Lancashire County Council

Estate Road Specification

January 2023

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Glossary of abbreviations

AC	Asphalt Concrete
AGS	Association of Geotechnical & Geotechnical Specialists
AAV	Aggregate Abrasion Value
AIP	Approval in Principle
BS	British Standard
BS EN	Designated British Standard version of a European Standard that has been adopted by a regional European standardising body
BS EN ISO	An International Standard, adopted at European level, released in British English, by the British Standards Institute
CBGM	Cement Bound Granular Mixture
CBR	California Bearing Ratio
CE	Conformity with European health, safety, and environmental protection standard
CRBM	Cold Recycled Bound Material
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
DNO	Distribution Network Operator
ELA	Energy Liability Acceptance
EU	European Union
FWD	Falling Weight Deflectometer
HBM	Hydraulically Bound Mixture
HRA	Hot Rolled Asphalt
IDNO	Independent Distribution Network Operator
IET	Institution of Engineering and Technology
ILP	Institution of Lighting Professionals
ISO	International Organization for Standardization
LCC	Lancashire County Council
LLFA	Lead Local Flood Authority
LRQA	Lloyd's Register Quality Assurance
LTN	Local Transport Note
LWD	Lightweight Deflectometer
MCHW	Manual of Contract Documents for Highway Works
MPa	Megapascals
msa	Million Standard Axles
PD	Published Document (normally a guidance document published by the British Standards Institute)
PPV	Polished Paver Value
PSV	Polished Stone Value
PTR	Pneumatic Tyred Roller
sa	standard axles
SMA	Stone Mastic Asphalt
SROH	Specification for the Reinstatement of Openings in Highways
ST	Standardised Prescribed Concrete
TRL	Transport Research Laboratory
UKCA	United Kingdom Conformity Assessed

1 General

1.1 Specification

This Specification (Specification) is based on extracts from the National Highways Specification for Highway Works and the Code of Practice for Highway Maintenance Management, together with additional Lancashire County Council (LCC) 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 2.9 then the Developer shall obtain from the Director of Highways and Transport the current requirements for such structures which include not only the Specification, but procedures for obtaining the approval of the Director of Highways and Transport 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 BS 6100; sub-section Highway Engineering. The term 'The Engineer' means the relevant Person or Persons working on behalf of the Director of Highways and Transport. Types of highway and parts of highway are as defined in Highways Act 1980. Estate road carriageway descriptions for the purpose of carriageway pavement design are indicative and relate to the anticipated traffic levels as indicated in the relevant tables within section 5

1.3 Quality Assurance and Standards

Unless otherwise specified all materials shall comply with the current edition of the appropriate British or Designated 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 Designated European 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 United Kingdom Construction Product Regulations, as per Statutory Instrument No. 465 The Construction products (Amendment etc.) (Exit) Regulations 2019. For products covered by a UK Designated standard (formerly a European harmonised standard) then a Declaration of Performance and a UK Conformity Assessment (UKCA) marking is required.

Construction products tested and passing a conformity assessment to EU Construction Products Regulation 305/2011 and those covered by a European harmonised standard and carrying a CE mark will be accepted until 31st December 2024.

1.4 Adoption

This Specification shall apply to any carriageway, footway, 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 as or as part of vehicular highway for maintenance at public expense. Advice on the requirements and procedures for adoption is given in the LCC residential road design guide "Creating Civilised Streets".

Any departure from the Specification will require the consent of the Head of Service-Asset Management

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 9.11, together with as-built drawings and health and safety file

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

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 the maintenance certificate (Part 2), as certified in writing, by the Engineer.

The Developer shall restore to the satisfaction of the Engineer, any highways, 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, inclusive of drainage, 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 Works on existing Highways

Any works to existing adopted highways must be carried out under a Section 278 Agreement of the Highways Act 1980 or such other appropriate Highways Act 1980 consent or licence.

Where work must 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. Note- a Temporary Traffic Regulation Order may be required.

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, in accordance with Chapter 8 of the Traffic Signs Manual and Safety at Street Works and Road Works: A Code of Practice. Reference shall be made to DfT guidance found within "Inclusive 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. Any excavation in and reinstatement of existing highway surfaces shall be planned and undertaken in accordance with the requirements of 'The Lancashire Permit Scheme for Road & Street Activities'. This includes the submission and approval of a PA1 form for road space booking.

1.7 Mud, debris, and dust on the public highway

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 their public highways 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 use of the highway

Existing public highways shall not be used as sites for stockpiling and storing plant, vehicles, use of the 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 work, 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.

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 or City Council.

1.12 Statutory Undertakers Equipment

Layout details and positioning of statutory undertakers' equipment shall be in accordance with 'Volume 1 – Street Works UK guidance on the positioning and colour coding of underground utilities' apparatus' and 'Volume 2 – Street Works UK guidelines on the positioning of underground utilities apparatus for new development sites'.

1.13 Design Criteria

Development proposals shall satisfy the principles of the LCC residential road design guide "Creating Civilised Streets" and Manual for Streets.

Cycling infrastructure shall be designed in accordance with 'LTN1/20 Cycle Infrastructure Design'.

Reference shall be made to Manual for Streets 2 'Wider Application of the Principles' for details of widths, alignments, gradients, crossfalls and intersections for all traditional housing layouts. Manual for Streets 3, when released shall supersede as necessary any requirements within the proceeding versions of the Manual for Streets.

The Developer must adhere to the Department for Transport advice on mobility found within "Inclusive 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 LCC Code of Practice on Road Lighting and Highway Electrical Systems Design and any specific design requirements of the Engineer.

1.14 Supervision

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

1.15 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 on Highway Land and shall permit the taking up and removal of any part or parts for analysis and testing.

1.16 Highway Structures

Highway structures include bridges, culverts and retaining walls, where they are defined as:

Bridges or culverts having a span of 1.5 metres or more, 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.

In the above definition span refers to the distance between centre of supports and not the clear distance between supports. In some instances, it is difficult to obtain the actual span (e.g., structures which are part of long culverted watercourses). In these cases, the following clear spans shall be considered as equivalent to a 1.5 metre span.

Construction	Clear Span (metres)
Masonry arches or slabs on masonry abutments	1.2
Reinforced concrete boxes	1.3
Concrete pipes	1.4

Table 1 - Structures spans

Retaining walls are defined as:

- Walls irrespective of height supporting or necessary for the support of highways and
- Walls irrespective of height supporting land or property above highways and within 3.65 metres of the edge of the highway.

Highway Structures will be subject to Approval in Principle (AIP) agreements, commuted sums, and associated easements in addition to a Section 38 Agreement of the Highways Act 1980 and Structures Agreement in connection with their adoption.

2 Cement, 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 BS 5328 and may be purchased from an approved ready-mixed concrete supplier or site batched and mixed.

2.2 Materials

Cement for Concrete Cement shall comply with BS EN 197-1:2011 and shall comprise ordinary portland cement to BS197-1:2011 combined with ground granulated blast furnace slag to BS EN 15167-1:2006 or combined with pulverised-fuel ash to BS EN 450-1:2012 as permitted in BS 8500: -2:2015 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:

- The method of transport and containers to be used.
- The method of discharge and storage.

Aggregate for concrete shall be obtained from sources to be approved by the Engineer and shall comply with BS EN 12620:2002.

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 BS EN 1008, water being sampled and tested by a testing organisation approved by the Engineer.

2.3 Mortar

Cement mortar shall consist of Ordinary Portland Cement complying with BS EN 197-1:2011 and sand complying with BS EN 13139:2002 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.

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.

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, sulphate resisting Portland cement shall be used.

2.5 Steel

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

Type	BS
Hot Rolled Steel Bars	4449 (B500B or C)
Cold Worked Steel Bars	4449 (B500B or C)
Hard Drawn Mild Steel Wire	4482
Steel Fabric	4483

Table 2 - British Standards for steel reinforcement

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 Reinforcement 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 scheme specific requirements may apply to structures (See Clause 1.16).

3 Highway Drainage

3.1 General

This section of the Specification is applicable to highway drains. For the construction of sewers, advice should be sought from United Utilities or other water and sewerage authority as appropriate.

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

Proposals to divert, modify or culvert any watercourse passing through the Developer's site shall have ordinary watercourse consent from the LCC Flood Risk Management Team as the Lead Local Flood Authority (LLFA) and/or an Environmental Permit for Flood Risk Activities from the Environment Agency for works to main rivers. This includes works within 8 meters from the top of the banks of any watercourse. To find more information and apply:

- Environmental Permit for flood risk activities on main rivers: Flood risk activities: environmental permits - GOV.UK (www.gov.uk)
- Ordinary Watercourse Consent: Alterations to a watercourse - Lancashire County Council

The Highway Authority will require evidence that the required consents and/or permits have been acquired from the relevant regulatory authority, which **must** be acquired prior to any works taking place. Failure to provide this evidence may result in the highway being unadopted.

Highway drains shall be 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 drains 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

Where deemed necessary by the Engineer, sub-soil drains shall be used to prevent drainage 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. 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 and outfall into the surface-water drainage system.

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 Engineers retention, sub-soil, cut-off, formation, and pond drains shall be filled with an approved free draining (Type B) material. The LA Value shall be more than 50kN when tested in accordance with BS EN 13242:2002. The material shall also comply with the following requirements:

- Grading

BS Sieve Size	Percentage passing by mass
80mm	100
63mm	98 – 100
40mm	80 – 99
20mm	0 – 20
10mm	0 - 5

Table 3 - Land drainage medium grading

- The material shall have a water-soluble sulphate content of less than 0.38% of sulphate (as SO_3) when tested on accordance with BS EN 1744-1:2009, Clause10.

3.3 Sewers, drains and apparatus

When excavating within a highway, drains, sewers, cables and other highway apparatus and apparatus together with statutory undertakers' apparatus must be located by hand in advance of machine excavation in accordance with HSG47.

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.

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

Clay pipes and fittings shall comply in every respect with BS EN 295:2013 and shall be supplied with an approved spigot and socket flexible joint sealed with a rubber ring. Manufacturer's 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.

Concrete pipes and fittings shall comply in every respect with BS 5911:2021 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 BS 5911:2021 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.

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 BS 4962:1989, and a resistance to impact complying with BS 4962:1989 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

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 13242:2002. The material shall also comply with the following requirements:

- Grading (PD 6682 – 1:2009 Table C.1 10/20 single-sized)

BS Sieve Size	Percentage passing by mass
40mm	100
31.5mm	98 – 100
20mm	85 – 99
10mm	0 – 20
4mm	0 - 5

Table 4 - Pipe granular bedding material grading

- The material to be used for bedding and surround for concrete pipes shall have a water-soluble sulphate content of less than 0.38% of sulphate (as SO3) when tested in accordance with BS EN 1744-1:2009, Clause 10.

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

3.6 Manhole covers and frames

Manhole covers and frames shall have a minimum 600mm square clear opening and shall and frames comply with BS EN 124:2015 and shall be marked with the BS Kitemark or Lloyd's Register Quality Assurance (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.

Manhole covers and frames shall be bedded on polyester resin mortar to Clause 2.3. They shall be accurately set for level and position as necessary on precast concrete adjusting units conforming to BS EN 1917:2002 and BS 5911-3:2010.

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 BS EN 622-4:2019, or other similar material approved by the Engineer.

3.8 Puddle Clay

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 topsoil, 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 BS 1377, greater than 30%.

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.

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 Setting Blocks 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

Gully chambers for carriageways shall be:

- Pre-cast concrete gully and cover slabs to BS 5911-6. 450mm diameter x 760mm deep with 150mm diameter outlet, complete with rodding eye stopper.
- In-situ cast gully formed by plastic rising liner with minimum thickness of 150mm ST4 concrete bed and surround. ST concrete to MCHW (Manual of Contract Documents for Highway Works) Clause 2602.

Mortar bedding to comply with MCHW Clause 507.

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

3.11 Gully Grates and Frames

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

Gully gratings and frames shall comply with BS EN 124:2015 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 1020cm2.

The grating and frame shall be capable of supporting without fracture an additional test load of 400kN with the 300mm x 235mm test load bearing block placed at any position wholly within the perimeter of the grating section

Gully grates and frames for footways shall be 225mm square, hinged to BS EN 124:2015.

Gratings to be raised on precast concrete adjusting units conforming to BS EN 1917:2002 and BS 5911-3:2010.

3.12 Excavation for Pipelines and Manholes

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 Manholes battered sides.

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.

The width of trenches shall be a maximum of the external diameter of the pipe +600mm, and a minimum of the external diameter of the pipe +300mm.

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

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 Excavations

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 BS 6031:2009.

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, overbreak and the trench, or pit bottom to become unsuitable, all the loose, disturbed, or unsuitable material slips shall be removed, the excavation trimmed back to vertical faces and the excess excavation treated as follows:

- 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 as per Clause 3.5 may be used as an alternative.

- 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.
- Where the pipe or manhole is not to have a concrete protection the excess width of over-break and excavation shall be filled with mix ST2 concrete, medium workability, or filled in the slip's same manner as the trench or pit of which the over-break is part, as directed by the Engineer.
- 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 reuse

Excavated material for re-use as fill shall be protected from weathering action or damage which if left unprotected would cause an increase or decrease in the natural moisture content or physical deterioration. The measures which should be undertaken for protection are:

- 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.
- Excavated materials for re-use must not be allowed to become contaminated with unsuitable material.
- Excavated material for re-use must be stockpiled clear of any water channel, or low spot in which water may collect.
- Excavated material must be stacked in a compact, ridged heap which will shed water.

3.16 Dewatering trenches and pits

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

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.

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 in addition to the required permissions from the Environment Agency, the Water and Sewerage company and the LCC Flood Risk Management Team as the LLFA, where such permissions are required. Under the Land Drainage Act 1991 (as amended by the Flood and Water Management Act 2010) the LLFA are responsible for regulating ordinary watercourses; this includes, for example, constructing a temporary or permanent structure in an ordinary watercourse. Further details of what requires ordinary watercourse consent can be found on our website:

https://www.lancashire.gov.uk/flooding/drains-and-sewers/alterations-to-a-watercourse/

Applicants should seek advice from the Environment Agency on water quality impacts and abstraction licenses associated with dewatering activities. Works to or within 8 meters of the top of the bank of a main river may require an environmental permit from the Environment Agency.

Discharge to public sewers may require permission from the relevant Water and Sewerage Company. Discharge to a highway drain will only be considered in exceptional circumstances and remains at the discretion of the highway authority. Evidence that the applicant has acquired all the relevant permissions will be required by the Highway Authority.

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.

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.

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

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.

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.

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

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:

- For pipe diameters 450mm and less, 500mm to 750mm.
- For pipe diameters greater than 450mm, 750mm to 1000mm.

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.

The thickness of the granular material below the barrel of the pipes shall be 1/6th of the external pipe diameter or 100mm, whichever is greater.

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.

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

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

- Concrete surround shall be provided for:
  - All pipes with less than 1.0m of cover under carriageways, footways, or or verges adjacent to them.
  - All pipes with over 6m of cover no matter where.
  - All pipes in highways where the Engineer requires a surround to be provided for engineering purposes.
  - All pipes in made up or filled ground.
  - All pipes in heading.

- Concrete bed and haunch shall be provided for all pipes with over 4.5m cover no matter where.

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

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 per MCHW Volume 3 – Highway Construction Details, F Series, Drawing F1, Detail Type Z.

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.

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

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 675mm to 1200mm diameter.
- 50mm for pipes greater than 1200mm diameter.

3.19 Jointing Pipes

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 450 fillet to the outer periphery of the socket.

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.

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.

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

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 culverts sewers, drains and culverts.

Before breaking into an existing sewer, drain or culvert, the Developer shall give notice of their intention and receive the required approval of the regulating Authority and the asset owner responsible for the sewer, drain or culvert. Any works, either permanent or temporary, within the banks of any ordinary watercourse which may alter or impede the flow of water, regardless of whether the watercourse is culverted or not, will require ordinary watercourse consent from the Lead Local Flood Authority. Consent must be obtained before starting any works to an ordinary watercourse, it cannot be issued retrospectively. Unconsented works within the highway may prevent adoption. An Environmental Permit for Flood Risk Activities from the Environment Agency for works to main rivers will be required if a culvert is classified as a main river.

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.

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 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.

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 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 more than 825mm diameter the junction is to be made good from the inside.

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 subsequently make good on completion to the satisfaction of the Engineer.

3.21 Manholes, Catchpits – General Requirements

Manholes and catchpits shall be constructed of precast concrete sections in accordance with the MCHW Volume 3 – Highway Construction Details, F Series. All manholes exceeding 4m in depth shall be designed to the Engineer's special requirements.

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

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

Channels and inverts shall be formed in prefabricated half-round channels bedded in mix ST4 concrete, medium workability, or formed in-situ in mix ST4 concrete, medium workability, which shall be made with sulphate-resisting cement where necessary. Inverts shall be carefully formed and where pipes of different radii enter or leave the manhole the inverts shall be semi-circular 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.

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 benching.

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.

Step irons complying with BS EN 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.

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

Precast concrete manholes shall be constructed of precast concrete sections in accordance with the MCHW Volume 3 – Highway Construction Details, F Series, F4-F7. The precast concrete manhole units shall comply with the requirements of BS5911 Part 3 and BS EN 1917.

On 75mm of concrete blinding mix ST2, medium workability, a 225mm thick, mix ST4, medium workability, in-situ 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 in-situ.

The limit of the mix ST4 medium workability concrete stooling shall be 50mm above the seating level of the bottom chamber ring.

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 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 cement mortar. Galvanised malleable iron step irons in accordance with Clause 3.21 shall be built in the manhole.

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

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

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.

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

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 3.26.2.

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

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.

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 in-situ raising piece shall be used to attain the correct level as.

3.25 Gully Connections

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

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

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.

3.26.1 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.

3.26.2 Backfilling of pits and around manholes

The backfill material shall consist of any one of the materials listed in Clause 3.26.3. 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 Clause 3.26.3 bullet 4 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 $6m^2$ 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 Clause 3.26.3 bullet 4 and at minor roads with Type 1 sub-base material as Clause 3.26.3, bullet 3

3.26.3 Types of fill material

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

- 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.
- 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.
- Type 1 sub-base material to Clause 5.4.3
- 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

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 1200mm 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.

3.30 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.

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

3.31 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.

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.

3.32 Smoke Test

Sealed and jointed pipes over 900mm diameter may be tested by means of the smoke test were 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.

3.33 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.

3.34 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.

3.35 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:

- Transport and Road Research Laboratory (TRL) - Road Note No. 35.
- Design Manual for Roads and Bridges.
- Transport Research Laboratory - Simplified tables of external loads on buried pipelines.
- Transport and Road Research Laboratory - A Guide to Design Loadings for Buried Rigid Pipes.
- Ciria – The SuDS Manual (C753).
- Ciria – Guidance on the construction of SuDS (C768).
- Ciria – Culvert, screen, and outfall manual (C768F).

3.36 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 Developers proposals.

3.37 Hydraulic Design

Highway drains shall be designed in accordance with the TRL Road Note 35 using the Design 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.

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

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.

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

Highway drains should normally be laid soffits level at manhole intersections.

3.38 Private connections to drainage systems intended for adoption by the Highway Authority

In line with County Council's Code of Practice for Highway Status and adoptions:

The County Council will normally be responsible only for those drains carrying surface water from the areas that are to be adopted. Gullies collecting water from private areas (roofs, drives, car parks etc.) should be drained to a surface water sewer (vested in the Water / Utility company) or to a separate private drainage system situated in land outside the highway. Only in exceptional circumstances will water from private areas be permitted to drain into a highway drain. This will require the express consent of the County Council.

Without such consent the Highway Authority will not accept private water into drainage systems under its adoption, any such drainage system proposed for adopted that includes private water will not be accepted.

It is considered that any such 'exceptional circumstances' should not occur in the design of Estates and other developments as there is sufficient opportunity in the planning of new developments to design them out. In addition, the Water Authority have a legal obligation to supply a sewerage connection when requested, as set out in Section 98 of the Water Industry Act 1991, and they also have the powers to maintain and adjust their apparatus in the highway in connection with their legal responsibilities as a utility company. The Highway Authority is not a statutory sewerage undertaker and has no legal powers (or duty) to accept third party surface water, whether by means of a pre-existing situation, new connection or on a temporary basis.

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:

- Peat, material from swamps, marshes, and bogs.
- Logs, stumps, and perishable material,
- Materials in a frozen condition,
- Wet clay and silt,
- Chemical and industrial organic waste,
- Materials susceptible to spontaneous combustion,
- 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 of the MCHW NG601, which outlines the accepted classification procedure for disposal of materials off site.

4.4 Filling material

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.

Filling materials shall be:

- Suitable excavated material being sub-soil materials accepted by the Engineer for use as fill,
- 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.
- Rock fill material, being quarried from a source approved by the Engineer, 125mm maximum size,
- 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.

- 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 63µm sieve.

4.5 Treatment of unsound ground – Rockfill/Hardcore

With the agreement of the Engineer rockfill/hardcore shall be placed:

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

Rockfill/hardcore shall be spread in layers not exceeding 400mm thick each adequately compacted until stabilisation is accomplished.

Where in the opinion of the Engineer, further excavation will result in extension of the soft area, the use of a non-woven geotextile membrane 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.
- Or where the highway is in cutting

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

4.7 Fill

Fill shall be suitable excavated material or granular filling material as described in Clause 4.4.

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.

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.

Suitable ground water drainage shall be provided at the toe of any embankment and must accepted by the Engineer.

Any fill which deteriorates during construction shall be removed.

4.8 Sub-formation

Where a sub-grade improvement (capping) layer is to be used, the surface of the embankment, preparation fill of the bottom of the excavation taken out below formation in cutting shall be trimmed to a tolerance of +20mm and -30mm immediately before the material is placed.

5 Road Pavements

5.1 General

Carriageways are generally constructed with bitumen bound, hydraulically bound, hydraulically and bitumen bound and block paving materials. Options for construction with each of these materials and combinations of are provided in this specification.

Footways and cycletracks within vehicular highway width are generally constructed with bitumen bound, hydraulically bound, hydraulically and bitumen bound, block paving and small element paving (slabs/flags) materials. Options for construction with each of these materials and combinations of are provided in this specification.

All materials and workmanship must be in accordance with the appropriate British Standard Specification and the relevant series and clauses of the National Highways MCHW current at the time of the appropriate agreement. Where available all materials must have a UKCA mark.

The amendments and additions to the specification included here are not exhaustive and it may therefore be necessary for additional appendices specific to the site in question to be prepared for approval, and inclusion in the relevant agreement.

The designs contained within this document are limited to roads carrying a maximum of 10 million standard axles (msa), roads carrying more than 10msa require a full pavement design in accordance with the Design Manual for Roads and Bridges (DMRB) must be undertaken, with the design traffic over a 40-year period to be agreed with LCC.

5.2 Site Investigation

Before the submission of any proposals a geotechnical site investigation must be completed to assess the following parameters that will inform the design:

- Disposal of surface water run-off:
- Depth to water table (or perched water table),
- Chemical contamination,
- Determination of suitable strata for soakaway discharges,
- Determination of suitable strata to delay discharge and conveyance, such as retention/detention ponds or swales,
- Interaction/impact on adjacent developments,
- Consultation with Environment Agency / Lead Local Flood Authority as appropriate.

Sub-soil drainage:

- Depth to water table (or perched water table),
- Potential of chemical attack to buried concrete pipes,
- Interaction/impact on adjacent developments.

Earthworks:

- Cutting or embankment fill slopes,
- Limits for earthworks acceptability/recycling of site won materials,
- Chemical contamination,
- Ground improvement of foundation soils,
- Interaction/impact on adjacent developments,

- Geotechnical certification for engineered slopes/reinforced structures.

Road Pavement Design:

- Short term subgrade surface modulus,
- Long term subgrade surface modulus,
- Frost susceptibility of sub-grade,
- Treatment of soft spots,
- Risk of differential settlement,
- Suitability of subgrade and site won soils for in-situ stabilisation,
- Shrinkage and consolidation potential of clays.

The geotechnical investigation must be carried out in accordance with 'Association of Geotechnical & Geotechnical Specialists (AGS) Guidelines for Good Practice in Geotechnical Ground Investigation'. The investigation should include a desk study followed by a ground investigation.

The desk study should consist of an initial desk study which should collect existing information as given in Clause 2.1.1.(7) of BS EN 1997 Part 2:2007 and any other additional information that is considered relevant. This should include a site inspection by a geotechnical Engineer.

5.3 Service ducts and pipework

Service ducts and pipework must, wherever practicable, be located outside of the road construction. Where this is not possible and service crossing must be installed prior to construction of the road and protected from damage.

5.4 Carriageway Pavement Foundations

5.4.1 Carriageway Pavement Foundation Design Thickness

The design subgrade California Bearing Ratio (CBR) shall be used in the pavement foundation design. The design subgrade CBR shall be determined as being equal to the lower of the short-term subgrade CBR and the long-term subgrade CBR.

The short-term subgrade CBR is that which is the estimated value during construction. The long-term subgrade CBR is the value when a state of equilibrium is reached under the pavement. The determination of the short-term and long-term subgrade CBR shall be carried out in accordance with BS 1377-9 and BS 1377-4, respectively.

The frequency of testing will be dependent upon the scale of development and the variability of the ground conditions found in the geotechnical investigation. However, a minimum of 10 tests per foundation area, with maximum spacings of 60m along each road lane applies.

Alternative methods (such as those detailed in MCHW Clause 882) for determining the short-term CBR may also be accepted subject to approval by the Engineer.

Any laboratory derived long-term CBR value that is less than 5% will normally require a capping layer (either in-situ stabilised, or material sourced and produced on site), as lower long-term CBR values are normally associated with lower short-term CBR values.

The pavement foundation shall be divided into characteristic sections of subgrade, each having a single design subgrade CBR. The characteristic sections should be based on the type of subgrade material and its condition.

The short-term subgrade CBR and long-term subgrade CBR shall be determined for each characteristic section of subgrade.

The presence of a high or perched water table (300 mm or less below formation level) can reduce subgrade stiffness, culminating in low subgrade surface modulus values at the time of construction. Guidance on determining subgrade surface modulus values in the presence of a high or perched water table is given in TRL Report LR1132 'The structural design of bituminous roads'.

For widening schemes, where the subgrade is consistent across the width of the existing carriageway and the proposed widening, use of the in situ long-term subgrade CBR of the subgrade below the existing carriageway may be used for design purposes.

For widening schemes, the depth at which the design subgrade CBR is determined may be dependent on any requirements to maintain drainage continuity between the existing carriageway and the proposed widening.

For each characteristic section of subgrade, the following shall be detailed:

- start and end chainage,
- short-term subgrade CBR,
- long-term subgrade CBR and,
- design subgrade CBR

Where the design subgrade CBR is lower 2.5%, improvement of the subgrade shall be undertaken. Subgrades with a design subgrade CBR is lower than 2.5% are unsuitable to support the construction of a pavement foundation.

Options for improvement of the subgrade include excavation and replacing between 500 to 1000 mm of the soft subgrade with granular fill and soil stabilisation.

The upper limit on design CBR for areas of improvement of the subgrade shall be 5%.

The short term CBR will need to be rechecked at the time of construction and where it is found to be lower than the design subgrade CBR, then action shall be taken by either effecting improvement of the subgrade or by reviewing the design subgrade CBR with a view to redesign using the lower value.

The foundation design requirements included below are based upon a long-term confined foundation surface modulus of greater than or equal to 100MPa (Foundation Class 2).

Five options for pavement foundation are given:

- Table 5 – Unbound sub-base only.
- Table 6 – Hydraulically bound sub-base only, including in-situ stabilisation.
- Table 7 – Unbound sub-base over in-situ stabilised capping.
- Table 8 – Hydraulically bound sub-base over in-situ stabilised capping.
- Table 9 – Unbound sub-base over site won capping.

The preferred option will be that which minimises virgin material use and minimises vehicle movements.

Construction traffic (standard axles)	< 50	50 - 200	201 – 500	501 – 2000	> 2000

Illustrative size of development	Up to 4 dwellings	Up to 20 dwellings or 2000m^2 commercial property	Up to 50 dwellings or 5000m^2 commercial property	-	Large development
Subgrade CBR <2%	Ground improvement will be necessary				
Subgrade CBR 2 to 3% (typically high plasticity heavy clay subgrade)	300 mm	350 mm	400 mm	450 mm	500 mm
Subgrade CBR >3 to 5% (typically medium plasticity clay subgrade)	250 mm	275 mm	325 mm	375 mm	425 mm
Subgrade CBR >5 to 7% (typically low plasticity sandy clay subgrade with average/good constructive conditions and low water table assumed – otherwise use row above)	225 mm	225 mm	250 mm	300 mm	350 mm
Subgrade CBR >7 to 14% (typically sandy subgrade)	225 mm	225 mm	225 mm	225 mm	275 mm
Subgrade CBR >15% (typically sandy gravel subgrade)	200 mm	200 mm	200 mm	200 mm	225 mm

Unbound sub-base to be to MCHW Clause 803, 804, 806 or 807.

Where the base layer carries the development construction traffic then the '< 50 standard axles' column applies irrespective of development size.

Table 5 - Unbound foundation thickness assuming the sub-base carries the development construction traffic and material deliveries

Construction traffic	**< 500 standard axles**	**> 500 standard axles**
Illustrative size of development	Up to 50 dwellings or 5000 m^2 commercial property	Large development roads and Minor Access Road, Major Access Road, Local Distributor Roads within other developments
Subgrade CBR <2%	Ground improvement will be necessary	
Subgrade CBR 2 to 3% (typically high plasticity heavy clay subgrade)	330 mm	380 mm
Subgrade CBR >3 to 5% (typically medium plasticity clay subgrade)	290 mm	340 mm
Subgrade CBR >5 to 7% (typically low plasticity sandy clay subgrade with average/good constructive conditions and low water table assumed – otherwise use row above)	220 mm	270 mm
Subgrade CBR >7 to 14% (typically sandy subgrade)	200 mm	250 mm

HBM to be minimum R_c class 3/4 to MCHW Clause 821, 822 or 840. Thicknesses are for mixture produced in a central plant. When produced by in-situ stabilisation, indicated thickness shall be increased by 50mm.

Where the base layer carries the development construction traffic then the '< 500 standard axles' column applies irrespective of development size.

Table 6 - Hydraulically Bound Mixture (HBM) foundation thickness assuming the sub-base carries the development construction traffic and material deliveries

Construction traffic	< 500 standard axles		> 500 standard axles	
Illustrative size of development	Up to 50 dwellings or 5000m^2 commercial property		Large development roads and Minor Access Road, Major Access Road, Local Distributor Roads within other developments	
	Capping	Sub-base	Capping	Sub-base
Subgrade CBR <2%	Ground improvement will be necessary			
Subgrade CBR 2 to 3% (typically high plasticity heavy clay subgrade)	310 mm	280 mm	360 mm	280 mm
Subgrade CBR >3 to 5% (typically medium plasticity clay subgrade)	310 mm	250 mm	360 mm	250 mm
Subgrade CBR >5 to 7% (typically low plasticity sandy clay subgrade with average/good constructive conditions and low water table assumed – otherwise use row above)	310 mm	200 mm	360 mm	200 mm
Subgrade CBR >7 to 14% (typically sandy subgrade)	310 mm	160 mm	360 mm	160 mm

Unbound sub-base to be to MCHW Clause 803, 804, 806 or 807.

Table 7 - Unbound sub-base on stabilised capping foundation thicknesses assuming the sub-base carries the development construction traffic and material deliveries.

Construction traffic	< 500 standard axles		> 500 standard axles	
Illustrative size of development	Up to 50 dwellings or 5000m^2 commercial property		Large development roads and Minor Access Road, Major Access Road, Local Distributor Roads within other developments	
	Capping	Sub-base	Capping	Sub-base
Subgrade CBR <2%	Ground improvement will be necessary			
Subgrade CBR >2%	310 mm	150 mm	360 mm	150 mm

Where the base layer carries the development construction traffic then the '< 500 standard axles' column applies irrespective of development size.

Table 8 - HBM sub-base on stabilised capping foundation thicknesses assuming the sub-base carries the development construction traffic and material deliveries

Construction traffic	< 500 standard axles		> 500 standard axles	
Illustrative size of development	Up to 50 dwellings or 5000m^2 commercial property		Large development roads and Minor Access Road, Major Access Road, Local Distributor Roads within other developments	
	Capping	Sub-base	Capping	Sub-base
Subgrade CBR <2%	Ground improvement will be necessary			
Subgrade CBR 2 to 3% (typically high plasticity heavy clay subgrade)	450 mm	250 mm	500 mm	250 mm
Subgrade CBR >3 to 5% (typically medium plasticity clay subgrade)	400 mm	230 mm	450 mm	230 mm
Subgrade CBR >5 to 7% (typically low plasticity sandy clay subgrade with average/good constructive conditions and low water table assumed – otherwise use row above)	280 mm	200 mm	330 mm	200 mm
Subgrade CBR >7 to 14% (typically sandy subgrade)	260 mm	170 mm	310 mm	170 mm

Unbound sub-base to be to MCHW Clause 803, 804, 806 or 807.

Capping to be sourced and produced on site in accordance with Clause 613.

Approval is required to use a bound sub-base over a capping layer.

Where the base layer carries the development construction traffic then the '< 500 standard axles' column applies irrespective of development size.

Table 9 - Unbound sub-base on capping foundation thicknesses assuming the sub-base carries the development construction traffic and material deliveries

5.4.2 Capping Materials

Capping materials shall be sourced and produced on site and in accordance with Clause 613.

If capping materials are not produced on site, then in-situ soil stabilisation shall be employed. Importing and exporting of material to and from the development produces unnecessary emissions and disruption, while also potentially using raw virgin aggregates. As such, in-situ stabilisation provides a more sustainable option and reduces vehicle movements to and from site, therefore benefitting communities local to developments.

5.4.3 Sub-base Materials

Unbound sub-base materials shall comply with MCHW Clause 803, 804, 805 or 807 and shall be transported, laid, compacted, and trafficked in accordance with Clause 802.

Bound sub-base materials shall comply with MCHW Clause 810, 811 and 812.

Mixed in-plant materials shall comply with MCHW Clause 814, 815, 820 and Clause 821, 822, 830, 831, 832, 834 or 835, as applicable.

Mixed in-place materials shall comply with MCHW Clause 816 and with Clause 821, 822 or 840 as applicable.

5.4.4 Geotextiles and Geogrids

Geotextiles do not improve sub-grade CBR; they prevent the mixing of subgrade with the sub-base and prevent subsequent loss of sub-base material, particularly finer material, while geogrids provide confinement to sub-base materials to allow aggregate interlock. This allows the sub-base to act as intended, they are however not a solution that fixes a weak sub-grade as any underlying weak and unconsolidated weak sub-grade areas are still present. They are therefore a means to contain pavement foundation material and prevent migration and as such their use does not eliminate the need to improve the strength of the underlying sub-grade, either by installation of effective sub-surface drainage or stabilisation.

5.4.5 Laying Sub-base

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. Bound sub-base layer thickness shall not be less than 150mm or greater than 250mm.

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.

Verification of foundation surface modulus shall be undertaken via Lightweight Deflectometer (LWD) or Falling Weight Deflectometer (FWD) testing. Tests shall be carried out at 10m centres in both wheel tracks.

For unbound foundations any areas that fall below the target foundation surface modulus of 100MPa shall be subject to further compaction and re-testing.

For bound foundations any areas that fall below the target foundation surface modulus of 100MPa shall be subject to further curing and re-testing. If the material continues to fall below the target foundation surface modulus, then those parts failing shall be replaced.

5.5 Carriageway Pavement and Surfacing

5.5.1 Pavement Layer Thicknesses and Materials

Carriageway description / Layer			Access ways, mews courts, access collectors	Local distributors	District distributors	Major distributors. Access roads to lorry parks or roads within commercial and industrial estates[1]
	Typical Traffic Levels	Commercial Vehicles/day	Up to 15	Up to 75	Up to 150	Up to 300
		Public service vehicles/day	None	Up to 25	Up to 50	Up to 100
		msa band	< 0.5	0.5 – 2.5	2.5 - 5	5 -10
Base Course	Cement Bound Granular Mixtures (CBGM) and Hydraulically Bound Mixtures (HBM)[2,3]	CBGM $C_{8/10}$, other HBM $C_{9/12}$	-	150mm	200 mm	220 mm
		CBGM $C_{5/6}$, other HBM $C_{6/8}$ (inc. MCHW Cl948 H4 & H5)	150mm	180 mm	220 mm	-
		CBGM $C_{3/4}$, other HBM $C_{3/4}$ (inc. Cl948 H1-H3)	150mm	-	-	-
	Cold Recycled Bound Materials (CRBM)	MCHW Cl948/ TRL611 QVE B3 (Bitumen Bound)	120 mm	140 mm	170 mm	205 mm
	Hot Mix Bitumen Bound[4]	MCHW Cl906 AC 20 dense bin 100/150 rec WTA	100 mm	120 mm	N/A	N/A
		MCHW Cl929 AC 20 HDM bin 40/60 des WTA	100 mm	120 mm	150 mm	180 mm
Binder Course	Cold Recycled Bound Materials (CRBM)[5]	MCHW Cl948/ TRL611 QVE B3 (Bitumen Bound)	60 mm	60 mm	-	-

Carriageway description / Layer			Access ways, mews courts, access collectors	Local distributors	District distributors	Major distributors. Access roads to lorry parks or roads within commercial and industrial estates[1]
	Hot Mix Bitumen Bound[5]	MCHW Cl906 AC 20 dense bin 100/150 rec WTA	50 mm	60 mm	-	-
		MCHW Cl929 AC 20 HDM bin 40/60[6] des WTA	-	-	60 mm	60 mm
Surface Course	Stone Mastic Asphalt	SMA 10 surf 100/150 surf WTA	-	40 mm	-	-
		SMA 10 surf PMB75/130-75 WTA[6]	-	-	40 mm	40 mm
	Hot Rolled Asphalt	HRA 55/10 F or C surf 100/150 des	40 mm	-	-	-
		HRA 30/14 40/60 F surf des	40 mm	40 mm	-	-
	Cementitious Grouted Macadam[7]	HAPAS Approved Proprietary System	-	-	-	40 mm
	Texture Depth Requirements[8]	SMA, High Stone Content HRA, Grouted Macadam	No requirement	0.8mm - 1.3mm		
		Chipped HRA	1.0mm - 1.5mm			
	Concrete block surfacing (To be specified in accordance with LCC Palette of Materials)		80mm block on 30mm bedding sand layer (BS 7533: Part 101 - Category II)	-		

Table 10 - Pavement construction thicknesses – asphalt and block paver surface

[1]The determination of future traffic volume figures must be provided and agreed, to ensure the 40-year design traffic, calculated in accordance with CD224.

[2]CBGM Mixtures $C_{5/6}$ and above shall conform to MCHW Clause 822 – CBGM 1 and BS 14227-1 figure 3/table 9, grading envelopes for cement bound granular mixture 1 – 0/14 (maximum category G1), and where applicable for CRBM mixtures, Zone A of table A1.1 of TRL611. CBGM $C_{3/4}$ shall comply with MCHW Clause 821 – CBGM 5 and BS 14227-1 table 3, or Zone A of table A1.1 of TRL611.

[3]Over CBGM and HBM the binder course should be laid as soon as possible to provide a weather-proof seal.

[4]Hot mix bitumen bound base shall only be used in exceptional circumstances and requires approval. This is to ensure development contributes to the council's sustainability aims.

[5]Due to the anticipated construction process of estate roads, i.e., an extended period of running on binder course prior to final surface course installation, CRBM binder course shall only be used when the final surfacing is to be applied immediately after the construction of the binder course. As such in most practical instances it is considered that a hot mix binder course will be required, although the preference from a sustainability point of view would be for recycled, cold mix materials to be used. The absolute maximum duration CRBM shall be left before overlaying is 10 days.

[6]An alternative polymer modified binder grade may be used subject to agreement by the Engineer. In addition, the Engineer, may in certain circumstances such as heavy, repeated slow loadings specify an alternative binder.

[7]The use of cementitious grouted macadam may be requested at the discretion of the Engineer in highly stressed areas such as roundabouts and turning areas within industrial areas and bus stops/laybys/lanes.

[8]Texture depth requirements shown are based on traffic speeds of 40mph and below and for 20mph and below for access ways, mews courts, access collectors.

General notes on HBM and CBGM:

The HBM and strength classes shown are compatible with BS EN 14227–1, for cement bound granular mixtures, other hydraulically bound mixtures (BS EN 14227–2, 3 & 5) and series 800 of the MCHW. The first number of each class relates to the compressive strength of cylindrical specimens with a slenderness ratio of 2 and the second number to a slenderness ratio of 1 or cubes.

5.5.2 Polished Stone (PSV) and Aggregate Abrasion Values (AAV) of asphalt surface course

The requirements for excessively high levels of skid resistance to be provided by the surface to aid road safety should be mitigated by fundamental safe and sustainable design that minimises speed and the introduction of high-risk areas. Eliminating the the need for high levels of skid resistance minimises the use of finite high PSV, low AAV aggregates.

Due to every road having different characteristics it is not possible to provide general requirements for PSV and AAV values. The designer shall therefore specify appropriate PSV and AAV values in accordance with DMRB CD236 and LCC Skid Resistance Code of Practice, for the level of perceived risk of the road geometry, characteristics and commercial vehicle flow.

In line with the principles outlined above the use of high friction surfacing will not be looked upon favourable; not only because of the high cost of ongoing maintenance to LCC and sustainability issues around the constituent materials of high friction surfacing systems, but because its presence in most situations indicates a failure in fundamental safe and sustainable design.

5.5.3 Polished Paver Value (PPV) of Concrete Blocks

PPV values are numerically equivalent to PSV and as such the values should be specified in line with Clause 5.5.2, with a minimum of 50.

The Engineer will require proof of PPV test results, undertaken in accordance with BS 7932 for the exact product to be used, including identical constitute raw materials, equivalents will not be accepted.

5.6 Placing, Compaction and Testing of Pavement Mixtures

5.6.1 General

This Clause gives general requirements for the placing and compaction of pavement mixtures, which are complementary and additional to the requirements of BS 594987 (for bituminous mixtures). These requirements and the requirements of BS 594987 apply to all bituminous mixtures,

All pavement mixtures shall be laid by organisations registered to and operating in compliance with BS EN ISO 9001 ‘National Highways Sector Scheme 16 for the Laying of Asphalt Mixes’

There shall be full interlayer bonding between pavement layers. This may be achieved by keeping the surface of the layers clean and uncontaminated, and by excluding moisture.

The underlying receiving surfaces shall be made good by cleaning and, if this proves impracticable, by rectification in compliance with MCHW Clause 702.

Prior to placing bituminous material on any new or existing bound substrate, a bond coat shall be applied in accordance with MCHW Clauses 920.

5.6.2 Transporting

Bituminous mixtures shall be transported in accordance with the requirements of BS 594987 and shall remain covered whilst awaiting tipping.

5.6.3 Laying

Bituminous mixtures shall be laid in accordance with the requirements of BS 594987 and this Clause.

Bituminous mixtures shall be spread, levelled, and tamped by a self-propelled paving machine.

Where the rate of delivery of material to the paver is intermittent for any reason, and the temperature of the material falls below that recommended by the manufacturer for laying, the cold material shall be removed, and a perpendicular joint formed in accordance with MCHW Clause 903.35 before laying recommences.

Hand placing of bituminous mixtures shall be restricted to the following circumstances:

- For laying regulating courses of irregular shape and varying thickness,
- In confined spaces where it is impracticable for a paver to operate,
- For laying mastic asphalt.

Hand-raking of surface course material or the addition of such material by hand-spreading to the paved area, for adjustment of level, shall be restricted to the following circumstances:

- At the edges of the layers of material and at gullies, manholes and other ironwork, and
- At the approaches to expansion joints at bridges, viaducts, or other structures.

The method of laying shall be such that the finished mat is free from dragging, tearing and segregation of the material.

When laying mixtures from more than one source, the mixtures shall have equivalent laying and compaction characteristics so that surface evenness is not compromised.

When paving adjacent to an expansion joint of a structure, the joint or joint cavity shall be kept clear of material.

When laying binder course or surface course, the paver shall be taken out of use whilst laying the remainder of the pavement up to the joint and the corresponding area beyond it.

When paving directly onto bridge deck waterproofing systems, any special requirements which apply to that system shall be complied with.

5.6.4 Tolerances

Where 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	+10 -30 mm
(b)	Base to receive binder course	±15 mm
(c)	Binder course to receive surface course	±6 mm
(d)	Surface course, general	±6 mm

Notwithstanding the above tolerances in surface levels, the cumulative tolerance shall not result in a reduction of the pavement, excluding the sub-base, by more than 15 mm from the specified thickness nor a reduction in the thickness of the bituminous surface course by more than 5 mm from that specified.

5.6.5 Surface Regularity

The requirements of MCHW Clause 702 Category A roads shall apply in full to all vehicular carriageways.

5.6.6 Chippings

The application of coated chippings to areas of surface course shall be by a mechanical spreader capable of distributing chippings to an even rate of spread.

Addition of chippings by hand operation shall only be permitted in the following circumstances:

- In confined spaces, where it is impracticable for a chipping spreader to operate,
- As a temporary expedient, when adjustments must be made to the spreader distribution mechanism,
- When hand laying of the surface course is permitted, and
- To correct uneven distribution of chippings.

Chippings shall be applied uniformly and rolled into the surface, so they are effectively held and provide the initial macrotexture depth specified in MCHW Clause 921.

5.6.7 Joints

For new, widened, and realigned pavement construction, all longitudinal joints in all layers shall be situated outside wheel track zones.

For the purposes of this Clause, for a 3.65m wide lane, the wheel track zones shall be taken to be between 0.5m and 1.1m and between 2.55m and 3.15m from the centre of the nearside lane markings for each traffic lane (or, in the absence of lane markings, lane edges).

Where the lane width is other than 3.65m then each wheel track zone shall be taken to be 0.6m wide with the inside edges of the wheel track offset from the centre of the lane by 0.72m.

Where an existing road pavement is resurfaced, joints in the surface course shall coincide with either the lane edge, the lane marking, or the middle of a traffic lane, whichever is appropriate.

Joints **must not** coincide with the wheel path.

Stepping of all joints shall be offset by 300mm from parallel joints in the layer beneath.

Where the requirements of 300mm steps and prohibition of joints in wheel track zones cannot be met, for example due to new lane configuration, the joints shall be offset as close as practicable to 300mm but not less than 150mm and only if the layer above is less than 150mm thick.

The faces of all cold upstanding edges, including previously laid asphalt, against which bituminous mixtures are to be laid to form joints shall be treated with one of the following:

- Hot elastomeric polymer-modified bituminous binder complying with BS EN 14023 with a penetration Class 4,
- Polymer modified bitumen emulsion complying with BS 594987 and BS EN 13808 Cohesion, table 4 class 4.

This operation shall be done so that the binder adheres to both the cold and the warm upstanding edges when the asphalt is placed.

Joints in binder courses and bases shall be compacted such, that when requested by the Engineer, the air voids content measured from core pairs whose centres are not more than 100mm from the final joint is not greater than 2% above the maximum permitted limit for core pairs in the body of the mat.

The air voids content shall be calculated in accordance with BS EN 12697-8 using the relevant bulk and maximum densities defined in Appendix B of BS EN 13108-20 for the relevant mixture type.

Within 24 hours of the joint being formed, a sealant shall be applied to the top surface of all base and binder course joints such that there is not less than 0.50 kg/m2 of residual bitumen 75mm either side of the joint.

The sealant, which may contain mineral filler to BS EN 13043, shall be one of the following:

- Hot elastomeric polymer-modified bituminous binder complying with BS EN 14023 with a penetration Class 4,
- Bitumen emulsion with a cohesion by pendulum of Class 4 or above in accordance with BS EN 13808, or

5.6.8 Regulating Course

Regulating course material shall be produced and laid in accordance with the requirements of MCHW Clause 907.

5.6.9 Use of Surfaces by Traffic

Where a new bituminous layer other than the surface course is to be opened to highway traffic as a temporary running surface it shall either:

- Be surface dressed in accordance with MCHW Clause 919 using chippings of category not less than PSV50, or
- Contain a coarse aggregate of category of not less than PSV50.

Construction plant and traffic shall not be permitted to damage the sub-grade, or the pavement courses already constructed. Running surfaces used by construction traffic shall be kept free of deleterious materials.

5.6.10 Laying, Compaction, Inspection and Testing of Cold Recycled Bound Materials (CRBM), Cement Bound Granular Mixtures (CBGM) and Hydraulically Bound Mixtures (HBM)

Laying

In general, CRBM, CBGM and HBM requires a greater surcharge than conventional asphalt, as such the ability of the paver to lay thick layers shall be confirmed with the Engineer prior to laying operations commencing. A high compaction screed may give greater flexibility in layer thicknesses, especially where base and binder courses incorporate CRBM.

When laying CBGM and HBM base courses unless the material is to be covered immediately by another pavement layer, a seal coat must be applied to ensure retention of sufficient moisture for hydration. One of three options must be employed:

- Machine spray tanker application of a 40% bitumen emulsion applied at not less than 0.5 litre/m^2 to seal the surface,
- Application of an aluminised compound,
- The very frequent application of water spray. (Only be appropriate where two or more lifts are employed, and bond is required between the lifts)

Compaction

Compaction shall be carried out in accordance with the general requirements of BS 594987 and using a vibrating roller. Initial passes shall be carried out using dead weight only and the level of vibration gradually increased.

For CBGM and HBM mixtures and CRBM not containing bitumen, a finishing pneumatic tyred roller (PTR) with a wheel load of not less than 3 tonnes operating at a minimum tyre pressure of 4 bar shall also be used.

Consideration shall also be given to the use of a PTR or combi roller for CRBM incorporating bitumen, noting the contractors experience with installing such material with such plant.

Production

Item	Inspection	Test
Aggregate stockpiles	Daily	Grading and moisture content before production and weekly
Binders	On receipt	Supplier data
Combined grading of mixture	Continual	Daily
Moisture content of mixture	Continual	Daily

Table 11 - Minimum Frequencies for Inspection and Test during production of CRBM, CBGM and HBM

Compaction Testing

After trimming and final compaction, the in-situ bulk density shall be measured using a nuclear density gauge in direct transmission mode, to a depth of 25mm of the layer thickness. The meter readings shall be verified periodically in accordance with BS EN 13286-2.

The in-situ bulk density values obtained shall be compared with the refusal density value of the job standard mixture or of the refusal density of a specimen representative of the day's production. The average in-situ bulk density of each set of five values shall be at least 95% of the refusal density, with no individual in-situ density value being less than 93% of the respective refusal density.

Representative samples of the material shall be taken either at the mixing plant or from site. 150mm diameter cylindrical test specimens shall be manufactured in sets of six by compacting to refusal in accordance with BS 598 Part 104. The specimens shall be 150mm diameter, 75mm height for bitumen bound materials and 150mm height for cement and hydraulically bound mixtures and compaction must be completed within 2 hours of mixing.

End Product Testing

Sampling shall be taken at a rate of three specimen samples per 1000 tonnes, with a minimum of 3 per day.

A minimum of 40kg to be collected per specimen sample, subsequently four test samples are required to be produced:

- PRD,
- Cylindrical,
- Moisture Content, and an
- Additional three PSD tests from a bulk sample of six individual samples.

End Product Criteria

The produced CRBM, CBGM and HBM shall be meet the following criteria:

Material property of characteristic	Individual results	Mean from test set of six specimens	
Particle Size Distribution	TRL 611 Zone A for CRBM BS 14227-1 figure 3, grading envelopes for cement bound granular mixture 1 – 0/14 (maximum category G1) for CBGM $C_{5/6}$ and above and HBM. CBGM $C_{3/4}$ shall comply with BS 14227-1 table 3 or Zone A of table A1.1 of TRL611.	-	
Moisture content	±2%	-	
Relative In situ density	93% minimum	95% minimum	
Layer thickness	±25 mm of specified	±15mm of specified	
Indirect Tensile Stiffness Modulus BS EN12697-26:2004 Annex C (Bitumen bound) or	N/A	QVE Class B3 3100 MPa	Less 5%
Dynamic Modulus **Flexural Strength**	N/A	QH/SH (H1-H5) - Hydraulically Bound	Equal to or greater than the Declared Minimum Performance Class
Compressive strength *(R_c)* **(BS 9227:2019)**	No less than 67% of minimum strength requirement	CBGM and HBM ($C_{3/4}$, $C_{5/6}$, $C_{6/8}$, $C_{8/10}$, $C_{9/12}$)	Equal to or greater than the Declared Laboratory mechanical performance category

Table 12 - End product criteria for CRBM, CBGM and HBM

Early life material properties

The recently installed performance of the CRBM shall be assessed using an LWD. It is important that the LWD can demonstrate a satisfactory correlation with an agreed reference test method, i.e., the FWD. Two options are permitted for LWD correlation (BS 1924-2, 2018): a site-specific correlation trial, or an annual correlation certificate. Proof of either method must be provided to the Engineer.

The performance of the final stabilised layer should be evaluated using a calibrated LWD within 24 hours of final compaction. Dependant on weather conditions testing could commence immediately, but in some instances a small rest period may be required. The final stabilised layer should meet the following criteria:

- The minimum surface modulus measurement should be ≥ 50 MPa within 2 hours of installation; or ≥ 100MPa within 24 hours of completion of installation.

Where this criterion is not met, consideration should be made to delaying final surfacing to allow further curing and stiffening of the layer to occur. Alternatively, a

repeat of all or part of the recycling process should be undertaken until a compliant surface modulus is achieved.

6 Footways & Cycletracks

6.1 General

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.

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.

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 Sub-base, Base and Surfacing materials and thicknesses

Loading Class	Layer	Material Reference	Thickness (mm)
Pedestrian Only	**Surface Course**	AC 6 dense surf 100/150 (footway only)	25
		Or	
		AC 10 close surf 100/150 (cycletrack or shared use)	30
	Binder Course	Clause 948 H1-H3 or HBM C3/4	150
		Or	
		AC 20 dense bin 100/150	50
		And	
	Sub-base	Type 1 sub-base	100
Light vehicle overrun	**Surface Course**	AC 6 dense surf 100/150	25
		Or	
		AC 10 close surf 100/150 (cycletrack or shared use)	30

	Binder Course	Clause 948 H1-H3 or HBM C3/4	255
		Or	
		AC 20 dense bin 100/150	70
		And	
	Sub-base	Type 1 sub-base	225
Heavy vehicle overrun	**Surface Course**	AC 6 dense surf 100/150	25
		Or	
		AC 10 close surf 100/150 (cycletrack or shared use)	30
	Binder Course	Clause 948 H1-H3 or HBM C3/4	340 (2-4% CBR) 285 (>4% CBR)
		Or	
		AC 20 dense bin 100/150	90
		And	
	Sub-base	Type 1 sub-base	320 (2.5-4% CBR) 210 (>4% CBR)

Table 13 – Footway and Cycletrack sub-base, base and surfacing materials and thicknesses

Note: When using MCHW Clause 948 CRBM, CBGM or HBM materials a combined base/binder and sub-base has been adopted, based on a variation of the design guidance for low traffic roads contained within TRL611. When adopting this approach, the use of an unbound sub-base is unnecessary, and the Clause 948/HBM material can be laid directly atop of the sub-grade.

The loading class shall be subject to agreement with the Engineer, at the Engineer's discretion areas deemed to be likely subject to repeated vehicle overrun such as parking, then a higher loading class may be selected.

6.4 Laying Sub-base

The sub-base shall be constructed in such manner:

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

6.5 Laying Binder Course

The sub-base or sub-grade surface shall be clean and free from standing water.

The material shall be covered with tarpaulins whilst being delivered and whilst stockpiled on site.

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.

Joints shall be treated in such a way as to ensure adequate compaction and bonding.

The finished surface shall be within +0 or -6mm from the true surface level.

6.6 Laying Surface Course

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

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

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

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.

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.

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).

Wherever practical the surface and binder course layers shall be machine laid to improve both durability, long-term strength, profile and shedding of surface water

6.7 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 where vehicle overrun is anticipated.

Where flags and/or block paving permitted, the materials shall conform to the requirements of the approved LCC Palette of Materials Code of Practice (CoP). Where an enhanced material is specified and agreed the developer shall be liable for a commuted sum for the increased maintenance burden over the lifecycle of the asset, as calculated in accordance with methodology contained within the LCC Palette of Materials CoP.

6.8 Laying of Flags and Block Paving

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.

Flags shall be laid in accordance with BS 7533: Part 4.

Block paving shall be laid in accordance with BS 7533: Part 3.

6.9 Laying Course

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

Small element concrete paving flags 450mm x 450mm or smaller shall be bedded on a laying course of sand 30mm thick to BS 7533: Part 4.

Block paving shall be bedded on a laying course of Category III bedding sand 50mm thick to BS 7533: Part 3.

7 Kerbs, Channels & Edge Restraints

7.1 Precast Concrete Kerbs, Channels and Edgings

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

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

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

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

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

Precast 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.

Channels formed in asphalt will not be accepted.

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

7.2 Kerb Foundations

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

Immediately after laying, kerbs shall be backed and/or haunched with mix ST1 concrete.

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. 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 areas where the sub-grade is prone to expansion and contraction resulting from climatic changes, such as clay, the concrete bed must be laid a top of a minimum of 100mm of type 1 sub-base, continued from the path construction. Alternatively, and where appropriate the edging can be omitted, in such scenarios each construction layer must be stepped out 150mm from the layer above and bound layers must be machine laid to ensure adequate level control and surface regularity.

7.4 Kerb and Edging Lines

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.

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.

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

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

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

A domestic vehicular crossing on the straight or radius over 12m shall consist of:

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

All pedestrian crossing points shall have kerbs laid flush-6mm and inverted bull nose kerbs shall be used as this ensures that there is no radius and a clean, straight, hazard free edge for asphalt to be laid up to can be provided. At all uncontrolled crossing points buff coloured tactile paving must also be provided in accordance with DfT guidance found within "Inclusive Mobility".

8 Road Restraint Systems

It is expected that all practical attempts should be made to prevent new hazards being created or to design them out, thus avoiding the need to consider vehicle restraint system provision. Where this is not possible reference should be made to Lancashire County Council Vehicle Restraint Systems Code of Practice.

Any proposals for new road restraint systems must be submitted for approval.

Notwithstanding the requirements contained within the LCC Vehicle Restraint Systems Code of Practice any new road restraint system shall be an un-tensioned system.

Plans to construct anything within 3.5m of an existing road restraint system shall require approval.

9 Street Lighting

9.1 Nature and extent of work

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.

The Developer shall include for the cost of, and arrange for the provision of, underground electricity service connections. The Developer 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.

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.

9.2 Provision and commissioning by the County 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:

- Supply two copies of the site plan in .dwg format 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 a completed schedule 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;

- Supply two copies of the site plan for the use of the Engineer who will return one copy together with a completed schedule 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 LCC 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

Lighting equipment shall be in accordance with the current LCC List of Approved Equipment.

The Developer shall provide and install equipment detailed by the Engineer on the schedule.

9.5 Approval of column and wall bracket positions on site

The Developer shall obtain the approval of the Engineer regarding 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

Columns, unless otherwise determined by the Engineer, shall be located:

- At the rear of the footway (where no verge is proposed),
- At the rear of the grass verge (where a verge is provided between footway and carriageway),
- On developments utilising 'car ways' and joint use cul-de-sacs 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.

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

9.7 Installation

9.7.1 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 footways 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.

9.7.2 Equipment Erection

Equipment erection shall be in accordance with the current LCC Special Details - Electrical.

9.7.3 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.

9.7.4 Reinstatement

The Developer shall be responsible for all permanent reinstatements including those of excavations due to the provision of electricity services.

Reinstatements shall be undertaken in accordance with Specification for the Reinstatement of Openings in Highways (SROH). Notwithstanding the requirements

of SROH the pavement, including foundation material thicknesses shall be at least equivalent to the requirements of table 6, for the specific road type, of this specification.

9.7.5 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 County Council covering the disconnection, removal, re-siting, reconnection and commissioning of this equipment and the provision of any additional equipment necessitated on existing highways by the development.

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

- BS 7671 Institution of Engineering and Technology (IET) Regulations for Electrical Installation,
- Institution of Lighting Professionals (ILP) Code of practice for electrical safety in highway electrical operations
- The Electrical Supply Regulations,
- The Electricity at Work Regulations.

9.7.6 Numbering of columns

Each column illuminated sign and bollard shall be numbered in accordance with instructions given by the Engineer.

9.8 Lighting columns

Lighting Columns shall be in accordance with the current LCC Lighting Column Specification.

9.9 Posts for traffic signs

Posts for traffic signs shall be in accordance with the current LCC Posts for Traffic Signs Specification.

9.10 Inspection

The works shall be available for inspection during all reasonable hours throughout the construction period.

9.11 Maintenance

The Engineer will take over commissioned lighting units for operation and maintenance in advance of completion of the works, provided that

The Engineer is advised within 28 days of the commissioning date of each unit,

- The installation is found on inspection, to be satisfactory in all respects,
- (The developer provides a Test Certificate in accordance with BS 7671 for each unit,
- 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 highway is adopted,
- 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,

- Completed Lighting Inventories have been submitted to and accepted by the Engineer.

'Taking over' for the purposes of operation and maintenance by the Engineer shall entail responsibility for -

- Payment of energy charges to the DNO from the date of taking over,
- Routine cleaning, lamp replacement and inspection provided that easy access is available for maintenance vehicles and/or personnel.

(Note: Energy charges from the date of connection to the date of taking over are the responsibility of the Developer)