - 0.55 litres per square metre.

2. The binder course as specified in Clause 5.8 is intended to serve also as a regulating layer and shall be machine laid. The finished level of the binder course shall be within the tolerance specified in Clause 5.12. Only in specific circumstances where the Engineer's approval is given will hand laying be permitted.
5. Carriageway Construction (Cont’d)

5.9 Laying Binder Course Regulating Layer (Cont.)

3. Where the binder course is to be left exposed to traffic for a significant length of time then the binder course shall include a hardstone aggregate to prevent polishing of the aggregate in the running surface.

5.10 Surface Course Material

The surface course shall comprise one of the following types of material, to be defined by the Engineer:

1. On estate roads with less than 10 commercial vehicles per day the surface course shall comprise Rolled Asphalt (recipe mix) to BS594987: 2007, Table 6B, HRA 30/14 F surf. The coarse aggregate shall be in accordance with the requirements of BS EN 13043, excluding limestone and gravel. The fine aggregate shall be sand complying with the requirements of EN13043. The binder shall be 40/60 pen complying with BS EN 12591.

Coated chippings shall be 14mm nominal size to EN 13108: Part 4. and have a minimum Polished Stone Value (PSV) of 60. The chippings shall be applied at a rate of 9.0 ± 1.0kg/m² and rolled to obtain a textured surface.

On residential estate roads with a speed limit of 30mph or less the required Texture Depth shall be 0.8mm (Sand Patch)

2. On estate roads with more than 10c/v/d, speed limits above 30mph and/or bus routes the surface course shall comprise 10mm size Stone Mastic Asphalt (SMA) surface course to BS 594987, Table 6C, SMA 10 surf 40/60 pen. The aggregate shall comprise crushed rock in accordance with BS EN 13108: Part 1: 2006 with a minimum Polished Stone Value (PSV) of 60.

The Texture Depth requirement on estate roads with a speed limit of 40mph is 0.9mm.

5.11 Laying Surface Course

1. The surface course shall be machine laid. Only in specific circumstances where the prior approval of the Engineer is given may the material be laid by hand. The final road surface shall conform to the required levels and shape within the tolerances allowed in Clause 5.12.

2. Prior to laying the surface course to Clause 5.10, the surfaces shall be brushed, cleaned and washed, if necessary, as required by the Engineer. The binder course shall be applied with a 50% polymer modified binder bond coat at a rate of 0.35 -0.55 litre per square metre.

5.12 Laying Tolerances

Where rolled asphalt, concrete asphalt or SMA mixtures are to be laid the previous course shall have been properly shaped and compacted by rolling to a uniform surface. The permitted deviations of the level of the finished surface of each type of construction from the true surface levels of each type of construction shall not exceed the following values.

(a) Sub-base to receive base +10mm and -30mm
(b) Base to receive binder course ±15mm
(c) Binder course to receive surface course ±6mm
(d) Surface course ±6mm

Accuracy of Finish

(a) Asphalt Concrete: The maximum permissible depth of gap beneath a 3m straight edge when laid on the compacted surface either longitudinally or transversely shall not exceed 25mm for base, 10mm for binder course or 7mm for surface course.

(b) Rolled Asphalt: The longitudinal regularity of the surface of the surface course shall be such that the maximum depression measured under a 3m straightedge placed parallel to the centre-line of the carriageway shall not exceed 5mm.
5. Carriageway Construction (Cont’d)

5.13 Special Surfacing

1. **Block Paving**
   
   (a) Block paving may only be used on residential roads with less than 25 dwellings. Location of use, and size, shape and colour of the blocks must be approved by the Engineer. Due consideration shall be given to the economic and maintenance liabilities associated with block paving.

   (b) The blocks shall be 80mm nominal thickness standard, rectangular blocks with chamfered edges. Concrete blocks shall conform to BSEN 1338. Clay pavers shall comply with BSEN 1344 Type PB with chamfers.

   (c) Blocks shall be laid in accordance with BS7533: Part 3 on a bed of sand with sub-base and roadbase thicknesses as described in Clause 5.2. Portions of less than one third of a block shall not be permitted. The bedding sand is critical in any block laying operation. The bedding sand should be category ii for all adopted highways and category ii for all pedestrian areas.

   (d) Where roadbase to Clause 5.6 has been laid as a temporary running surface, before laying bedding sand and block paving, the surface shall be thoroughly cleaned by scraping and brushing and, if necessary, power washing. A 1.0m grid of 25mm diameter vertical holes shall then be drilled through the roadbase to connect with the underlying sub-base. The holes shall be filled using bedding sand contiguously with the block paving bedding.

2. **Small Element Precast Concrete Paving**

   The possibility of using small element paving flags is allowed for residential roads with less than 25 dwellings. Where permitted the construction shall be as follows:

   The paving flags shall be precast concrete 70mm thick and 450mm x 450mm or smaller. They shall be laid in accordance with BS7533: Part 4 on a bed of sand with sub-base thickness as described in Clause 5.2.

3. **Natural Stone Setts**

   Natural stone setts may be used on residential roads whether granite or sandstone. The method of laying shall be as agreed with the Engineer.

   Laying of setts has, in the past, been somewhat problematical.

   Current best practice suggests that the setts should be placed on a wet concrete base and tapped to level to ensure some embedment of the setts into the concrete. In the past setts have been laid on a dry concrete base and this has proved insufficient to prevent debonding and rocking.

   The joint filling to secure the setts is probably the most important element and it is recommended that a powered specialist cement grout is used to carefully fill the joints.

   The height of filling of the joints will be dependent on the use of the setts. It is suggested that jointing filling to the shoulder of the sett would be appropriate for highway and pedestrian use.
6. Footway and Footpath Construction

6.1 Order of Work

All drainage and sewerage, statutory undertakers’ mains and street lighting service connections which run along the footway shall be installed and all trenches and pits shall be filled in accordance with Clauses 3.26 to 3.28 before footway construction is commenced. Footways shall be completed up to binder course level, if flexible, or completed if flagged before any house is occupied. Manhole covers, valve boxes, gully grates, hydrant boxes, stop tap boxes shall be adjusted by the Developer to required levels to the satisfaction of the Engineer.

Where manhole covers are adjusted, the amount of brickwork above the slab shall not exceed 2 courses. In footways and verges 112mm brickwork in cement mortar may be used.

IMPORTANT NOTE: The U.K. British Standards for blacktop specifications, BS 594 and BS 4987 have been replaced by the new European Standard Specification BS EN 13108 from the 01 January 2008. In addition, the laying and compaction of blacktop will be covered by a new, amalgamated BS 594987.

The implementation of the new European Standard will result in a number of changes to the way the bituminous materials are specified and described. The major change is that existing BS 4987 materials, i.e. coated macadam, are now called asphalt concrete.

The way penetration grades of bitumen are expressed has also changed and are listed below:

<table>
<thead>
<tr>
<th>Prior to 2008</th>
<th>BS EN 13108</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>30/45</td>
</tr>
<tr>
<td>50</td>
<td>40/60</td>
</tr>
<tr>
<td>125</td>
<td>100/150</td>
</tr>
<tr>
<td>190</td>
<td>160/220</td>
</tr>
<tr>
<td>290</td>
<td>250/330</td>
</tr>
</tbody>
</table>

Note: Recycled aggregates and reclaimed products will be the preferred choice over natural aggregates and products where it can be demonstrated that the reclaimed materials will prove no detriment to the in service performance of the highway and the surrounding development.

Further guidance together with advice on testing can be obtained from the County Council's Principal Materials Engineer on 01772 538562

6.2 Formation Preparation

The formation shall be shaped and rolled to levels as shown on the drawings.

Any organic material, any wet, dusty, loose or deteriorated material shall be removed and replaced with properly compacted granular material to the required level. Total weedkiller shall be applied in accordance with the manufacturer's instructions.

6.3 Construction Depths and Layer Thickness

Table 1: Flexible Construction

<table>
<thead>
<tr>
<th>Construction Layer</th>
<th>Min. Thickness of Layer (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6mm size dense surface course</td>
<td>20</td>
</tr>
<tr>
<td>20mm size dense binder course</td>
<td>60</td>
</tr>
<tr>
<td>Type 1 Sub-base</td>
<td>100</td>
</tr>
<tr>
<td>Total construction depth</td>
<td>180</td>
</tr>
</tbody>
</table>
6. Footway and Footpath Construction (Cont'd)

6.3 Construction Depths and Layer Thickness (Cont.)

Table 2: Flag Paved Surface

<table>
<thead>
<tr>
<th>Material</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-cast concrete flags</td>
<td>63</td>
</tr>
<tr>
<td>Sand Laying course</td>
<td>25</td>
</tr>
<tr>
<td>Type 1 Sub-base</td>
<td>200</td>
</tr>
<tr>
<td>Total construction depth</td>
<td>288</td>
</tr>
</tbody>
</table>

Note: Where the sub-grade is particularly weak the engineer may require the sub-base thickness to be increased or, if the foundation is in a poorly drained fine granular soil (e.g. silt or silty fine sand), a fabric filter sheet to be laid on the foundation prior to placing the sub-base layer.

6.4 Sub-base Material

The sub-base shall be Type 1 Sub-base as 5.4.

6.5 Laying Sub-base

The sub-base shall be constructed in the manner specified in Clause 5.5 except:

(a) Compaction shall be carried out with a roller weighing not less than 2.5 tonnes.
(b) The thickness of layer after compaction shall be not less than 100mm.
(c) The surface of the sub-base shall be within +0 -20mm of the specified level.

6.6 Binder Course Material

The binder course shall consist of 20mm size dense binder course to BS EN 13108 with 100/150 or 160/220 pen bitumen.

6.7 Laying Binder Course

1. The sub-base surface shall be clean and free from standing water.
2. The material shall be covered with tarpaulins whilst being delivered and whilst stockpiled on site.
3. The material shall be compacted by rolling with a 2.5 tonne roller or approved vibrating roller until subsequent passes result in no further roller marks.
4. Joints shall be treated in such a way as to ensure adequate compaction and bonding.
5. The finished surface shall be within +0 or -6mm from the true surface level.

6.8 Flexible Surface Course Material

Flexible surface course shall consist of the following types of material to be determined by the Engineer:

1. The standard recommendation is 6mm size dense surface course to BS EN 13108: Part 1 with 100/150 pen bitumen. However, where thought appropriate a 4mm size Fine Surface Course can be substituted.
2. Wherever practical the surface and binder course layers should be machine laid to improve both durability and long-term strength.
3. Any sections of surfacing to be designated for use as cycle routes shall incorporate hardstone crushed rock coarse aggregate with a minimum PSV of 55 in surface course(s).
4. On rural cycle routes the finished surface should be surface dressed to increase the skid resistance and to prevent the formation of hoar frost.

6.9 Laying Flexible Surface Course

1. The binder course surface shall be clean and free from standing water.
2. If necessary due to settlement or to correct surface profile a separate regulating course of surface course material shall be laid to bring the surface to within the required tolerances and rolled.
6.  Footway and Footpath Construction (Cont'd)

6.9  Laying Flexible Surface Course (Cont.)

3.  If the binder course is dry and dusty or the binder has stripped an appropriate tack coat emulsion shall be applied by spraying with a fine mist spray at a rate of 0.35 -0.55 litres/m² all as Clause 5.9.

4.  The start and finish of the surface course and all construction joints shall be properly 'keyed-in' to the adjacent surface.

5.  The material shall be covered with tarpaulins during delivery and whilst stockpiled on site.

6.  The surface course material shall be spread and compacted evenly to the required profile to a layer thickness of 20mm.

7.  The material shall be compacted by rolling with a 2.5 tonne roller or approved vibrating roller until all roller marks have been removed from the surface.

8.  The finished surface shall be within +0 or -6mm of true surface profile. The finished surface shall be 3 - 6mm above any kerb or channel block or gully frame, or edging if the surface falls towards the edging.

6.10 Flags and Block Paving

Flags and block paving shall be used only where heavy pedestrian traffic is expected or when justified in particular circumstances and their use shall be subject to the prior agreement of the Engineer. No flagged areas will be permitted for vehicle use.

Where imported flags are approved for use Lancashire County Council will require additional stocks to cover breakages. Imported flags can be more susceptible to staining, particularly from fats and sugars, so contractors should consider the choice of material carefully.

Where permitted, the materials shall be as follows:

1. Precast concrete flags 63mm thick, hydraulically pressed and complying with BSEN 1339

2. Small element precast concrete paving flags 70mm thick and 450mm x 450mm or smaller.

3. Block pavers shall be 80mm nominal thickness either concrete or clay rectangular blocks with chamfered edges as described in 5.13. Where over-running by vehicles is unlikely the block thickness may be reduced to 65mm.

4. Natural stone flags as agreed with the Engineer.

6.11 Laying of Paved Areas

1. Flags shall be laid to the required crossfalls and to 150mm or 300mm bond with the longer sides of the flags at right angles to the kerb unless otherwise specified. On circular work where the radius is 12m or less all flags shall be radially cut on both edges to the required line.

2. Flags shall be laid in accordance with BS7533: Part 4.

3. Block paving shall be laid in accordance with BS7533: Part 3.

6.12 Laying Course

1. Precast concrete flags larger than 450mm x 450mm shall be bedded on a laying course of 3:1 sand cement mortar 25mm thick.

2. Small element concrete paving flags 450mm x 450mm or smaller shall be bedded on a laying course of sand 30mm thick to BS7533: Part 4.

3. Block paving shall be bedded on a laying course of Category III bedding sand 50mm thick to BS7533: Part 3.
7. Kerbing and Edging

7.1 Precast Concrete Kerbs Channels and Edgings

1. Precast concrete kerbs channels and edgings shall be to BSEN 1339 in pressed concrete with the coarse aggregate having a 10% fines value not less than 120kN.

2. Kerbs shall be 125mm x 255mm half battered (12½o). Where a grass verge lies directly behind the kerb line, the Engineer may require 125mm x 255 mm 45o splayed kerbs.

3. Bullnose kerbs at domestic vehicle crossings and pedestrian crossings shall be 125mm x 150mm.

4. Special dropper (taper) kerbs shall be used to reduce the kerb face for crossings on straight runs.

5. The correct radius kerb shall be used for all radii of 12m or less.

6. PC concrete channels 230mm x 75mm shall be used in conjunction with kerbs on lengths where in the opinion of the Engineer longitudinal falls are inadequate for satisfactory natural drainage. The channels to be bedded on mix ST1 concrete 225mm thick. False falls shall be created along the channel by reducing the kerb height to 75mm at summits and increasing the height to 125mm at valleys.

7. Edgings shall be 50mm x 200mm pressed concrete flat topped square section.

7.2 Kerb Foundations

1. All kerbs shall be set on a bed 275mm wide x 150mm deep of cast insitu mix ST1 concrete.

2. Immediately after laying, kerbs shall be backed and/or haunched with mix ST1 concrete in accordance with Appendix 5.

3. Kerb bed and haunching concrete shall be adequately compacted.

7.3 Laying Edgings

The 50mm x 200mm precast concrete footway edgings to Clause 7.1.7 shall be laid on edge on a bed of mix ST1 concrete 75mm thick, true to the line and levels of the footway and shall be haunched at the back with 100mm concrete within 50mm of the top and at the front with 50mm concrete to within 75mm of the top in accordance with Appendix 5.

7.4 Kerb and Edging Lines

1. Kerb and edging lines shall be properly set out with road pins and string lines to the lines and levels given on the approved drawings.

2. The kerbs and edgings shall be laid accurately to these lines and fine adjustments made so that a smooth flowing alignment is achieved free from sudden deviations or imperfections within a tolerance of +13mm to the satisfaction of the Engineer.

3. Kerb upstand shall be between 100mm and 125mm on completion as required by the Engineer.

4. The surface level of kerbs and edgings shall not deviate from the design level by more than +6mm, nor shall the longitudinal surface regularity deviate by more than 3mm in 3m when checked with a 3mm straight edge.

7.5 Dropped Kerbs

1. Dropped kerbs shall be provided at vehicular crossings and pedestrian crossing places including junctions.

2. A domestic vehicular crossing on the straight or radius over 12m (Appendix 4) shall consist of:

   (a) A taper/dropped kerb for 125mm x 255mm half (or full) battered kerbs.
   (b) A minimum of four 125mm x 150mm bullnose kerbs laid to give a 25mm face.
   (c) A taper/dropped kerb.

3. A pedestrian crossing on the straight or radius over 12m shall be as above but with two bullnose kerbs with 12mm face.
7. Kerbing and Edging (Cont'd)

7.5 Dropped Kerbs (Cont.)

4. At authorised crossings, such as pelicans or signals with a pedestrian phase, tactile surfacing as described in the Code of Practice on Mobility must be provided in conjunction with flush kerbs.

7.6 Special Edgings

Natural setts, granite cubes, natural stone kerbs, engineering brick or concrete blocks will be considered as alternatives in certain cases to precast concrete kerbs. In all cases the edgings will be embedded for at least 2/3 of their depth minimum 75mm in mix ST1 concrete.
8. Verges and Tree Planting

8.1 Verges and Grassed Areas

1. Grassed areas shall be prepared by clearing the area of all rubbish, bricks, stones and breaking any hard ground by hand forking or harrowing or rotovating so that the prepared area is 150mm below the proposed finished level.

2. Approved topsoil shall be spread and lightly rolled to a finished thickness of 150mm for seeding and 100mm for turfing.

3. The topsoil shall be fertilised by evenly spreading the following fertiliser at a rate of 50kg to 650m².

   The fertiliser shall contain not less than:
   
   10% Nitrogen
   15% Phosphoric acid
   10% Potash

4. Where the area is to be turfed, turves shall comply with BS3969. They shall be laid to bond and tamped into the topsoil bed. On banks turves shall be laid diagonally and if necessary pegged with wooden pegs flush with the surface.

   The soil level shall finish 12mm above surrounding pavements and kerbs and the whole area shall not fall below this level.

   Precast concrete edgings as described in Clause 7.1.7 shall be laid between the footway and the grass verge.

5. Where the area is to be seeded special low-maintenance highway seed shall be used and spread at a rate of 1kg to 32m².

   The seed shall contain:
   
   80% Creeping Red Fescue
   10% Chewings Fescue
   10% Brown Top

   The seed shall be lightly raked and rolled into the soil.

6. Any areas where seed fails to germinate within one month of seeding shall be raked and re-seeded.

8.2 Planting

1. Trees shall not be planted in highway land unless special arrangements have been agreed with the Engineer.

2. Advice on other planting is given in the Lancashire County Council Residential Road Design Guide.
<table>
<thead>
<tr>
<th>Scientific name</th>
<th>Common name</th>
<th>Location / Landscape Type</th>
<th>Local conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agrostis capillaris</td>
<td>Common Bent</td>
<td>Bowland &amp; East Lancs.</td>
<td>Shade</td>
</tr>
<tr>
<td>Anthoxanthum odoratum</td>
<td>Sweet Vernal-grass</td>
<td>Upland &amp; moorland</td>
<td>Soil</td>
</tr>
<tr>
<td>Brachypodium sylvaticum</td>
<td>False Brome</td>
<td>Lowest (within 1km of coast)</td>
<td></td>
</tr>
<tr>
<td>Briza media</td>
<td>Quaking grass</td>
<td>Limestone areas -</td>
<td>Hydrology</td>
</tr>
<tr>
<td>Cynosurus cristatus</td>
<td>Crested dog's-tail</td>
<td>Silvertake, Warton and</td>
<td></td>
</tr>
<tr>
<td>Deschampsia flexuosa</td>
<td>Wavy-hair grass</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Festuca ovina</td>
<td>Sheep's fescue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Festuca rubra ssp. rubra</td>
<td>Red fescue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Achillea millefolium</td>
<td>Yarrow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ajuga reptans</td>
<td>Bugle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alliaria petiolata</td>
<td>Garlic mustard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caltha palustris</td>
<td>Marsh marigold</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Campanula rotundifolia</td>
<td>Harebell</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carex flacca</td>
<td>Glauces sedge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Centaurea nigra</td>
<td>Common knapweed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conopodium majus</td>
<td>Pignut</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daucus carota</td>
<td>Wild Carrot</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digitalis purpurea</td>
<td>Foxglove</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filipendula ulmaria</td>
<td>Meadow sweet</td>
<td></td>
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<tr>
<td>Galium saxatile</td>
<td>Heath Bedstraw</td>
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<tr>
<td>Galium verum</td>
<td>Lady's Bedstraw</td>
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<tr>
<td>Geranium pratense</td>
<td>Meadow crane's-bill</td>
<td></td>
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<tr>
<td>Geum rivale</td>
<td>Water avens</td>
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<td></td>
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<tr>
<td>Geum urbanum</td>
<td>Wood Avens</td>
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<tr>
<td>Hypericum perforatum</td>
<td>Perforate St. John's-wort</td>
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<tr>
<td>Hypericum tetrapterum</td>
<td>Square-stalked St. John's-wort</td>
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<tr>
<td>Knautia arvensis</td>
<td>Field Scabious</td>
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<tr>
<td>Lathyrus pratensis</td>
<td>Meadow vetching</td>
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<tr>
<td>Leontodon autumnalis</td>
<td>Autumn Hawkbit</td>
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<td></td>
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<tr>
<td>Leontodon hispidus</td>
<td>Rough Hawkbit</td>
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<tr>
<td>Leucanthemum vulgare</td>
<td>Oxeye daisy</td>
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<tr>
<td>Lotus corniculatus</td>
<td>Bird's-foot-trefoil</td>
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<tr>
<td>Lotus pedunculatus</td>
<td>Greater Bird's-foot-trefoil</td>
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<tr>
<td>Lychnis flos-cuculi</td>
<td>Ragged robin</td>
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<tr>
<td>Lythrum salicaria</td>
<td>Purple Loosestrife</td>
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<tr>
<td>Mentha aquatica</td>
<td>Water mint</td>
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<td>Papaver rhoesae</td>
<td>Common Poppy</td>
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<td>Plantago lanceolata</td>
<td>Ribwort plantain</td>
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<td>Potentilla erecta</td>
<td>Tormentil</td>
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<td>Primula veris</td>
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<td>Primula vulgaris</td>
<td>Primrose</td>
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<td>Prunella vulgaris</td>
<td>Self heal</td>
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<td>Ranunculus acris</td>
<td>Meadow buttercup</td>
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<td>Rhinanthus minor</td>
<td>Yellow Rattle</td>
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<td>Rumex acetosa</td>
<td>Common Sorrel</td>
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<tr>
<td>Rumex acetosella</td>
<td>Sheep's Sorrel</td>
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<td>Sanguisorba officinalis</td>
<td>Great burnet</td>
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<td>Scrophularia auriculata</td>
<td>Water figwort</td>
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<td>Silene dioica</td>
<td>Red campion</td>
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<td>Stachys officinalis</td>
<td>Betony</td>
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<td>Stachys sylvatica</td>
<td>Hedge Woundwort</td>
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<td>Stellaria graminea</td>
<td>Lesser stitchwort</td>
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<tr>
<td>Stellaria holostea</td>
<td>Greater stitchwort</td>
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<tr>
<td>Succisa pratensis</td>
<td>Devil's-bit Scabious</td>
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<tr>
<td>Veronica chamaedris</td>
<td>Germander Speedwell</td>
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<tr>
<td>Vicia cracca</td>
<td>Tufted vetch</td>
<td></td>
<td></td>
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<tr>
<td>Vicia sepium</td>
<td>Bush Vetch</td>
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</tbody>
</table>
9. Street Lighting

9.1 Nature and Extent of Work
1. The Developer shall include for the supply and delivery to site of all equipment detailed hereafter, the erection, wiring, testing and commissioning of the installation and leaving it in working order to the satisfaction of the Engineer.

2. The Developer shall include for the cost of, and arrange for the provision of, underground electricity service connections. He shall provide all necessary ducts, etc and such facilities as may be required by the Distribution Network Operator (DNO) to carry out their inspections and tests.

3. The Developer shall complete the Energy Liability Acceptance Form (ELA) required by the DNO. In so doing the Developer accepts responsibility for the payment of energy charges from the date of connection until the date of taking over by the Engineer. (See Clause 9.11)

9.2 Provision and Commissioning by District Council
Should the Developer require the County Council to carry out the provision and commissioning of the street lighting installation at a site within the County Council’s area, this may, at the discretion of the Engineer, be arranged against an official order issued by the Developer to the County Council which shall include for the provision of service connections by the DNO.

9.3 Standard and Type of Lighting
In order that the Engineer can specify the standard and type of lighting required on a development, the Developer shall

(a) Supply two copies of the site plan to the Engineer who will design the lighting scheme and return the plans marked up to indicate the approximate locations of the lighting columns (and wall brackets where appropriate) together with two copies of completed Schedule A (Appendix 6 sheet 2) (see Clause 9.4) detailing the type of equipment to be provided and installed. The Developer will be required to reimburse the County Council for the cost of the time spent by the Engineer in designing the scheme and for which an estimate can, if requested, be given in advance. Alternatively, the Developer shall

(b) Supply two copies of the site plan for the use of the Engineer who will return one copy together with completed Schedule A indicating the standard of lighting required and the type of equipment to be used. The Developer must then arrange for the lighting scheme to be designed, in accordance with the current Lancashire County Council Code of Practice on Road Lighting and Highway Electrical Systems Design, and submit two copies of the proposed lighting layout plan for the formal approval of the Engineer.

9.4 Lighting Equipment
1. Lighting equipment shall be in accordance with the current Lancashire County Council List of Approved Equipment.

2. The Developer shall provide and install equipment detailed by the Engineer on Schedule A.

3. Where, in Mews Courts and Housing Squares, lanterns are to be mounted on wall brackets, the bracket and conduit arrangements for building into structures shall be as shown in fig. 1, (Appendix 6 sheet 1).

9.5 Approval of Column and Wall Bracket Positions on Site
The Developer shall obtain the approval of the Engineer with regard to the precise positions of the lighting columns, wall brackets and other electrical equipment on site prior to the commencement of erection.

9.6 Locations of Columns
1. Columns, unless otherwise determined by the Engineer, shall be located:-

(a) at the rear of the footway (where no verge is proposed),

(b) at the rear of the grass verge (where a verge is provided between footway and carriageway),
9. Street Lighting (Cont’d)

9.6 Locations of Columns (Cont.)
1. (c) on developments utilising 'car ways'(Type 4B roads) and joint use cul-de-sacs (Type 5 roads) where sited in the adopted service strip or on an adopted footway where it intercepts the shared carriageway surface, 0.5 metres back from the shared surface edging. (See Appendix 1).

2. The door of the column shall face the footway, or the carriageway where there is no separate footway.

9.7 Installation
1. Compliance with Regulations.

All equipment shall be installed in full compliance with the current edition of:

(a) BS7671 Institution of Electrical Engineers (IEE) Regulations for Electrical Installation;

(b) Institution of Lighting Engineers (ILE) Code of Practice for Electrical Safety in Public Lighting Operations;

(c) The Electrical Supply Regulations;

(d) The Electricity at Work Regulations.

2. Electricity Service Connections
The Developer shall instruct the DNO and shall pay the cost of providing an underground service to each lighting column.

The developer shall inform the County Council if it intends to use the services of an Independent Distribution Network Operator (IDNO).

All cables will normally be DNO cables forming part of the DNO mains network on completion. Exceptionally, for illuminated traffic signs and bollards and for lighting columns on footpaths remote from DNO mains, isolatable cables may be considered which will become the responsibility of the Highway Authority on adoption.

Such cables shall be subject to a specific design and specification agreed with the County Council in every case.

3. Equipment Erection
Equipment erection shall be in accordance with the current Lancashire County Council Special Details - Electrical.

4. Damage to Services
The Developer will be held responsible for any damage to services or underground works or to any overhead services or works caused during, or in consequence of, any part of the installation work.

5. Work on Existing Highways
See Clauses 1.6 to 1.9.

6. Reinstatement
The Developer shall be responsible for all permanent reinstatements including those of excavations due to the provision of electricity services (See also Clause 1.10).

7. Removal of Existing Equipment
The Developer shall bear the cost of removing or re-siting any existing lighting equipment affected by the Development. The Developer shall place an order with the District or County Council as appropriate covering the disconnection, removal, resiting, reconnection and commissioning of this equipment and the provision of any additional equipment necessitated on existing highways by the development.
9. **Street Lighting (Cont’d)**

<table>
<thead>
<tr>
<th>9.7 Installation (Cont.)</th>
<th>9. Numbering of columns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Each Column, illuminated sign and bollard shall be numbered in accordance with instructions given by the Engineer.</td>
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<thead>
<tr>
<th>9.8 Lightning Columns</th>
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<tbody>
<tr>
<td>Lighting Columns shall be in accordance with the current Lancashire County Council Lighting Column Specification.</td>
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<tr>
<th>9.9 Posts for Traffic Signs</th>
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<tbody>
<tr>
<td>Posts for Traffic Signs shall be in accordance with the current Lancashire County Council Posts for Traffic Signs Specification.</td>
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<tr>
<th>9.10 Inspection</th>
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<tr>
<td>The works shall be available for inspection during all reasonable hours throughout the construction period (See also Clause 1.5).</td>
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<tr>
<th>9.11 Maintenance</th>
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<tbody>
<tr>
<td>1. The Engineer will take over commissioned lighting units for operation and maintenance in advance of completion of the roadworks, provided that</td>
</tr>
<tr>
<td>(i) the Engineer is advised within 28 days of the commissioning date of each unit;</td>
</tr>
<tr>
<td>(ii) the installation is found, on inspection, to be satisfactory in all respects;</td>
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<tr>
<td>(iii) The developer provides a Test Certificate in accordance with BS7671 for each unit;</td>
</tr>
<tr>
<td>(iv) the Developer accepts responsibility for the cost of any necessary repairs or replacements arising from faulty workmanship, damage, or from the failure of materials, until the roadworks are adopted;</td>
</tr>
<tr>
<td>(v) the lighting units commissioned and offered for maintenance form a continuous lighting system with existing public roads and, within the development, illuminate complete lengths of road between junctions or to the boundaries of approved phases of the development, or entire cul-de-sacs.</td>
</tr>
<tr>
<td>(vi) completed Lighting Inventories as Appendix 6 Sheet 3 have been submitted to and accepted by the Engineer.</td>
</tr>
</tbody>
</table>

| 2. ‘Taking over’ for the purposes of operation and maintenance by the Engineer shall entail responsibility for - |
| (i) payment of energy charges to the DNO from the date of taking over; |
| (Note: Energy charges from the date of connection to the date of taking over are the responsibility of the Developer) |
| (ii) routine cleaning, lamp replacement and inspection provided that easy access is available for maintenance vehicles and/or personnel. |