

PART 4

SPECIFICATION FOR ESTATE ROADS - CONSTRUCTION AND MATERIALS

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Note: the Section numbers follow the pattern of Highways Agency's Specification for Highway Works Volume 1. However, within each Section the clause numbering departs from the above document.

SECTION 0

INTRODUCTION

0.1 This Part of the Design Guide for Highways in Residential and Commercial Estates specifies how Developers can construct roads, footpaths etc. in such a manner that they can be adopted as highways maintainable at public expense. It should be considered in conjunction with Parts 1, 2 and 3 of this Guide, which covers highway design and layout.

0.2 PURPOSE AND STATUS OF THIS DOCUMENT

0.2.1 Whether Developers carry out the works themselves, or employ a contractor to undertake the works, they must prepare a statement of specification which shall be considered an integral part of the Section 38 Agreement.

The “SHW” 0.2.2 The specification applicable to a particular Agreement should be prepared on the basis of this Part of the Guide and as further enlarged upon by the Highways Agency’s Manual Of Contract Documents For Highway Works Volume 1 Specification For Highway Works (hereafter referred to the SHW). The SHW can be viewed here: <http://www.standardsforhighways.co.uk/mchw/index.htm>
This Specification is a general parent specification that covers the provision of all anticipated works.

This Specification and the “SHW” 0.2.3 This Part of the Guide gives the requirements for the vast majority of cases. Where a matter is not covered herein, however, the current Specification for Highway Works applies and is to be consulted.

0.2.4 The specification prepared by the Developer shall cover all carriageway, footway, margin, verge, footpath, cycleway, surface water drainage system, service provisions and street lighting being constructed or installed as part of a development and which the Highway Authority will adopt as a highway maintainable at public expense.

Definition of “Engineer” and “Developer” 0.2.5 In this Part of the Document the term Engineer shall mean the County Environment Director or his representative. The term Developer means the principal of the Section 38 Agreement with whom all negotiations are transacted; where the Developer employs a contractor neither are absolved from the requirements of this Specification.

0.2.6 It is strongly advised that copies of the relevant parts of this specification is made available to groundworks and surfacing works contractors and also forms part of any contract review process.

0.3 GROUND INVESTIGATION BEFORE START OF WORKS

- 0.3.1 For the purposes of determining the required highway structure the Developer shall be required to commission the Devon County Council's UKAS accredited Materials Laboratory, Exeter (tel. 01392 386500, e-mail: materials.laboratory@devon.gov.uk) to undertake a ground investigation. Adequate notice shall be given to enable the investigation to be scheduled and the resultant report produced and issued.
- 0.3.2 Ground investigation will also include, but not be limited to, determination of permeability where a SuDS system is proposed, and corrosivity to any buried steel structures. The developer will render any assistance required in conducting these tests, e.g., provision of water bowser and soakaway medium.
- 0.3.3 A choice to use maximum construction thickness does not obviate the need for trial pit or borehole investigation where there is a potential for deeper lying problems, e.g., soft spots, caused by peat etc.
- 0.3.4 Where the site is underlain by deep deposits of made ground, peat etc. special consideration may need to be given in relation to the investigation and any measures required for the construction of the highway.

SECTION 1

GENERAL ITEMS

1.1 NOTICE FOR INSPECTION

- 1.1.1 The Developer shall give the Engineer seven clear days notice in writing of the date upon which roadworks will start, and then two days notice for any covering up of works during the course of the development. This will enable the Engineer to arrange the inspection of the stages of road construction without delay. No work shall be covered up without the Engineers approval. Where work is covered up without the Engineers approval, it is at the Developers risk, and the Developer will bear any costs in demonstrating that the work is satisfactory.
- 1.1.2 It is the Developers responsibility to ensure that all work is carried out in accordance with the Specification or with supplementary advice given by the Engineer. All work shall be carried out strictly in accordance with the approved plans. (See also Part 3, Appendices 3D and 3E).

1.2 WORK ON PUBLIC HIGHWAYS

- 1.2.1 If, in the development of an estate, it is necessary to carry out works affecting an existing public highway (including carriageway, footway, footpath, verge or public right of way), the Developer shall make a written application to the Engineer for permission to carry out these works, which, unless covered by a Section 38 Agreement for the estate road works, will require a separate Agreement with the County Council as Highway Authority or its Agent Authority. Plans of the proposed work will be required by the Engineer and the Developer shall give an appropriate indemnity to the County Council in respect of the proposed work, together with an inspection fee. Notice to open up excavations in a public highway may need to be given, in accordance with the New Roads and Streetworks Act 1991.
- 1.2.2 Before undertaking any works that may affect apparatus belonging to a Statutory Undertaker the Developer must give at least 28 days notice to the appropriate body. If permission is refused, the Engineer may carry out the works at the Developers expense. An estimate of the cost of work will be sent to the Developer prior to the commencement of work and confirmation shall be given by the Developer of his agreement to bear the cost of the work.

- 1.2.3 No work on the public highway shall be commenced before these requirements have been met. The Developer shall also ensure that at all times adequate access is maintained to all land and premises. If at any time it is found necessary to close any existing means of access, the Developer shall, at the Developers own expense, provide adequate temporary means of access.
- 1.2.4 Road closures require a minimum of 5 days notification to the Engineer, and the Developer is to supply, erect and maintain diversionary signing at the Developers own expense.
- 1.2.5 Work on the public highway is to be carried out expeditiously and in such a manner as to cause no unnecessary inconvenience to the public.

1.4 SAFETY

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| Traffic Safety | 1.4.1 Where work has to be carried out on or adjacent to an existing public highway or a highway to which the public have access, the Developer shall comply in all respects with the recommendations contained in Chapter 8 Traffic Safety Measures for Roadworks of the Traffic Signs Manual (HMSO May 1991). Traffic signs, lamps, barriers and traffic control signals shall be in accordance with the current editions of the Traffic Signs Regulations and General Directions. The Engineer may require additional measures in certain instances to safeguard the highway user. |
| Temporary Traffic Signals | 1.4.2 Temporary Traffic Signals may be used with the permission of the Engineer. Diesel or petrol generators are not to be used outside the hours of 8am to 6pm in residential areas. |
| Use of Explosives | 1.4.3 The use of explosives will be subject to Regulation 19 of the Construction (General Provisions) Regulations 1961. The use of explosives within the highway will not be permitted except with the written consent of the Engineer, and then it will be subject to any conditions that he imposes. In all cases where this permission is given, the Developer shall carry out all blasting operations in compliance with the relevant requirements of the Police and the Home Office. The Developer shall be responsible for all costs resulting from accidents or damage due to the use of explosives. If, in the Engineer's opinion, the operations are being carried out in a dangerous or unsatisfactory manner, the Engineer may withdraw permission. |
| Danger to Children on | 1.4.4 Developers should take account of the serious dangers to children on construction sites particularly when the site is |

Construction Sites	<p>vacated after working hours. Developers should therefore ensure that all reasonably practical precautions are taken. In this respect the advice in Guidance Note GS7 (Revised 1989) issued by the Health and Safety Executive must be complied with. This relates in particular to:-</p> <ul style="list-style-type: none">(a) liaison with school heads and publicity visits to schools(b) exclusion of all children from the site during working hours, except for properly supervised educational visits(c) provision of perimeter fencing to the site(d) guarding to edges of excavations(e) safe stacking of materials, e.g., pipes, topsoil etc.(f) removal of access to elevated areas(g) isolation of electricity and other energy sources(h) correct storage of hazardous materials.
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1.5 POLLUTION & NUISANCE

- 1.5.1 The Developer is to carry out work in such a manner that avoids pollution, nuisance or danger to adjacent occupiers or users of the public highway.
- 1.5.2 Measures shall be taken to prevent the generation of excessive dust or noise during construction operations. Guidance on measures to reduce dust & noise during construction can be found in BRE Report 456 & BS 5228 respectively.
- 1.5.3 Under the Control of Pollution Act 1974, the District Council can impose maximum noise levels permissible during the construction of works and can enforce them; the District Council can also restrict working hours in sensitive areas. The Developer should contact the appropriate District Council before work starts to ascertain the permissible noise levels.
- 1.5.4 Measures to prevent degradation of local air quality shall include measures such as ensuring that all plant, both static & mobile are regularly serviced and where possible comply with the most recent Euro standard.
- 1.5.5 For works within designated Air Quality Management Areas it is recommended that advice is sought from the Environmental Health Department of the local district council.

1.6 SERVICES

- 1.6.1 The procedures adopted for the excavation and reinstatement of trenches must be in accordance with the normal safe practices for such work and subsequent appropriate sections of this document.
- Laying Mains 1.6.2 The Developer shall be responsible for contacting the Statutory Undertakers at the commencement of works to determine what mains, cables and services exist and are proposed, and he shall be responsible for ensuring that such cables, mains and services are completed before commencing any construction work that may be affected. Appendix 4B shows the standard detail indicating the relative location of services.
- Protection of Mains 1.6.3 The Developer shall comply with the requirements of the New Roads and Streetworks Act 1991 and shall take all reasonable measures required by a Statutory Authority for the full protection of its mains, pipes, cables or any apparatus during the progress of the works (see also paragraph 5.8.3). Where privately owned services pass through the site and are affected by the works the Developer shall provide an alternative service to the satisfaction of the owner of the service and the Engineer.
- Co-ordination of Works 1.6.4 The Developer shall be responsible for the co-ordination of all Statutory Authorities works related to the development.

1.7 STANDARDS OF MATERIALS AND SAMPLES

- Submission of Samples and Test Certificates 1.7.1 Unless otherwise specified, all materials shall comply with the current edition of the appropriate British Standard or British Standard Code of Practice (BS), European Standard (EN) or Harmonised European Standard Specification that supersedes the relevant BS.
- 1.7.2 All materials shall be transported, stored and used in accordance with the requirements or recommendations of that Specification. Where available and unless otherwise specified, materials and articles produced under a Sector Scheme for Quality Management in Highway Works, KiteMark or Safety Mark, Highways Authorities Product Approval Scheme (HAPAS) or other accredited third part certified scheme shall be used.
- 1.7.4 Samples of construction materials will be taken as considered necessary by the Engineer. The Developer will provide all necessary assistance. The names of the suppliers shall be

submitted for approval in advance of materials being ordered, and no source of supply shall be changed without the Engineer's consent prior approval. Bituminous materials may only be obtained from plants accredited to the National Sector Scheme for Asphalt Production (Sector Scheme No. 14). When any material or article is required to comply with a European or British Standard such material or article or its container shall bear the stamp of the UKAS registered certification trademark. Alternatively, the Contractor shall submit test certificates furnished by the supplier or manufacturer of the material or article indicating compliance with the relevant British Standard. The test certificates should be from a UKAS laboratory accredited for the particular test. A UKAS testing service is available from the Devon County Council Materials Laboratory. Subbase shall be from a DCC-approved source that has been assessed as capable of supplying compliant material under an appropriate quality control regime. Certificates of compliance for frost heave and required aggregate properties from a UKAS accredited laboratory shall represent the current production quality and be no more than 12 months old.

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| Storage of Materials | 1.7.5 All materials liable to deterioration or damage shall be stored in such a way that they shall be in accordance with the Specification at the time of use. |
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1.8 DEVELOPER'S RESPONSIBILITIES

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| Damage to Highways | 1.8.1 The Developer shall be responsible for any damage to existing roads, footways, verges, drains and Statutory Undertakers property, whether forming part of the works or not, which have arisen from the works, the transport of men, materials and plant to or from the works, or because of the diversion of normal or extraordinary traffic from their customary routes due to the construction of the works. The Developer shall repair and make good all damage to the satisfaction of the Engineer, or shall pay for the repairs to be carried out by the Engineer. The Developer shall be responsible for arranging with the Engineer for any necessary joint survey. |
| Mud, Materials or Equipment on Highway | 1.8.2 Materials are not to be stored on the public highway, nor is equipment to be deposited on the highway so as to damage or obstruct it. The Developer shall keep adjacent carriageways, footways and footpaths, drains and ditches near the works free from mud, debris or dust arising from the works. Surface water from the works shall not be permitted to flow on to any existing public highway. |
| Clear up on Completion | 1.8.3 The whole of the works shall be left in a neat and tidy condition on completion, free from refuse, litter and debris of all kinds. |
| Maintenance | 1.8.4 For a period of at least 12 months after completion of the works |

Period the Developer will be required to fully maintain the new road (including sweeping, gully emptying, grass cutting, shrub beds etc.), and repair any defects to any part of the works that may arise. Such repairs shall be carried out to the Engineer's satisfaction.

1.9 Recycled Materials, Secondary Aggregates & Energy Minimisation

1.9.1 Devon County Council encourages the use of recycled materials and secondary aggregates within highway construction. Wherever possible and practicable consideration should be given to maximise the use of these materials when it can be shown that there will be no detriment to the durability and serviceability of the highway. Approval has already been given for many more sustainable materials. These include bituminous materials that contain a percentage of reclaimed aggregates, glass and concrete. These materials are readily available from many quarries within & bordering Devon. Where any doubt exists, guidance can be sought from Devon County Council Materials Laboratory.

1.9.2 It is widely recognised that minimising our use of energy, particularly from the so called fossil fuels is an essential element in society's drive for greater sustainability. This specification, although containing no specific element of energy minimisation, seeks to achieve the most durable construction, which in itself should minimise both materials demand and energy usage over the whole life of the highway. One example of how energy usage can be reduced is by obtaining materials from local sources. If the Developer wishes to propose any further ways in which overall energy demand can be reduced whilst still achieving the required level of durability this will be considered.

SECTION 2

SITE CLEARANCE

2.1 UNDERGROUND OBSTRUCTIONS

- 2.1.1 Underground structures and chambers shall be demolished, properly cleaned out, filled with acceptable material and compacted in compliance with paragraph 6.3.2. Disused foul and surface water drains within 1.0m of formation level shall be removed and trenches backfilled in accordance with paragraph 5.4.5. Other disused drains shall be effectively stopped up.

2.2 EXISTING MATURE TREES, STUMPS AND ROOTS

- 2.2.1 No existing trees shall be felled in contravention of a Tree Preservation Order. Any trees that are to be felled must be with the full written consent of the Local Planning Authority. Where shown on drawings approved by the Local Planning Authority trees shall be uprooted or cut down as near to ground level as possible. All felled timber shall be removed from the site.
- 2.2.2 Stumps and tree roots within the vicinity of roadworks shall, unless otherwise agreed with the Engineer, be totally removed and disposed of. Holes left by the stumps or roots shall be filled with acceptable material and compacted in compliance with paragraph 6.3.2.

SECTION 3 NOT USED

SECTION 4 NOT USED

SECTION 5

DRAINAGE AND SERVICE DUCTS

NOTE: If roof water or water from any source other than the highway is to be carried by a surface water drain, then the drain will be defined as a sewer which will be the responsibility of South West Water or its agents to whom reference should be made for its requirements.

The requirements of this Section, therefore, apply to

- a) the excavation of surface water drains carrying highway water
- b) the laying of pipes etc. of surface water drains carrying highway water, and
- c) the backfilling of all trenches whether they contain highway surface water sewers, other surface water sewers, or foul sewers, where they lie within the carriageway, together with their associated manholes, catchpits etc.

5.1 PIPES FOR DRAINAGE

5.1.1 The class of pipe should be calculated in accordance with Simplified Tables of External Loads on Buried Pipelines (HMSO). The internal surfaces of all pipes and fittings shall be subject to the approval of the Engineer in respect of smoothness. Surface water drainage pipes shall have a minimum diameter of 150mm.

Acceptable materials for sewers

5.1.2 Pipes for drainage shall be selected from the following alternatives, and as more fully described in Table 5/1 of the Specification for Highway Works:

- a) Vitrified clay pipes shall be normal or surface water pipes as defined in BS65. They shall have Type 1 flexible joints unless otherwise approved by the Engineer and be of the strength stated on the approved drawings.
- b) Concrete pipes (with Portland cement or sulphate resisting cement when necessary) shall comply with BS5911, have flexible joints and be of the strength class shown on the approved drawings.
- c) Unplasticised polyvinyl-chloride (UPVC) solid wall concentric external rib-reinforced pipes shall comply with BS4660 or BS EN 1401-1:1998 and with the relevant provisions of WIS (Water Industry Specification No 4-31-05).
- d) Cast iron or ductile iron pipes shall be Class B, have spigot and socket flexible joints, shall comply with BS437 or BS EN 545 and shall be used where agreed with the Engineer.

5.1.3 Pipes and fittings other than those included in Table 5/1 may be used with the approval of the Engineer provided that they hold a

current British Board of Agrément Roads and Bridges Certificate stating that they are a suitable alternative for the usage specified in Table 5/1. Rigid jointed pipes are not normally permissible.

- 5.1.4 Pipes for land drainage, including French Drains, shall comply with the paragraph 5.1.2 above and SHW clause 501.3 and Table 5/1 of the Specification for Highway Works.

5.2 EXCAVATION FOR PIPES AND CHAMBERS

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| Trenches | <p>5.2.1 Excavation in trenches and pits within the boundaries of highways to be adopted shall have vertical sides unless the specific approval of the Engineer is obtained to batter them. The sides of trenches and pits shall be adequately supported at all times so as to maintain the stability of the adjacent ground. Trenches and pits shall be kept free of water at all times, and shall remain open only for the minimum period necessary before backfilling.</p> <p>5.2.2 Widths of pipe trenches shall be either
 <i>a maximum</i> of external pipe width plus 600mm, or
 <i>a minimum</i> of the external pipe width plus 300mm, unless otherwise required by the Engineer.</p> |
| Overbreak | <p>5.2.3 In the event of an overbreak, slip, or if the Developer allows the bottom of trenches or pits to become unsuitable, the loose or unsuitable material shall be removed, the bottom of sides trimmed horizontally and vertically and the excess excavation treated as follows:-</p> <ol style="list-style-type: none"> i. In the bottom of the trench or pit the excess excavation shall be filled with concrete Mix ST2 to BS 8500-2 and BS EN 206-1 or granular material for which specific written approval has been obtained ii. Where the pipe or manhole is designed to have a concrete protection, the excess width of excavation shall be filled with extra concrete of the quality of the proposed protection. iii. Where the pipe or manhole is not designed to have a concrete protection, the excess width of excavation shall be filled with the pipe surround material shown on the drawings i.e. pipe bedding material or selected fill, as agreed with the Engineer. |

5.3 SUB-SOIL DRAINS

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| When Required | <p>5.3.1 An adequate system of sub-soil drainage is to be constructed where:-</p> |
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- i. the winter height of the water table is within 600mm of formation, or
 - ii. the sub-soil is unstable because it is waterlogged, or
 - iii. springs, drains or watercourses are encountered, or
 - iv. there is likelihood of water running off or out of adjacent ground.
- 5.3.2 Sub-soil drains shall be accurately laid in trenches to suitable alignments and gradients. The gradients shall be sufficient to produce a self-cleansing velocity of 0.75m per second. Pipelines shall be properly linked with junction pipes, discharge into catchpits or manholes and outfall into the surface water drainage system.
- 5.3.3 Sub-soil drains shall consist of perforated earthenware, concrete or open jointed pipes complying with the appropriate British Standard and Section 5.1 below. Sub-soil drains shall be surrounded with a free-draining filter material as Type A, as shown in Table 1. French drains shall be surrounded with filter material Type B and shall be filled with this material up to ground level. Standard Construction Details are shown in Appendix 4A.
- 5.3.4 Additionally, the filter material Type A or Type B shall, where more than 2% of the material passes a 425 μ m test sieve, be non-plastic. The material shall have a soaked 10% fines value of not less than 50kN, and have a water soluble sulphate content of less than 1.9 grammes per litre.
- Land Drains 5.3.5 Existing land drains and springs severed by the work shall be connected into the surface water drainage system.

Table 1

Table 1: Grading and geometrical requirements for filter drain material		
	Type A	Type B
Standard	BS EN 13285	BS EN 13242
Size, mm	0/20	20/40
Grading and oversize categories	G_F (with an additional sieve)	G_C80-20
Oversize category	OC_{80}	-
Category for tolerances at mid-size sieves	-	GT_{NR} (no requirement)
Category for maximum fines	UF_3	F_{NR} (no requirement)
Summary grading requirements		
Sieve size, mm	Percentage by mass passing	
80	-	100
63	-	98 - 100
40	100	80 - 99
20	80 - 99	0 - 20
10	50 - 90	0 - 5
4	30 - 75	-
2	15 - 60	-
0.500	0 - 35	-
0.125	0 - 4	-
0.063	0 - 3	-
% in size fraction		
4/10	5 - 35	-
2/4	5 - 35	-

Pipe Bedding Material	5.4.1	To prevent the intrusion of fine-graded soils such as clays, silts or fine sands into the bedding or the pipe of sub soil and French drains, especially under wet conditions, a permeable geotextile material, approved by the Engineer, shall be used as a separator.
Pipelaying	5.4.2	All pipe laying shall commence at the outfall unless agreed with the Engineer, and pipes shall be laid true to line and level as shown on the approved drawings. Pipes should be laid as soon as possible after excavation of the trench.
Concrete Protection	5.4.3	Concrete surround shall be provided to pipes having less than 1.2m cover unless otherwise agreed with the Engineer. Where concrete surround is required, it shall be concrete Mix ST2 to BS 8500-2 and BS EN 206-1 with separation at the joints of expanded polystyrene or other approved material as agreed with the Engineer. After inspection and testing the pipeline the concrete shall be placed in compacted layers to a height of 150mm above the pipe. In the case of flexible pipes, an alternative method is to protect the pipe by a bridging slab, minimum thickness 150mm, formed from concrete class C20P.
Backfilling of Trenches	5.4.4	The fill material to be used up to carriageway formation level shall, in the absence of quantifiably suitable on-site material, be suitable imported recycled or secondary material, or Type 1 granular sub-base material to SHW clause 803, and shall be deposited and compacted in compliance with SHW clause 505.
Upon Completion	5.4.5	On completion of the works all manholes and pipes shall be rodded or flushed from end to end with water and left clean and free from obstructions, witnessed by the Engineer. In certain cases, video inspection may be required e.g. where the whole drainage system is to be adopted by the Highway Authority. All testing or inspection is to be at the Developers expense.

5.5 MANHOLES AND INSPECTION CHAMBERS

Manholes and Inspection Chambers	5.5.1	Manholes and inspection chambers shall be constructed as specified below and in accordance with the standard details shown in Appendix 4A. Manholes may be constructed of pre-cast concrete ring sections, to the requirements of BS5911, or brick-work, and must be to the Engineers satisfaction and watertight on completion. All manholes on sewers of 600 mm diameter or greater must be provided with safety chains (galvanised wrought iron close link 10mm) on the downstream side. Benching shall be at least 335mm wide on one side. Step irons for manholes shall be galvanised malleable cast iron complying with BS1247: Part 1.
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5.6. MANHOLE COVERS AND FRAMES

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| Covers and Frames | <p>5.6.1 Manhole covers and frames in carriageways shall</p> <ul style="list-style-type: none"> • comply with the requirements of EN124 ref D400 and be Kitemarked • be of ductile iron or other approved material • be square in plan • have clear opening of 675mm • have a polished Skid Resistance Value (SRV) of >45 (for guidance on covers that meet this requirement please contact the Materials Laboratory on 01392 386500) |
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In footways and verges the requirements are similar except that the covers may be to EN124 ref B125 as agreed with the Engineer.

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| 5.6.2 | <p>Manhole covers and frames are to be bedded on an approved polyester resin or proprietary cementitious high strength mortar, used in accordance with the manufacturer's instructions, on at least two and not more than four courses of 225mm Class B Engineering brickwork and shall be fixed so as to be flush with adjacent surfaces. For the treatment of manhole covers in block paving see paragraph 11.8.3.</p> |
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5.7 GULLIES

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| Gully pots for Carriageways | <p>5.7.1 Gullies shall be trapped as described in clause 508 of the Specification for Highway Works and be in accordance with the standard details shown in Appendix 4A. Where in-situ gullies are formed with permanent shuttering such as plastic, such shuttering is to have a current British Board of Agrément Roads and Bridges Certificate.</p> |
| Gully pots for footways | <p>5.7.2 Gully pots for footways shall be:-</p> <ul style="list-style-type: none"> • salt glazed ware to BS65 round street gully with rodding eye, stopper and chain and trap, 300mm diameter x 600mm deep with 150mm diameter outlet, or • concrete to BS5911 Part 2 unreinforced street gully with rodding eye, stopper and chain and trap, 300mm diameter x 600mm deep with 150mm diameter outlet, or • in-situ concrete formed with permanent shuttering (e.g. plastic gullies) such shuttering to have a current British Board of Agrément Roads and Bridges Certificate. |
| Gully Connections | <p>5.7.3 Gully connections shall be of pipe complying with the requirements of paragraphs 5.1.2. or 5.1.3. and be of a minimum of 150mm diameter. The pipes including collars shall be bedded and surrounded, unless otherwise agreed with the</p> |

Engineer, with concrete Mix ST2 to BS 8500-2 and BS EN 206-1 to a minimum thickness 150mm, over the full length of the connection, in accordance with paragraph 5.4.4.

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| Gully
Gratings and
Frames | <p>5.7.4 Gully gratings and frames in residential estate roads shall</p> <ul style="list-style-type: none"> • be certified as complying with the requirements of EN124 ref C250 • be of ductile iron • have dimensions to be agreed with the Engineer • be hinged and/or lockable where required by the Engineer • have flanges on three sides only (except where agreed with the Engineer) so that they can be placed immediately adjacent to the kerb face. <p>5.7.5 Gully gratings and frames in commercial estate roads shall</p> <ul style="list-style-type: none"> • be certified as complying with the requirements of EN124 ref D400 or C250 as agreed with the Engineer • be of ductile iron • be double triangular 450mm x 450mm. |
| 5.7.7 | <p>5.7.7 Gully gratings and frames shall be so fixed as to be 3 mm below the surface of the road channels, carriageway or footway surface.</p> <p>5.7.8 Double gullies shall be provided at low points.</p> |
| Connections
to Existing
Drainage | <p>5.7.9 Existing sewers, drains and culverts shall be properly connected to the new system as construction proceeds. (See also the requirements of paragraph 1.2.2). When ironwork has to be re-set on trafficked roads, it shall be bedded on an approved polyester resin.</p> |

5.8 SERVICE DUCTS

- 5.8.1 All service ducts shall be constructed in accordance with the requirements of the Statutory Undertaker concerned.
- 5.8.2 Service ducts shall have smooth internal bore and be constructed of:-
- unplasticised polyvinyl chloride pipes complying with Class B or C. of BS 3506, or BS 4660, or BS EN 1401-1:1998, bedded on, and surrounded with concrete Mix ST2, or
 - steel pipes and joints complying with BS 534, or
 - internally glazed vitrified clay ducts with plastic flexible sleeve joints. When tested in accordance with Appendix B of BS 65 the ducts shall conform with the extra strength requirements of that British Standard, or
 - glazed earthenware pipes with Type 1 sockets with flexible joints, manufactured in accordance with the extra strength requirements of BS 65.

- 5.8.3 Inspection pits for Statutory Undertakers apparatus shall be consistent with those authorities' requirements. Covers for all pits, including draw pits, shall be capable of sustaining vehicle loading, and shall not be constructed in plastic.
- 5.8.4 All Statutory Undertakers and the Highway Authority must be advised at least 7 days in advance of any proposed and approved works taking place. When excavating within a highway, highway drains, sewers or statutory undertakers apparatus must be located in advance of machine excavation. If any apparatus is encountered during excavation, the Highway Authority or Statutory Undertaker must be notified immediately and no pipe or cable shall be disturbed without their approval. (Some Statutory Authorities have free phone numbers for use in determining the location of their services.)

5.9 SOAKAWAYS & SUSTAINABLE DRAINAGE SYSTEMS

- 5.9.1 Soakaways for highway surface water drainage shall, where permitted by the Engineer, be designed in Accordance with Building Research Establishment Guidance in BRE Digest 365. Alternative designs based on CIRIA guidance or Environment Agency recommendations may also be considered.
- 5.9.2 In the absence of any additional allowance for Climate Change impacts being made in national guidance a capacity factor of +20% will be applied.
- 5.9.3 Guidance on acceptable forms of SuDS can be found in Part 3 of this design guide.

SECTION 6

EARTHWORKS

Note: The classification and confirmation of acceptability of earthworks materials shall be carried out by the Engineer based on soils information to be provided in accordance with paragraph 0.3.1. If pre-construction testing was undertaken during design, a reassessment of the CBR and moisture content of soils may be necessary at the commencement of works, and any changes to construction thicknesses etc. are to be made where required.

The references to the Highways Agency's Specification for Highway Works in this section can be found here:

http://www.standardsforhighways.co.uk/mchw/vol1/pdfs/series_0600.pdf

6.1 CLASSIFICATION AND USE OF EARTHWORK MATERIALS

Unacceptable Material	6.1.1	Unacceptable material shall not be used in the Permanent Works. Unacceptable material includes:- <ol style="list-style-type: none"> a) peat, material from swamps, marshes and bogs b) logs, stumps and perishable material c) material in a frozen condition d) clay having a liquid limit determined in accordance with BS1377: Part 2, exceeding 90 or plasticity index determined in accordance with BS1377: Part 2, exceeding 65 e) material susceptible to spontaneous combustion f) non-hazardous materials other than those permitted in Table 6/1 of the Specification for Highway Works g) material having hazardous chemical or physical properties requiring special measures for its excavation, handling, storing, transportation, deposition and disposal.
Acceptable Material	6.1.2	Acceptable material is material excavated from within the site or imported onto the site, which meets the requirements of Table 6/1 in the Specification for Highway Works for acceptability for use in the Permanent Works.
Stripping Topsoil	6.1.3	Turf and topsoil shall be stripped from the whole area of the road works and stored in stockpiles of height not exceeding 2 metres unless otherwise agreed with the Engineer.
Corrosion Potential	6.1.4	All earth works materials including capping and fills within 500mm of metallic items (including lighting columns and sign posts) shall be quantified as non aggressive if the following conditions are met:

(all tests in accordance with Series 600 of the Specification for Highway Works)

pH Value: 6 minimum 9 maximum

Chloride ion content: 0.025% maximum

Water soluble sulphate content: 0.25g/l maximum

Resistivity: 5000ohms.cm minimum

Redox Potential: 0.43volts minimum.

6.2 EXCAVATION

- 6.2.1 Excavation shall be carried out to the widths and depths shown on the approved plans and cross section or to such other dimensions as may be considered necessary by the Engineer to secure an adequate foundation.
- 6.2.2 If the correct depth of excavation is exceeded the levels shall be made up with approved granular material to SHW clause 803 or other material approved by the Engineer. If any soft areas are encountered within the area of the formation or the formation becomes puddled or soft, the affected material shall be removed and replaced with acceptable material, which shall be deposited and compacted as specified for the formation of embankments. The low spots shall be suitably drained by land drains where required by Engineer.
- 6.2.3 Construction plant shall not run on the formation unless the Developer maintains the level of the bottom surface at least 300mm above formation level. Any damage to the subgrade shall be made good by the Developer as specified in paragraph 6.2.2.
- Trimming
Side Slopes
- 6.2.4 The side slopes of cuttings and embankments shall be trimmed to the slope shown on the Approved Drawings or to such other gradually changing slopes that the Engineer may direct. Should the slopes of any cuttings be excavated beyond the widths shown on the Drawings, the Developer shall make good each affected area in a manner satisfactory to the Engineer.

6.3 FORMING OF EMBANKMENTS AND FILLS

- 6.3.1 Embankments and other areas of fill shall be formed of material defined as acceptable material in paragraphs 6.1.2. Where embankments traverse areas subject to flooding they should be constructed in granular material up to 300mm above anticipated maximum flood level.
- 6.3.2 Embankments shall be built up evenly over the full width and shall be maintained at all times with a sufficient camber and a

surface sufficiently even to enable surface water to drain readily from them. During the construction of embankments the Developer shall control and direct construction traffic uniformly over their full width. Damage to compacted layers by constructional traffic shall be made good by the Developer.

- 6.3.3 It is not good practice to allow road embankments to remain unfinished or unprotected for any length of time. Weather protection should be provided by placing 300mm minimum compacted thickness above formation level. The material should be of the same type as that used in the sub-formation.
- 6.3.4 A method statement for the transportation, storage, handling, placement & compaction of fill materials shall be provided for approval prior to commencing any such works.

6.4 PERMEABLE BACKING TO EARTH RETAINING STRUCTURES

- 6.4.1 Permeable backing to earth retaining structures shall consist of one of the following materials:-
- i. granular material 4/20 Gc 90/15 in accordance with BS EN 12620:2002 , to a minimum thickness of 300mm, or
 - ii. precast porous concrete blocks laid in stretcher bond with dry joints in 225mm thick walling.

6.5 COMPACTION OF EMBANKMENTS AND FILLS

- 6.5.1 Fill shall be acceptable excavated material or granular filling as described Section 6.1. It shall be spread and compacted as soon as practicable after deposition in layers in accordance with Table 2 below.
- 6.5.2 The developer shall supply a documented procedure for the formation and compaction of embankments and/or fill. This is to include details of site control procedures for the materials and their placement together with measures to verify that the required results have been obtained at all stages in the works. Such measures should include the use of SPT or similar methods for quantifying that adequate levels of compaction have been achieved.
- 6.5.3 The Engineer may at any time carry out comparative field density tests in accordance with BS1377: Part 9: 1990 Clause 2.1/2.2 on material which he considers has been inadequately compacted. If the test results, when compared with the results of similar tests made on adjacent approved work in similar materials show the state of compaction to be inadequate the Developer shall carry out such further work as the Engineer

may decide is required, and the costs of testing reimbursed to the Engineer.

6.5.4 The Developer shall, not less than 72 hours before he proposes to carry out compaction processes, apply to the Engineer for permission in order that the Engineer may make proper provision for the supervision of compaction in the permanent work.

6.5.5 Where materials of widely divergent characteristics are used in embankments and fill areas they shall be spread and compacted in separate clearly defined areas.

6.6 CAPPING LAYER

Capping Layers

6.6.1 In cases where the CBR value of the sub-grade soil is less than 5%, a capping layer of material complying with SHW Types 6F2, 6F3 or 6F4 may be provided. This shall comprise non-argillaceous material and, where the material size permits, shall have a CBR value of at least 15% when tested in accordance with BS1377: Part 4:7 at the in-situ moisture content following compaction. Appropriate thicknesses of capping layer are given in section 7.1.

6.6.2 If the capping layer is within 350mm of the road surface it shall be non-frost susceptible. This requirement shall be deemed to be met if the material after compaction, when wet sieved, produces 8% or less passing the 63µm sieve.

6.7 PREPARATION OF FORMATION

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

- i. All surfaces shall be cleaned and any wet materials, mud, slurry, unsound or unstable material removed.
- ii. The surface shall be brought to the formation level shown on the approved drawings by the addition of fill material or by grading-off high spots.
- iii. The formation shall then be compacted in accordance with Table 2.
- iv. The surface shall be regulated and trimmed to within a tolerance of plus 20mm or minus 30mm of true level and given one further pass with the roller.

6.7.2 Where the formation is not immediately covered with sub-base or base course material, it may be protected by a membrane of 125µm thick impermeable plastic sheeting with 300mm laps set to prohibit ingress of moisture. If the Developer allows the moisture content of accepted compacted material to reach a value above the maximum permitted for the material for compaction the Developer shall allow the material to revert to

an acceptable moisture content and if directed by the Engineer, make good the surface by re-compaction before laying the sub-base in accordance with 6.7.1(i) to (iv) inclusive.

6.8 EARTHWORKS TO BE KEPT FREE OF WATER

- 6.8.1 The Developer shall arrange for the rapid dispersal of any water shed on to earthworks or completed formation or which enters the earthworks from any source. Where practicable, the water shall be discharged to the permanent outfall for the piped drainage system.
- 6.8.2 The Developer shall provide where necessary temporary water courses, ditches, drains, pumping or other means of maintaining the earthworks free from water. Adequate means for trapping silt shall be provided before any water from the site is discharged into permanent drainage systems.

6.9 VERGES

- Preparation 6.9.1 Verges which are to seeded shall be carefully prepared by being thoroughly dug over or ploughed one spit deep, levelled and thoroughly cleared of existing turf, weeds, rubbish, large stones etc. ready to receive topsoil. The top 100mm shall be approved topsoil lightly compacted and then the top 25mm worked to a fine tilth.
- 6.9.2 Immediately prior to seeding or turfing, fertiliser shall be applied to the prepared verge at a rate of not less than 75g per square metre. The fertiliser shall consist of a compound containing not less than 10% nitrogen, 15% phosphoric acid and 10% potash and shall be submitted for the Engineers approval.
- Seeding 6.9.3 Grass seed as specified below shall be evenly sown at the rate of not less than 1kg to 30 square metres and lightly raked into the soil. In case of failure the sowing shall be repeated until the grass is established. The seeded area is to be maintained, including mowing, until the road is adopted.
- Turfing 6.9.4 The grass seed shall be a tested mixture from an approved source; certificates of purity and germination shall be provided at the request of the Engineer. Unless otherwise agreed with the Engineer, the following mixture shall be used.
- | | |
|--|-----|
| Chewings Fescue (<i>Festuca Rubra Commutata</i>) | 24% |
| Smooth Stalked Meadow Grass (<i>Pod Pratensis</i>) | 24% |
| Hard Fescue (<i>Festuca Rubra</i>) | 24% |
| Brown Top (<i>Agrostis Tenuis</i>) | 8% |
| Perennial Ryegrass (<i>Lolium Perenne</i>) Ranger | 20% |
- 6.9.5 Where the area is to be turfed, turves shall be clean and strong and shall comply with BS3969. The turfs shall be well bonded and tamped into the prepared topsoil bed. Where turfs are

required to be laid on side slopes they shall be laid diagonally and pegged as necessary using wooden pegs left flush with the surface.

- 6.9.6 All turfs shall be laid within 1 week of cutting during the period 1st April to 31st August or within two weeks of cutting during the remainder of the year. Laid turfs shall be maintained until the road is adopted.
- Trees
- 6.9.7 Trees planted in verges shall be nursery grown Standard trees and shall be planted within seven days of being taken up from the nursery during the months of October to March inclusive. A list of recommended trees and shrubs is given in Appendix 4C.
- 6.9.8 The trees shall be planted in prepared holes at least 1.0m x 1.0m x 0.5m deep with the bottom broken up to a further 0.3m depth. The tree roots should be properly spread out in the hole and topsoil backfilled in layers gently trodden in with the foot. Trees shall be staked, fastened and protected as necessary.
- 6.9.9 The position of the trees is to be as shown on the Drawings or as agreed with Engineer.

SECTION 7**ROAD PAVEMENTS - GENERAL**

Construction Thicknesses

7.1.1 The required **minimum** depth of construction for each type of Residential and Commercial Roads is given below in Tables 3 and 4.

Construction Thicknesses in Residential Estate Roads

Table 3:

	Type R33 Block Paved Shared Surface Access Roads*	Type R31 and R32 and R33 Bituminous Access Ways	Type R2 Access Roads	Type R1 Residential Transition Roads
	0.1 m.s.a.	0.1 m.s.a.	0.2 m.s.a.	up to 1.5 m.s.a
Surface Course	80/65mm	25mm of 0/6mm SMA	30mm of 0/10mm SMA	35mm of 0/10mm SMA
Binder Course	-	50	50	50
Sand Bedding Course	50 [2]	-	-	-
Base (Roadbase)	50 [1]	80	85	100
Foundation thickness for all types of road				
CBR of sub- grade:	Sub-base alone [3]	Sub-base plus Capping Layer	Geotextile required	
1% or less	not permitted	Special conditions apply. To be agreed with the Engineer		
less than 2% but greater than 1%	not permitted	150 + 600	Yes	
2%	not permitted	150 + 450	Yes	
3%	not permitted	150 + 350	Yes	
4%	not permitted	150 + 300		
5%	240(350)	150 + 250		
6%	220(290)			
7%	200(250)			
8%)	190(225)			
10%	170(225)			
15%	150(225)			
Notes: * Where the block paving is integral to any SuDS system this will be subject to a design provided by the block manufacturer & approved by the Engineer.				
[1] A 50mm of DBM is required when the sub-base is to carry construction traffic in which case the depth of the sub-base may be reduced by 50mm.				
[2] Thickness of sand is given in paragraph 11.8.5.				
[3] (220) - for figures in brackets, see para. 7.1.2.				

Table 4: Construction Thicknesses in Commercial Estate Roads

	Area of Development			
	acres hectares	over 15 over 6	15 to 70 6 to 28	70 to 120 28 to 48
Surface Course		40mm of 0/14mm SMA	40mm of 0/14mm SMA	40mm of 0/14mm SMA
Binder Course		55	60	60
Base (Roadbase)		150	155	200

7.1.2 The water table should not rise to within 600 mm of the formation; subsoil drainage or raising the embankment may prevent this, but if neither of these are practicable the construction thicknesses shown in brackets in Tables 3 and 4 are to be used.

Surface Levels and Surface Regularity of Pavement Courses

7.1.3 The level of any point on the constructed surface of the pavement courses shall be the design level subject to the following tolerances:

Surface Course	+ or - 6mm
Binder course	+ or - 6mm
Base	+ or - 15mm
Sub-base	+ 10mm to - 30mm

7.1.4 Notwithstanding the tolerances permitted in surface levels of pavement courses, the cumulative tolerance shall not result in a reduction in thickness of the pavement, excluding the sub-base, by more than 12mm from the specified thickness.

7.1.5 The surface course thickness stated is the minimum acceptable, i.e., there is no lower tolerance. It is therefore advisable to ensure that the target thickness of the surface course in the laying operation takes this into account.

Checking of Longitudinal Surfaces

7.1.6 A straight edge 3 metres long shall be used to check longitudinal surface regularity and the maximum allowable difference between the surface and the underside of the straight edge, when placed parallel with, or at right-angles to, the centre line of the road at points decided by the Engineer shall be:

for pavement surfaces	3mm
for binder courses	6mm

On lengths of surface course in excess of 75 metres, a calibrated rolling straight edge will be used. Tolerances are:

Length Tested	Maximum number of irregularities		
	4 mm	7 mm	Greater than 10 mm
75 m	9	1	0
300 m	20	2	0

Surface Irregularities out of Specification

7.1.7 Where surface levels or irregularities do not comply with the above the Developer will be required to rectify the matter to the satisfaction of the Engineer.

Use of Surfaces by Traffic and Construction Plant	7.1.8	Where the Developer proposes to use the sub-base for construction plant he shall improve the sub-base to accommodate the method of construction and the type of plant and vehicles which he proposes to use, in order to avoid damage to the sub-base, any capping and the subgrade. Any permanent thickening shall be across the whole width of the pavement, unless otherwise agreed with the Engineer. Temporary thickening shall not impede drainage of the sub-base or the sub-grade.
Order of Work	7.1.9	All drainage and sewerage works, statutory undertakers mains and services, street lighting cabling and ducting etc., shall be installed and the trenches properly reinstated before carriageway binder course is laid.
Traffic Calming Features	7.1.10	Where ramps, plateaux and other sections where texture changes are required in estate roads, the sub-base and upper bituminous layer shall be laid to provide a smooth running temporary surface for construction traffic and afterwards shall be carefully removed over the necessary area and to the required depth in order to construct the ramp, table etc.
Weather conditions for laying bituminous materials	7.1.11	Laying of road pavement materials containing bitumen binders may proceed during light precipitation provided that both the surface to be covered and the air temperature are above 0°C, except where otherwise specified in this Clause. Responsibility for working methods shall remain with the Contractor including all necessary adjustments to suit changes in weather conditions.
	7.1.12	Laying of road pavement materials containing bitumen binders may proceed provided that the temperature of the surface to be covered is 0°C or more, the air temperature is at or above – 1°C and rising and the surface to be covered is dry, unfrozen and free from ice, snow, salt and grit, except where otherwise specified in this Clause
Wind Speed	7.1.13	Wind speed shall be measured by anemometer positioned near the laying site to accurately reflect conditions at the laying site. The anemometer shall be fitted with a digital accumulative device. Although compaction will be assessed by means of the air voids test it is strongly recommended that the acceptable laying conditions given in the following charts are adhered to. In the case of handlay work additional allowance may need to be made to achieve the specified level of air voids, i.e., higher ambient temperature and/or lower wind speed.

FIGURE 7/1: Wind Speed and Air Temperature Laying Restraints for up to 35mm Thickness of SMA Surface Course

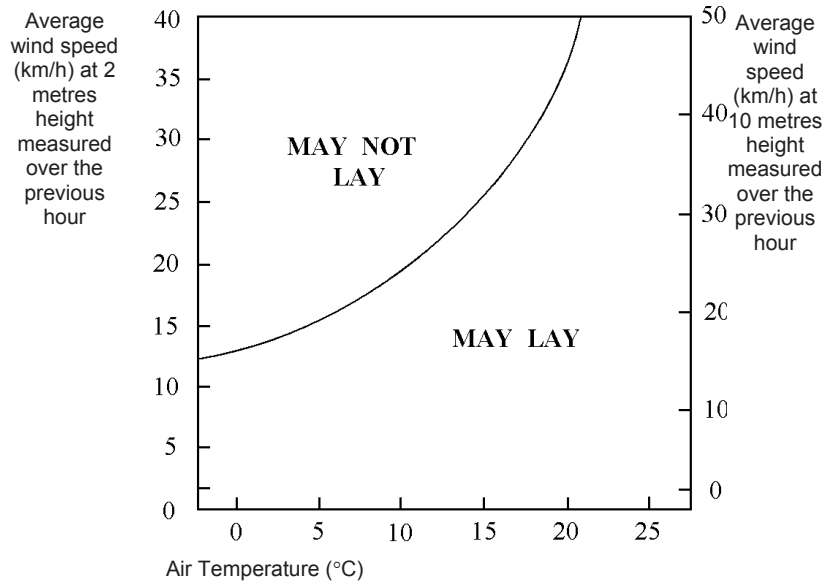
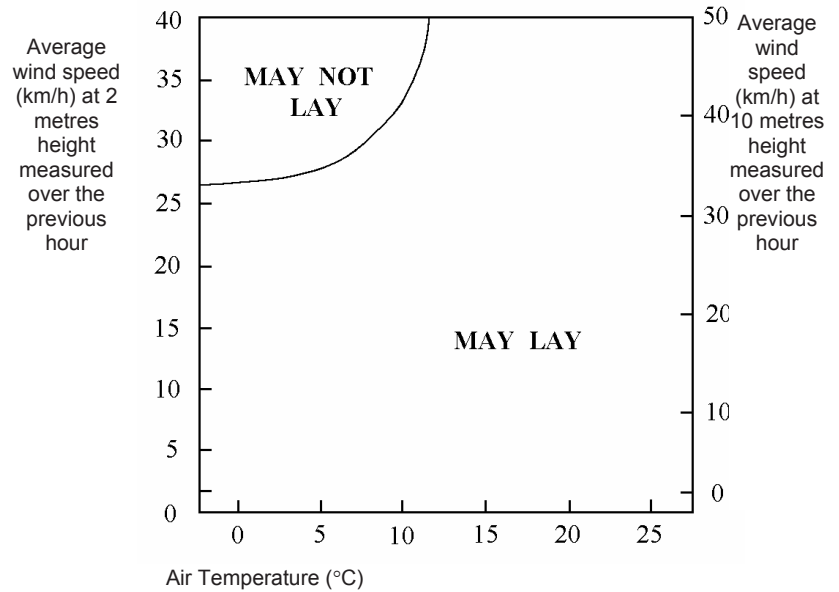


FIGURE 7/2: Wind Speed and Air Temperature Laying Restraints for Dense Bitumen Macadam Surface Course or Binder Course



SECTION 8

ROAD PAVEMENTS – UNBOUND MATERIALS

- | | |
|--|--|
| The Sub-base | <p>8.1.1 The Sub-base shall be granular material Type 1 to SHW clause 803. If the material is to be placed within 350mm of the surface a certificate of frost heave compliance shall be provided. The test will have been carried out no longer than 12 months prior to supply.</p> <p>Other subbase materials will be considered on a site-specific basis. Details of such alternatives shall be notified to the Engineer at least 2 weeks prior to intended use.</p> <p>8.1.2 The material shall transported, handled and laid without drying out or segregation. It shall be spread evenly in layers to the required shape and total thickness shown on the approved drawings either by hand or machine, and compacted as shown in Table 5 below.</p> |
| Sub-base
Protection for
Block Paved
Roads | <p>8.1.3 Where carriageways are constructed in concrete or clay pavements, if the sub-base is to be used as a running surface by construction traffic, a layer of 0/20mm nominal size dense bitumen base-course macadam shall be laid to a minimum thickness of 50mm. Any damage or deformation to the carriageway shall be made good to the Engineers satisfaction and the bituminous layer shall have holes (between 100mm and 150mm diameter) drilled at the rate of one per square metre and filled with 2,8/6,3mm clean chippings prior to laying paving blocks.</p> |

**Table 5 (table 8/1 of the Specification for Highway Works
Compaction Requirements for Granular Materials**

Type of compaction	Category	Number of passes for layers not greater than		
		110mm	150mm	225mm
Smooth-wheeled roller (or vibratory roller operating without vibration)	Mass per metre width of roll :			
	over 2700kg up to 5400kg	16	Unsuitable	Unsuitable
	over 5400kg	8	16	Unsuitable
Pneumatic-tyred roller	Mass per wheel: over 4000kg up to 6000kg	12	Unsuitable	Unsuitable
	over 6000kg up to 8000kg	12	Unsuitable	Unsuitable
	over 8000kg up to 12000kg	10	16	Unsuitable
	over 12000kg	8	12	Unsuitable
Vibratory roller	Mass per metre width of vibrating roll over 700kg up to 1300kg	16	Unsuitable	Unsuitable
	over 1300kg up to 1800kg	6	16	Unsuitable
	over 1800kg up to 2300kg	4	6	10
	over 2300kg up to 2900kg	3	5	9
	over 2900kg up to 3600kg	3	5	8
	over 3600kg up to 4300kg	2	4	7
	over 4300kg up to 5000kg	2	4	6
	over 5000kg	2	3	5
	Vibrating plate compactor	Mass per unit area of base-plate 1400kg up to 1800kg	8	Unsuitable
over 1800kg up to 2100kg		5	8	Unsuitable
over 2100kg		3	6	10
Vibro-tamper	Mass over 50kg up to 65kg	4	8	Unsuitable
	over 65kg up to 75kg	3	6	10
	over 75kg	2	4	8
Power rammer	Mass 100kg up to 500kg	5	8	Unsuitable
	over 500kg	5	8	12
During the compaction the surface profile shall be trimmed so that the finished surface levels are within plus 10mm and minus 30mm of those shown on the approved plan.				

SECTION 9

ROAD PAVEMENTS - BITUMINOUS BOUND MATERIALS

9.1 OVERALL REQUIREMENTS

From April 1st 2008 all bituminous surfacing shall be carried out by companies certificated to National Highways Sector Scheme 16 for the Laying of Asphalt Mixes. Details are available here:

<http://www.ukas.com/Library/downloads/publications/NHSS%2016.pdf>

Only materials supplied by a manufacturer certificated as complying with the Quality Assurance Sector Scheme No. 14 for the manufacture of asphalt (bituminous materials) will be acceptable. All delivery tickets will be made available to the Engineer when required.

The surfacing contractor shall only use material supplied by coating plants that have a current Q level (as defined in the National Sector Scheme for the Production of Asphalt Mixes) no worse than Q4 provided that the plant has maintained a Q level of Q3 or better in two of the previous four weeks.

9.1.1 Details of any non complying material notified by the supplier to the surfacing contractor shall be passed on to the County Council's Materials Laboratory immediately. No material shall be accepted under the supplier's concession arrangements in respect of any non-compliance with the required specification.

Transporting
of Bituminous
Materials

9.1.2 Bituminous materials shall be transported in clean vehicles that have fully insulated bodies and shall be double sheeted or quilted when in transit or awaiting tipping (an Easysheet-type system is also acceptable). The use of dust, coated dust, or water on the interior of the vehicles to facilitate discharge of the mixed materials is permissible but the amount shall be kept to a minimum by tipping or brushing prior to loading. Under no circumstances is diesel to be used.

Laying of
Bituminous
Materials

9.1.3 Bituminous materials shall be spread, levelled and tamped by approved self-propelled pavers. The materials shall as soon as possible after arrival at the site be supplied continuously to the paver and laid without delay. The rate of delivery of material to the paver shall be so regulated as to enable the paver to be operated continuously and it shall be so operated whenever practicable. The rate of travel of the paver and its method of operation shall be adjusted to ensure an even and uniform flow of material across the full laying width, freedom from dragging, tearing and segregation of the material. Diesel is not to be used for lubrication or cleaning of any part of the paver that may come into contact with the bituminous material, e.g., the screed mechanism or hopper.

Hand Laid Work	<p>9.1.4 Hand laying of any bituminous materials will be permitted only in the following circumstances:-</p> <ul style="list-style-type: none">i. laying regulation courses of irregular shape and varying thicknessii. in confined spaces where it is impracticable for a mini-paver to operateiii. in footways. <p>9.1.6 Compaction of bituminous materials should commence as soon as the uncompacted material will bear the effects of the rollers without undue displacement or surface cracking. Compaction should be substantially completed before the temperature falls below the minimum rolling temperatures. Rolling shall continue until all roller marks have been removed from the surface.</p> <p>9.1.7 Compaction shall be carried out preferably using self propelled vibratory rollers operated in accordance with the manufacturers instructions (particularly in respect of amplitude and frequency of vibration) or by using 8-10 tonnes dead weight smooth-wheeled rollers having a width of roll of not less than 450mm, or a combination of these rollers.</p> <p>9.1.8 Vibratory rollers should be capable of achieving at least the standard of compaction of an 8-tonnes deadweight roller.</p>
Adequacy of Compaction of Bituminous Materials	<p>9.1.9 The adequacy of compaction of bituminous materials will be determined by the Engineer from the attained air void content of the laid material using the method specified in BS598: part 104 except that 100mm diameter cores shall be used. The Engineer will take samples in accordance with the following:-</p> <ul style="list-style-type: none">i. pairs of 100mm diameter cores shall be taken when the new material has attained ambient temperatureii. for sites exceeding 1000 sq. m in area, three core pairs per 1000 sq.miii. for sites of less than 1000 sq. m, three core pairs for the complete site. <p>The air void content of each of the individual layers will be determined and shall not exceed the limits given in Table 6.</p>

Table 6

Material	Mean of 6 cores		Mean of any pair	
	Min%	Max%	Min%	Max%
Dense macadam base (roadbase) (BS4987 Clause 5.2)	2	7	1.5	9
Dense macadam binder course (BS4987 Clause 6.5)	2	6	1.5	8
Stone Mastic Asphalt (SMA) 14mm nominal size	2	6	1.5	7
Stone Mastic Asphalt (SMA) 10mm nominal size	2	8	1.5	9
Stone Mastic Asphalt (SMA) 6mm nominal size	2	10	1.5	11
Dense macadam and close graded macadam surface courses- Machine laid (BS4987 Clause 7.5)	2	9	1.5	11

Notes:

1. The maximum permissible air void content given in Table 6 may be increased by 1% for hand laid materials in accordance with paragraph 9.1.4.
2. Air voids results will be rounded to the nearest whole number for the purpose of assessing compliance over a core pair and to the nearest 0.5% for single core pair compliance.
3. The measured mix density will be used in the calculation. This figure is based on data from laboratory analysis of the mix density. The figure used will be the most recent mix density measured for the same material type from the supplying quarry. For referee purposes a 200mm diameter core may be extracted for subsequent analysis of mix density.

Making of Joints

9.1.10 Where joints between laying widths or transverse joints have to be made in surface courses, the material shall be fully compacted and the joints made flush by cutting back the exposed joints to a distance of not less than the specified thickness. This cutting back shall result in the removal of any visually segregated material. All loosened material shall be discarded and the vertical face so formed shall be coated completely and evenly with a suitable bitumen-based product immediately prior to the abutting part of the layer is placed. A cold thixotropic bitumen can be used as per BS4987:Part 2.

All joints shall be offset at least 300mm from parallel joints in the layer beneath.

Delivery Temperatures

9.1.11 The delivery temperatures for bituminous bound materials shall comply with the recommendations of BS4987, as summarised in Table 7 below. A calibrated thermometer suitable for checking the above-specified temperatures shall be provided by the Developer and kept available for use by the Engineer. The calibration will have been carried out within the previous 12 months and will provide clear evidence of traceability to National Standards e.g. via a UKAS certificate.

Table 7

Material	Delivery Temperatures		
	Maximum Temperature on Delivery	Minimum Temperature of mixture immediately prior to laying	Minimum Temperature immediately prior to rolling
	°C	°C	°C
85 pen SMA	190	140	130
125 pen SMA	185	140	125
125 pen DBM (laid by machine)	160	120	95
125 pen DBM (laid by hand)	150	120	95

9.1.12 The carriageway shall not be used as a haul road for heavy construction loads until the binder course has been laid, but before the surface course is laid. Any damage or deformation to the carriageway shall be made good to the Engineer's satisfaction prior to the laying of the surface course.

9.1.13 A bituminous tack coat emulsion of K1-40 or K1-60 to BS434 shall be applied to the clean, dry or barely damp surface immediately prior to laying successive courses of bituminous materials, i.e., between base and binder course and before any regulating layer. It shall be applied at a metered rate in accordance with the following tables.

K1-70 emulsion, formulated with bitumen having a maximum penetration value of 220dmm and less than 1% w/w of added volatile flux oil may also be used.

Table 8 — Recommended Tack coat application target rates in kg/m² of residual bitumen for Newly laid asphalt – New construction.

Binder content upper layer	Binder content lower layer		
	≤ 4%	4.1 – 5.0%	≥ 5.1%
≥ 5.1%	0.15	0.15	0.15
4.1 – 5.0%	0.20	0.15	0.15
≤ 4%	0.25	0.20	0.15

Table 9 — Recommended Tack coat application target rates in kg/m² of residual bitumen for trafficked surfaces.

Binder content upper layer	Nature of lower layer/existing surface (see Note below)		
	Fretted/binder lean	Planed asphalt	Binder rich
≥ 5.1%	0.20	0.15	0.15
4.1 – 5.0%	0.25	0.20	0.15
≤ 4%	0.25	0.25	0.20

NOTE: Application rates in this standard are quoted in kg/m² of residual bitumen. This differs from previous standards, which quoted rates in l/m² of total emulsion. For example, the rate 0.15 kg/m² residual bitumen would approximately equate to 0.35l/m² of K1-40 or 0.25l/m² of K1-60 emulsion.

If the surface is contaminated the carriageway shall be thoroughly washed to effectively remove the detritus. The bitumen emulsion spray shall be applied evenly and no puddles shall be allowed to form. The emulsion shall be allowed to break (turn from brown to black) before the next course is laid. For all areas of machine laid surfacing this tack coat shall be applied by mechanical means fitted with a spraybar certificated as complying with the requirements of BS 1707. A certificate to this effect will be available for inspection when required. Calibration is to be carried out at least annually using a K1-40 or K1-60 grade of bitumen emulsion.

- 9.1.14 A polymer-modified bond coat applied in accordance with the manufacturer's instructions will be required to be applied immediately prior to laying the SMA surface course. The bond coat shall be applied in accordance with the manufacturer's recommendations. Bond coats shall be applied by a calibrated sprayer in accordance with 9.1.13.

9.2 THE BASE (Roadbase)

- 9.2.1 Before laying base (Roadbase) material the sub-base surface shall be clean and free from standing water.
- 9.2.2 Base material shall consist of 0/32mm size dense macadam to BS4987, Clause 5.2.
- 9.2.3 The binder shall be 125 pen to BS 3690. For Commercial Estate Roads the grade shall be 50 pen.

9.3 THE BINDER COURSE

- 9.3.1 Binder Course material shall be Dense Bitumen Macadam binder course to BS4987 1988: Clause 6.5, with 0/20mm nominal size crushed rock aggregate. The material shall be spread evenly to the correct profile and compacted.
- 9.3.2 If the binder course is used as a temporary running surface or if laying of the surface course does not take place within three days, the surface of the binder course shall be thoroughly cleaned and a bond coat applied before the surface course is laid. An aggregate of PSV >50 will be required in the upper layer of the binder course if it is trafficked for longer than 28 days. The Engineer shall be consulted on the actual PSV requirements.
- 9.3.3 The binder shall be 100/150 grade (125 pen). For Commercial Estate Roads the grade shall be 40/60 grade (50 pen).

9.4 THE SURFACE COURSE

Residential Estates 9.4.1 Surface course material shall be as shown in Table 3. The penetration grade of the bitumen shall be 85pen. Guidance on an appropriate material can be obtained by contacting Devon County Council's Materials Laboratory.

9.4.2 Hand-raking of surface course material which has been laid by a paver and the addition of such material by hand-spreading to the paved area for adjustment of level will be permitted only at the edges of the layers of material and at gullies and manholes, or where otherwise agreed with the Engineer. Segregation is to be avoided in all cases.

Gritting of SMA 9.4.3 On all carriageways and any bridleways where SMA is used this shall be gritted using clean 3mm crushed quartzite or approved 3mm steel slag complying with the grading requirements in Table 8. This shall be applied evenly during the initial rolling at a metered rate of 0.6 - 1.0kg per square metre. The excess will be thoroughly removed on the completion of final rolling and before opening to traffic.

TABLE 8: Grading of Grit for Surface Application to SMA	
BS test sieve:	% passing
6.3mm	100
5.0mm	95 - 100
3.35mm	66 - 90
1.18mm	0 - 20
600µm	0 - 8
75µm	0 - 1.5

PSV of Aggregate 9.4.4 The Polished Stone Value (PSV) for bituminous materials to be used as a surface course shall be at least that stated in Table 9.

9.4.5 The risk rating of the site is defined as either:

Potentially High Risk

Includes:

Traffic signals, pedestrian crossings, railway level crossings – including 50 m approaches

Roundabouts and their exits – including 50 m approaches

Bends < 100 m radius where the speed limit > 40 mph (65 kph) – including 50 m approaches

Downhill gradients > 10% for more than 50 m (single or dual carriageway)

Uphill gradients > 10% for more than 50 m (single carriageway only)

or Average or Low Risk

All other situations on single and dual carriageways, including:

Generally straight sections of carriageway

Approaches to and across major/minor road junctions

Bends of 100 m radius or greater, at any speed limit

Downhill/Uphill sections of 10% gradient or less

Road Type	Potentially High Risk	Average or Low Risk
R1	68	60
R2	65	55
R31, R32 & R33	60	50
Cycleways	55	50
Footways	55	50

Commercial Estates 9.4.6 Surface course material shall be as above except that 50pen grade bitumen with natural latex modification (0.2 – 0.3% by mass of the total mix) shall be used or an alternative modified binder may be submitted to the Engineer for approval.

9.4.7 Where frequent turning movements by heavy goods vehicles is likely an “industrial” grade of SMA will be required. Guidance on an appropriate material can be obtained by contacting Devon County Council’s Materials Laboratory.

SECTION 10

ROAD PAVEMENTS - CONCRETE AND CEMENT BOUND MATERIALS

10.1 CONCRETE CARRIAGEWAY

10.1.1 Concrete carriageway construction shall comply with the provisions of the Department of Transports Specification for Highway Works and requires written agreement of the Engineer.

SECTION 11

KERBS, FOOTWAYS AND PAVED AREAS

11.1 PRECAST CONCRETE KERBS, CHANNELS, EDGINGS AND QUADRANTS

11.1.1 Precast concrete kerbs, channels, edgings and quadrants that are to be handled by specialist machinery or handling devices shall be hydraulically pressed and shall comply with the requirements of BS EN 1340. Tapered kerbs, quadrants and some of the less popular sizes of radius kerbs may not be manufactured in pressed form and in these cases only, hammer compacted products will be accepted, provided that they too comply with the requirements of BS EN 1340. Such machine-handled kerbs shall also comply with clause 11.1.2.

11.2 NATURAL OR SIMULATED STONE KERBS

- | | |
|---------------------------|--|
| Natural Stone Kerbs | 11.2.1 Stone kerbs shall be of granite or sandstone, or other approved stone, clean and of regular shape, sound and free from cracks, weathering or faults. They shall be laid in a manner similar to precast concrete kerbs. |
| Reconstituted Stone Kerbs | 11.2.2 Reconstituted stone kerbs may be used in Residential Estates subject to the approval of the Engineer. The County Kerb produced by Redland, the Conservation Kerb produced by Marshalls and the Countryside Kerb CSK2 and CSK3 produced by Charcon are typical products. Radii, quadrants and dropping kerbs are to be used where necessary. |

11.3 LAYING KERBS

- 11.3.1 Kerb and edging bases shall be constructed in concrete Grade C8/10 or ST1 to BS 8500-2 AND BS EN 206-1 to paragraph 14.1.3 properly compacted by tamping. For light weight kerbs refer to 11.1.3. Kerbs may be laid direct on to the wet concrete base or on a mortar bed 10mm to 40mm thick laid on previously constructed base. The concrete should not be used if more than two hours have elapsed since the mix was batched.
- 11.3.2 Edging shall be laid in a minimum 125 mm base of homogeneous concrete and must be bedded in the wet concrete.
- 11.3.3 After laying, the line of the kerbs is to be approved by the Engineer, and then shall be backed and/or haunched with concrete Grade C8/10 or ST1 to BS 8500-2 AND BS EN 206-1.
- 11.3.4 Precast concrete kerbs shall be laid butt jointed, without the

use of mortar infill.

11.4 FOOTWAYS AND PAVED AREAS - GENERAL

- 11.4.1 All drainage work, statutory undertakers mains and services and street lighting cabling which runs along the footways or footpaths must be installed and properly backfilled and compacted before footway or footpath construction commences.
- Preparation of Formation 11.4.2 The formation shall be prepared by removing all vegetation growth, water, mud, slurry and unsound or unstable material and the surface brought to formation level by the addition of acceptable granular material and rolled with a smooth wheel roller weighing not less than 2.5 tonnes or by an equivalent vibrating plate or roller. The level of the approved formation shall be within plus or minus 20mm of levels shown on the approved drawings.
- Foundation 11.4.3 The foundation material shall be granular sub-base material to SHW clause 803 spread evenly and without drying out or segregation to the required profile in one layer of 125mm compacted thickness.
- 11.4.4 Compaction shall be achieved by rolling with a smooth wheel roller weighing at least 2.5 tonnes or by an equivalent vibrating roller until no further compaction can be achieved.
- 11.4.5 The level of the foundation material shall be within plus 10mm or minus 30mm of the levels shown on the approved drawings.
- Application of Weed-killer* 11.4.6 The application of weed-killer is required prior to footway construction and prior to final surfacing works. The chemical weed-killer is intended as a weed growth preventant and shall be Dichlobenil. It shall not be applied during or before weather conditions that would render their use ineffective or result in the contamination of surrounding areas.
- 11.4.7 The chemical is to be by an approved method by the Engineer using purpose built plant or applicators. The Contractor shall ensure that a good treatment technique is adopted and that contamination of surrounding areas, plantings, grass, watercourses is avoided.
- 11.4.8 The Contractor shall only undertake chemical weed-killing using operatives who are certified as being competent by an authorised organisation or body for the purposes of Conditions 6 and 7 of the consent in use of pesticides given by Ministers on the 6th October 1986 in exercise of the power in the Control of Pesticides Regulations 1986. Operators Certificate of Competence must be available for inspection at the request of the Engineer.
- 11.4.9 The use of chemical weed-killer shall be strictly in accordance with the manufacturers recommendations, recommendations issued by the Ministry of Agriculture, Fisheries and Food and

The Control of Pesticides Regulations 1986, and any amendments thereof. Chemical weed-killers shall be of an approved type licensed for the appropriate use by the Ministry of Agriculture, Fisheries and Food and be non-corrosive, of low toxicity to humans, animals, fish and bees, and non-flammable.

11.4.10 The Contractor's attention is drawn to the requirement to state the type, product trade name and active ingredients of the weed-killer(s) he proposes to use for the Engineer's approval. The Contractor shall also submit full details and specifications of the product, including Health and Safety Data sheets. The Contractor shall state whether "full" or "provisional" approval has been given to the product under the Control of Pesticides Regulations. All the above is to be submitted to the Engineer at least three days before the weed-killer is to be used.

11.4.11 The use of chemical weed-killers containing any of the following shall not be permitted:

- (i) 2 - 4 - 5T
- (ii) Aldrin
- (iii) Substances from the triazine group
- (iv) or any other nationally banned substance.

Surface
Course

11.5.2 On Residential Estates the surface course shall be 0/6mm SMA. The grade of bitumen used for surface course shall be 100/150 grade (125pen). On Commercial Estates the surface course shall be SMA of 6mm nominal size. The grade of bitumen used for surface course shall be 70/100 grade (85pen).

The material shall be spread and compacted to the required profile and to a finished layer thickness of not less than 20mm by means of a vibratory roller delivering the appropriate compactive effort (recommended to be at least a 3 tonne deadweight roller).

The finished surface shall be within plus or minus 6mm from the surface level as shown on the approved drawings and flush with adjacent kerbs, covers etc.

Limestone surface course will not be acceptable. No area of segregated material will be permitted.

The air voids limits for the compacted layer are given in Table 6.

Tack/Bond
coat

11.5.3 Tack coat is required where existing surfaces are to be overlaid irrespective of how newly laid. Older and visually contaminated surfaces will require thorough cleaning e.g., water jetting prior to the application of tack/bond coat. Bond coat is required beneath all SMA surfaces laid on carriageways.

11.6 FOOTWAYS AND PAVED AREAS - PRECAST CONCRETE PAVING SLABS, PAVIOURS OR SETTS

General Requirements	11.6.0 All materials used in the footways shall be capable of maintaining a minimum in-service slip resistance of 40SRV (45 on gradients of 10% or greater) when measured using a standard slider and pendulum-type skid resistance meter on a sample of the paving that has been subject to an approved accelerated polishing regime.
Precast Concrete Paving Slabs	11.6.1 Precast concrete paving slabs shall be hydraulically pressed and shall comply with the requirements of BS EN 1339:2003. The slabs shall be a minimum of 60mm thick and shall be a maximum size of 400mm x 400mm square or 450mm x 300mm rectangular. They shall be laid on an all over bed of 35mm uncompacted thickness of sand complying with Table 10a. Limestone coarse aggregate or fines shall not be used unless evidence of satisfactory in-service slip resistance can be provided. Joints shall be butt-jointed and sealed with dry sand brushed in.
Concrete Paving Blocks	11.6.2 Concrete paving blocks for footways shall be in accordance with paragraph 11.9.1 except that the blocks shall not be less than 65mm thickness. They shall also generally conform to the requirements of paragraphs in the series 11.8 and 11.9.
Bricks or Clay Paviours	11.6.3 Clay and calcium silicate pavers shall conform to BS6677 Part 1. Paviours shall be rectangular in shape and not less than 50mm thickness, and shall be laid in accordance with Part III of the Standard. The thickness of sand bedding material to be used when clay and calcium silicate pavers are the surface course shall be in accordance with BS 7533 and shall be not less than 50mm. The Engineer will require Polished Paver Values (PPVs) for any clay paver before approval for use is given.

11.7 STEPS AND RAMPS

Steps	11.7.1 Steps shall be constructed of either precast or in-situ concrete Grade C30P or of approved natural stone. All materials used in their construction shall be capable of maintaining a minimum in-service slip resistance of no less than 45SRV when measured using a standard slider and pendulum-type skid resistance meter. For in-situ concrete the formwork shall provide adequate support to the wet concrete to prevent deformation. A252 mesh reinforcement shall be placed parallel to the ground and positioned to have
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40mm of cover.

- 11.7.2 The steps shall normally be 1.8 metres wide. Landings shall be of the same width as the steps and have minimum length of 2m. A flight of steps shall consist of not more than 12 risers of 150mm, and where there are 4 or more risers a handrail shall be provided. Where the width exceeds 2 metres a central bollard and handrail shall be erected. The treads should have a going of 300mm and have 6mm head fall, shall have a non-slip finish to the surface and the nosings shall have arrises of 10mm radius. The minimum throat dimension (i.e. the minimum thickness of the slab) shall be 150mm.
- 11.7.3 Walls flanking the steps, bollards, free standing handrails and handrails attached to walls are to be to a design approved by the Engineer.
- 11.7.4 Adequate drainage and lighting shall be provided to steps, ramps, landings and approach paths.

11.8 PAVIOURS IN CARRIAGEWAY - OVERALL REQUIREMENTS

- 11.8.1 All materials used in the carriageway shall be capable of maintaining a minimum in-service skid resistance of 40 SRV (45 on gradients of 10% or greater) when measured using a standard slider and pendulum-type skid resistance meter. The Engineer may specify a higher level of skid resistance where a particular risk rating requires it.
- 11.8.2 Paving blocks are to be laid in accordance of the Code of Practice for Laying Precast Concrete Block Pavements, published jointly by the Cement and Concrete Association, the County Surveyors Society and the Interlocking Paving Association (Interpave). The blocks are to laid to a 45-degree herringbone pattern and have sufficient edge restraint to be provided to prevent outward migration of the blocks.
- 11.8.3 In cases where purpose made edge blocks cannot be used, soldier courses laid at edges (including those adjoining manholes, gullies. etc.) are to be in accordance with the above Code of Practice, and as illustrated in the Appendix 4A. Blocks shall be cut so that no individual block shall be less than half of a block in length. To satisfy this requirement the last two courses adjacent to the edge of the carriageway or other obstruction shall be adjusted as necessary, e.g. where the gap is, say, 1/4 block in length, cut two 5/8 blocks. Alternatively, some manufacturers produce a block that is one and a half times the size of a normal block, which can assist in forming such edges.
- 11.8.4 Paviours will have nibs which run the full height of the

block/brick.

11.8.5 Paving blocks shall be bedded on sand in accordance with the following grading thicknesses as shown in Tables 10a and 10b below:

Table 10a

Grading of Bedding Sand for Paviours	
Sieve (mm)	Percentage Passing
6.3	100
5	90 - 100
2.36	75 - 100
1.18	55 - 90
0.600	35 - 75
0.300	8 - 35
0.150	0 - 10
0.075	0 - 1.0

Table 10b

Thickness of Bedding Sand		
	Max	Min
	Thickness (mm)	
Blocks laid on:		
DBM Binder course	50	25
Sub-base	50	35

The material shall be naturally occurring silica sand, free of deleterious salts and contaminants, with particles of a rounded or sub-rounded shape. Advice on suitable sources of approved sand can be obtained from the Engineer.

11.8.6 All joints shall be sealed with a proprietary joint sealing material approved by the Engineer. Care shall be taken to ensure that the sealant does not contaminate the surface of the blocks/bricks so as to cause discoloration or reduction in skid resistance.

Fin Drains

11.8.7 Fin drains to the approval of the Engineer shall be incorporated to ensure drainage of the sand bed at all low channels etc. where water could pond in the sand, and the surface of the sub-base or bituminous under layer shall be graded to ensure that no local ponding will occur.

11.9 PAVIOURS IN CARRIAGEWAY - CONCRETE PAVING BLOCKS

11.10 PAVIOURS IN CARRIAGEWAYS - CLAY PAVIOURS AND ENGINEERING BRICKS

11.10.1 Clay paviours shall be laid only where approved by the Engineer. When permitted, clay paviours shall be capable of achieving a minimum in-service Skid Resistance Value (SRV) of 45 after 2 years trafficking or, on gradients of 10% or steeper, a minimum in-service SRV of 50 after 2 years trafficking. The Engineer may specify a higher level of skid resistance where a particular

risk rating requires it. The pavements shall be not less than 65mm thick and shall be laid in accordance with the provisions of the appropriate part of BS 7533. The Engineer will require Polished Paver Values (PPVs) for any clay paver before approval for use is given.

Engineering
Bricks

11.10.2 Prior to work commencing, the Engineer's approval in writing shall be obtained to the type of brick to be used. Bricks used for this purpose should not contain frogs or holes. Engineering bricks shall be class A or B of BS3921 and shall be laid on edge and in a similar manner to concrete block paving.

11.11 VEHICLE CROSSINGS OF FOOTWAY OR VERGE

11.11.1 Construction thicknesses for light and heavy duty crossings are shown in Table 11.

11.11.2 Where paving blocks are to be laid directly on to Type 1 subbase the surface shall be blinding using a dry limestone "3mm to dust" and vibrated using a plate compactor to produce a void-free surface. Additional blinding and vibratory compaction may be required dependant upon the nature of the subbase surface so as to achieve complete filling of any surface voids.

Table 11

Vehicular Crossing of Footways and Verges	
Residential Roads	
Bituminous Crossing	Minimum of 30mm of 6mm SMA*. Binder penetration grade 85pen (May – September) & 125pen (October – April). Aggregate minimum PSV 50.
Block Pavers	60mm thick 0/20mm DBM binder course*. Binder grade 125 pen. 150mm thick Type 1 sub-base** 80mm thick block pavers# 50mm sand#
Concrete	150mm thick Type 1 sub-base** 100mm pavement quality air entrained concrete Grade C30/37 Waterproof membrane 100mm thick Type 1 sub-base**
Where it is likely that vehicular crossings will be used by commercial vehicles of over 1.5 tonnes unladen weight, the crossing shall be constructed to the same specification as the carriageway and in the case of concrete to the specification for Commercial roads (see below).	
Commercial Roads	
Concrete	235mm pavement quality air entrained concrete Grade C30/37 with A193 mesh reinforcement to BS4483 in top and bottom of slab Waterproof membrane 265 thick Type 1 sub-base**

Note:

- * Other requirements as per Section 9 of this specification
- ** Other requirements as per Section 8 of this specification
- # Other requirements as per Section 11 of this specification

SECTION 12

TRAFFIC SIGNS

12.1 TRAFFIC SIGNS

- 12.1.1 Traffic signs are to be provided where directed by the Engineer, and shall conform with the Specification for Highway Works Series 1200. Any electrical connections shall be made at the same time as those for street lighting.

12.2 STREET NAMEPLATES

- 12.2.1 Street nameplates shall be of a design and material approved by the District Council. Nameplates shall be provided by the Developer and erected before any premises in the street are occupied. The nameplates shall be fixed to the satisfaction of the District Council and the Engineer.
- 12.2.2 Where appropriate, the street nameplate shall incorporate a “No Through Road” sign.

12.3 ROAD MARKINGS

- 12.3.1 Roadmarkings shall be provided where directed by the Engineer, and Deep Cream (to BS 351) lines 50mm wide where an on-street parking order has been imposed. The markings shall be Thermoplastic or Acrylic material and be certificated as capable of meeting the performance criteria outlined in 12.3.3. Certificates to this effect will be considered as acceptable if produced by a UKAS accredited laboratory with those tests in their schedule.
- 12.3.2 All road marking shall be carried out by a contractor certificated to the National Highways Sector Scheme No. 7.
- 12.3.3 All white roadmarking shall meet the following requirements from BS EN 1436. The minimum period for maintaining these levels is 24 months from the time of application or notification of the Engineer whichever is the greater. Measurement shall be in accordance with BS EN 1436.
- 12.3.4 Deep Cream marking shall have a minimum skid resistance of S1 in accordance with BS EN 1436.

Parameter	Class	Minimum Value
Retroreflectivity	R2	RL 100 mcd. m ⁻² lux ⁻¹
Skid Resistance	S2	SRT 55
Luminance	B2	β 0.30

12.3.4 Temporary road markings shall be applied to the binder-course at the discretion of the Engineer. This will generally be where the road may be used by the public prior to installation of the surface course. Any such temporary lining shall be removed prior to laying the surface course. Temporary markings shall meet the requirements of the above table.

SPECIFICATION FOR LIGHTING ON NEW RESIDENTIAL ROADS

INTRODUCTION.

Equipment

Normally, only equipment as detailed in the current list of approved equipment for use on new developments subject to Devon County Councils materials specification will be acceptable.

Services

All street lighting electrical service cables, cut-outs and switching devices are to be supplied and installed by Western Power Distribution (South West) plc (WPD). The Developer is recommended to liaise with WPD at an early stage to ensure, where practicable, simultaneous laying of domestic and street lighting service cables. If the electricity supply to the street lighting system is to be unmetered, it is the Developer's responsibility to ensure that the supply has been registered with an authorised electricity supply company before any part of the system is energised. For more information and a registration pack please contact:-

The Unmetered Connections Team,
Western Power Distribution (South West) plc,
Osprey Road,
Sowton Industrial Estate,
Exeter,
EX2 7WP.
Telephone 01392 352665 & 352667,
email wpdunmeteredsouthwest@westernpower.co.uk.

The final connections cannot be made without evidence that the relevant Supply Number (sometimes referred to as MPAN) has been registered.

1.1 DEFINITION

This specification is intended as a guide and it must be borne in mind by the developer that any and all proposals put forward by the developer are subject to confirmation by the Street Lighting Engineer for Devon County Council. All proposals must conform to BS 5489-1:2003 Code of Practice for Road Lighting, Electricity at Work (Health & Safety) Act 1989, Institute of Electrical Engineers [I.E.E.] 16th Edition Wiring Regulations (Revised), Institute of Lighting Engineers [I.L.E.] Code of Practice for Electrical Safety in Lighting Operations, I.L.E. Guide on the reduction of light pollution; any and all subsequent revisions, additions or relevant changes in Law. Following submission to Devon County Council's section 38 officer, of the developers proposals (both paper & electronic (DWG) copies of plans will be required), the streetlighting department of Devon County Council will provide an appropriate design and subsequently submit marked up copies of the plans indicating required column positions back to the section 38 officer for forwarding to the developer. It is the developers sole responsibility to ensure that all positions of streetlighting equipment are transferred from the submitted plans onto their official Sect 38 plan. The Streetlighting Engineer for Devon County Council will only consider the new development for adoption following a successful inspection of the scheme as indicated on their original design has been installed. Omission of any streetlight position on developers S38 plans will not be accepted as an viable reason. Although design etc will be carried out by Devon County Council, the developer will still be responsible for all installation works.

1.2 PROSPECTIVE RESIDENTS' LIAISON

The developer shall show all proposed positions of lamp columns and other illuminated equipment (signs, bollards etc) on all construction/layout plans (including sales and legal/conveyancing literature) in order that prospective residents are aware that there may be equipment placed adjacent to any given plot or property. Devon County Council will not involve itself in any dispute between the developer and prospective resident. Neither will Devon County Council entertain any request to move or alter any equipment arising from any such dispute arising from the developer not informing the prospective resident of the proximity of any equipment in relation to a plot or property. Where, following complaints or concerns regarding the positioning of any item of streetlighting equipment from residents should arise, the developer will be responsible to fund any necessary works (fitting of shields and or baffles, or if necessary, resiting of equipment following permission from Devon County Council's lighting engineer), deemed necessary to overcome residents concerns.

1.3 'NOT ADOPTED' SIGNS TO BE ERECTED

On all lamp columns and lit signs erected as part of the development (whether On-site or Off-site), the developer shall attach by means of non-metallic cable ties; one 'Not Adopted by DCC' sign. These signs shall be attached to the lamp columns upon erection and remain until such time that Devon County Council adopts the equipment. The signs shall generally face the carriageway. The pattern and legend of this sign shall be approved by Devon County Council – but the purpose is to advise residents to whom they should refer any lighting defect or other related enquiry. On a large development (consisting of more than one new road) Devon County Council would advise the developer to erect an informative sign at the entrance to the site advising residents of contact details for ALL maintenance purposes. It is essential that the sign shall have accurate contact information for the developer or his agent.

2. ESTATE ROADS LIGHTING

2.1 LAMP COLUMNS - TYPE

Lighting columns are to comply with EN40, and Devon County Council's current

lighting column specification. Columns to be Hot Dip Galvanised steel with root protection system and be supplied from Mallatite. Other columns manufactured from different materials, from different manufacturers i.e. Aluminium columns from the Aluminium Lighting Company will be specified at the discretion of the lighting engineer. Details of column height, uplift angle and bracket projection will be included within the key on the lighting design drawing. Footpaths / areas that are unable to be accessed by use of maintenance vehicles will require raise & lower columns to be installed. The column to be used in these locations will be manufactured by Mallatite and will be their galvanised steel mid-hinged raise & lower column with TRP root and be supplied pre-wired. Under no circumstances will low level footway bollards be accepted as a means of providing illumination for areas to be adopted by Devon County Council.

2.2 LAMP COLUMNS – STORAGE AND ERECTION

Lamp Columns awaiting erection must be stacked strictly in accordance with the manufacturer's guidelines. Devon County Council will accept no lamp column if it is bowed or bent.

2.2.1 COLUMNS SHALL:-

be planted in the ground at a depth recommended by the manufacturers; (additional precautions against corrosion shall be taken where Redox and resistivity readings indicate a high risk of corrosion);

be carefully erected and aligned in the vertical position by the use of slings applied at the correct lifting points as recommended by the column manufacturers

Be concreted to 150mm below finished ground level and be consolidated in layers of not more than 150mm using backfilling. A black 50mm duct supplied by WPD shall be inserted through the cable entry slot and will terminate 150mm below the column door aperture and will extend for 100mm beyond the concrete foundation. The remaining open section of the cable entry slot shall be temporarily plugged to ensure that is maintained free from concrete during the backfilling process. All excavated material is to be removed from site and NOT to be used as backfill.

only be installed by a street lighting contractor to be approved by Devon County Council street lighting engineer.

Be installed so that the door aperture is facing away from oncoming traffic so as to provide safety for operatives working on the unit.

2.2.2 PAINTING

There shall be no painting of street lighting columns unless the development is a continuation of an existing painted site, or a "Non Standard" i.e. Victorian style column & lantern scheme etc has been installed. If painting of steel lamp columns (including galvanised steel) is required it shall be carried as below:

- (i) All surfaces shall be degreased and cleaned down before painting which shall be carried out strictly in accordance with the paint manufacturers instructions.
- (ii) Columns, brackets and doors which have been treated at the factory with a metal or galvanised coating shall be treated on site by the application of a final finishing coat as one coat of SIKA Icosit 6630 high solid or similarly approved paint to all external surfaces of the lighting column and bracket arm. This is to include the inside surface of the column door and the door abutment of the column base to a wet film thickness (wft) of 220-275 microns (100-125 microns dry film thickness (dft) using good quality brushes. Rollers must not be used. The colour shall be 12B21, BS4800: 1981.
- (iii) No painting shall be carried out during extremes of temperatures or wet or foggy conditions.
- (iv) No thinning of the paint is to take place.

2.2.3 NUMBERING

Prior to issue of Part 2 certificate, all columns are to be numbered as indicated by Devon County Council. A number 50mm high shall be stencilled in black paint, on a white background, on the road side face of each column at a position 2 metres above finished ground level.

2.3 EQUIPMENT ERECTED IN SOFT AREAS

There are two soft areas defined.

- 1) Verge.
- 2) Service Margin.

If a streetlighting column or illuminated signpost is too be installed in any of the areas noted above a concrete plinth of 0.5m x 0.5m x 0.1m deep shall be provided at the base of each column or lit sign. This is to provide an area that is clear of vegetation, and provide protection to the base of the column / sign post from damage from grass mowers / trimmers etc.

2.4 LANTERNS

- 2.4.1 Lanterns are to comply with BS4533 with a minimum protection rating of IP65. The light source for new works shall be at the discretion of the lighting engineer but will generally be either High Pressure Sodium (SON/T), CDO or compact miniature florescent lamps. Therefore, lanterns designed specifically for these sources shall be used. Details of the lantern chosen for the scheme by the lighting engineer will be included within the key on the submitted lighting design plan. Any lantern specified for the new scheme will be supplied with Philips "Primavision" electronic control gear, or any future electronic control gear specified by Devon County Council, and will include the relevant lamp.
- 2.4.2 Wiring between the terminal block of the lantern and the Devon County Council isolator shall be of polyvinyl chloride insulated and sheathed cable of 600/1000 volt grade, having a copper conductor size of not less than 2.5mm ϕ . All cables shall be correctly colour coded. Unsupported lengths of wiring shall be kept to a minimum and not allowed to come into contact with components by their freedom of movement.

2.5 ISOLATORS

A Lucy “Trojan” double pole isolator, complying with ESI standard number 12-19, fitted with a 6 Amp fuse, or any subsequent future isolator specified by Devon County Council, (details will be within the key on the lighting design plan) shall be fitted within the base compartment of the column. The final line, neutral and earth leads shall be polyvinyl chloride double insulated 600/1000 volt grade having a copper conductor size of not less than 6mm² and correctly colour coded. Sufficient length shall be allowed for final connection between Devon County Council’s isolator and Western Power Distribution’s cut-out. Evidence that the unmetered supply has been registered by an electricity supply company shall be required before the cut-out may be fitted, see SERVICES within the introduction of this document

2.6 EARTHING

All circuit protective conductors shall be sheathed using the correct colour coding, and terminated within Devon County Council’s isolator. All extraneous metalwork shall be bonded by means of a polyvinyl chloride and sheathed cable of 600/1000 volt grade having a copper conductor size of not less than 6mm². The main earth bond from the WPD cut out to the column earth stud shall be 10mm². All terminations shall be made with the use of compression lugs.

2.7 PHOTO-ELECTRIC CELLS

Photo-electric cells will comply with BS5972 and also to Western Power Distribution’s document M69.

All lanterns will be fitted with a one part electronic mini photoelectric cell, although in some situations lanterns may be required to be supplied with a NEMA socket to allow for fitting of a 1 part electronic photoelectric cell. The PEC must be set at 70 lux on 35 lux off and consume no more than 0.25 Watts.

Unless otherwise stated by the lighting engineer, all time controls will be set to so as to operate at the following periods:-

Dusk until Dawn, or

Dusk to midnight and 06.30hrs until dawn

The chosen timing regime for the specific site will be specified within the key on the lighting design plan.

2.8 *SETTING OUT*

The developer or his site representative shall be responsible for marking all positions for the required streetlighting equipment on site, in readiness for his appointed contractor to install the lighting equipment. If any equipment is found to be located in the incorrect position when the site is inspected by Devon County Council, the developer will be responsible to arrange and fund relocation of the equipment to its position as specified on the original lighting design plan. This is to include any correspondence / negotiations required with any prospective or current residents within the vicinity of the required relocation of equipment.

3. ILLUMINATED SIGNS

3.1 SIGNING – GENERALLY

Any Signage that is required must be sited in conjunction with the streetlighting system; and the developer should bear this in mind. The opportunity should be taken to mount traffic signs where possible (and subject to approval) on lamp columns to reduce the number of items of street furniture. All necessary signs will be as determined by Devon County Council, and will be as Devon County Council's current specification. All sign erection shall be in accordance with the Traffic Signs Manual Chapter 13. All sign faces shall be perpendicular from the kerb face unless otherwise specified by Devon County Council. Minimum mounting heights criteria will apply to all signs.

3.2 SIGNING – LIGHTING UNITS

All signs shall be externally lit by means of a Simmonsigns LUA92 with two x 7 Watt PL lamps and integral Royce Thompson Micro Star cell (100/200 lux 1:2). Brackets for post top mounting to be of LUA type, and for mounting on a streetlighting column to be of Two Band Channel and secured by means of "Tamtorque" banding strip.

3.3 SIGNING - ISOLATORS

A Lucy "Trojan" double pole isolator, complying with ESI standard number 12-19, fitted with a 6 Amp fuse, or any subsequent future isolator specified by Devon County Council, shall be fitted within the base compartment of the wide based post. The final line, neutral and earth leads shall be polyvinyl chloride double insulated 600/1000 volt grade having a copper conductor size of not less than 6mm² and correctly colour coded. Sufficient length shall be allowed for final connection between Devon County Council's isolator and Western Power Distribution's cut-out. Evidence that the unmetered supply has been registered by an electricity supply company shall be required before the cut-out may be fitted, see SERVICES within the introduction of this document

3.4 *EARTHING*

All circuit protective conductors shall be sheathed using the correct colour coding, and terminated within Devon County Council's isolator. All extraneous metalwork shall be bonded by means of a polyvinyl chloride and sheathed cable of 600/1000 volt grade having a copper conductor size of not less than 6mm². The main earth bond from the WPD cut out to the column earth stud shall be 10mm². All terminations shall be made with the use of compression lugs.

3.5 *SIGNING – WIDE BASED POSTS*

Any wide based post shall be a 4m hot dipped galvanised steel post with wrap round door, manufactured by Mallitite, or any subsequent future manufacturer as specified by Devon County Council. The post will not be painted and left in its galvanised state. As this is a 4 metre above ground height post, it could be necessary to cut it to the required finished height. This will be carried out prior to the erection of the wide based post and all burrs will need to be removed. As in 2.2.1 (v), the door apertures shall face away from oncoming traffic so as to provide safety to operatives carrying out work on the unit.

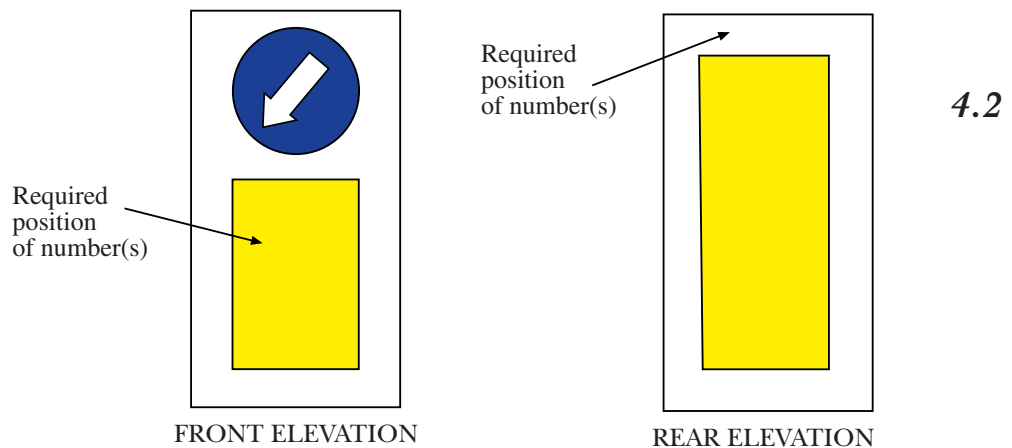
3.6 *SIGNING - STORAGE AND ERECTION*

For wide based posts, the same applies as 2.2 – columns, and 2.2.1 for installation of columns stated previously in this document. In addition sign plates shall be stored vertically in accordance with the manufacturers' instructions, and any sign face that has been scratched or otherwise damaged will not be accepted.

4. ILLUMINATED TRAFFIC BOLLARDS

4.1 BOLLARDS - TYPE

- a) The bollard base shall be the Simmonsigns Ltd 'Global/2PL' type with 2 x 11 watt PLL lamps. Entries for service cables will be by means of standard compression glands. The integral gear/lamp tray shall be removable by insulated handles. A Lucy Double Pole Miniature isolator – MC04/0DN shall be installed in the base of each bollard. The unit shall include a suitably labelled earthing connection point. All circuit protective conductors shall be sheathed using the correct colour coding, and terminated within Devon County Council's isolator. All extraneous metalwork shall be bonded by means of a polyvinyl chloride and sheathed cable of 600/1000 volt grade. The main earth bond from the WPD cut out to the labelled bollard earth stud shall be 10mm². All terminations shall be made with the use of compression lugs.
- b) The shells are to be Simmonsigns 'Simbol' flexi type. The aspect shall be Diagram 610 (Left) unless otherwise required. Fixing (pinning) of the shell to the base shall be by means of 4 x M8 Hex Stainless Steel nuts and bolts.
- c) Bollards are to be numbered prior to issue of Part 2 certificate as per current Devon County Council specification as shown below.



BOLLARDS - ERECTION

Bollards on an island shall be erected so that they are in the centre of the traffic island segment (in plan view) and generally in line with the crown of the carriageway. The bases shall be installed in accordance with the manufacturer's guidelines with special care taken to ensure the correct finished height. It should be ensured that the manufacturers dust caps over securing bolts are complete and in place to ensure bolt does not become encased with dirt etc and become seized.

4.3 *BOLLARDS - CONTROL*

All bollards are to be at the present time to be continuously lit. However due to possible future changes to Devon County Council procedures it maybe required in the future to have a control device installed to control operating times of the illuminated bollards. The bollards are to be electrically fed via 4mm² PVC/SWA/PVC 3 core Armoured cable from an adjacent position specified by Devon County Council. The third core of the armoured cable will be utilised as the earth conductor and will subsequently be marked / sleeved to identify it as such. The armouring of the cable will not be relied upon alone to provide means of earthing. If it is not ergonomically possible to utilise an adjacent lamp column for the supply, then a Feeder Pillar shall be installed, ideally at the rear of the footway. The pillar shall be manufactured by Lucy and have glass protected root, be of a size suitable to permit easy access and maintenance (ideally 6 x 6) and have a isolator (as specified under item 2.5 under column specification noted previously in this document) installed with suitable sized fuses fitted. The SWA cables shall be terminated by means of the correct sized glands and the isolators will have suitable gland plates to facilitate termination.

5. ELECTRICITY SUPPLIES

5.1 SUPPLY SOURCE

With the exception of illuminated bollards, the lighting installation shall have all individual supplies provided direct from Western Power Distribution's (WPD) mains supply. The developer is responsible for the provision of whatever ducting that WPD should require, to enable them to facilitate any necessary connection to the mains supply. Should any item of street lighting equipment be installed prior to WPD providing a connection then the developer will be required to provide an excavation at the base of each lamp column, signpost or pillar for WPD to draw in their service cable.

5.2 PRIOR TO ENERGISATION

Prior to energisation, the developer shall provide a completion certificate to WPD (of a type required by them) to prove that the installation is safe to receive a supply. A copy of each certificate shall be forwarded to Devon County Council to be kept on file.

5.3 SWA (DCC PRIVATE) CABLES - OWNERSHIP

All islands shall be supplied via SWA cables. These shall become the responsibility Devon County Council following satisfactory inspection of development leading to adoption.

5.4 SWA (DCC PRIVATE) CABLES

All SWA cables must be labelled at the point of source as to their destination and labelled at the destination as to their source.

The following must be submitted to Devon County Council as part of the adoption agreement:

- 1) An 'as installed' plan (1:500 scale) indicating the final position of all equipment including the location, run and cover of SWA cables.
- 2) Test and installation (Completion) certificates for each item of lit equipment,

5.5 *SWA (PRIVATE) CABLE DUCTS*

All SWA cable ducts must be specifically designed and laid solely for use by Devon County Council, and must not be utilised by any other party for their use. The duct shall be 100mm smooth bore orange High Impact Polyethylene - wall thickness 5mm (min.) stamped "Street lighting cables". The ducting shall be continuous and any joints or bends will be properly sleeved. Rot proof draw cords shall be used to facilitate the installation of SWA cable(s) with a device employed to prevent draw cords being inadvertently pulled into / or out of the duct.

5.6 *SWA CABLE JOINTING*

No jointing of any SWA cable supplying Devon County Council streetlighting equipment is permitted. In the event of damage etc to such a cable then the developer shall be responsible for replacing the length of cable in its entirety.

6. MAINTENANCE RESPONSIBILITY

6.1 ROUTINE INSPECTIONS

The lit equipment on a development is likely to be in service for some time prior to the commencement of the maintenance period (and thereafter adoption by Devon County Council). Therefore, it is recommended the developer set up and maintain a maintenance regime to inspect (Scout) the new equipment during the hours of darkness. This scouting should be kept up until the commencement of the maintenance period as defined within the legal agreement.

6.2 PRIOR TO ADOPTION BY DEVON COUNTY COUNCIL

Provision of street lighting to highways adoptable under Section 38 or 278 of the Highways Act, 1980 is the responsibility of the developer and must be carried out in accordance with this specification. Devon County Council reserves the right to place notices on lamp columns not adopted by Devon County Council, if the developer has not already done so as per item 1.3 noted previously. The provision of these notices may be charged to the developer. All equipment will be 'bulk lamp changed and cleaned' at the developers expense prior to the commencement of the maintenance period.

6.3 ELECTRICITY CHARGES

Devon County Council will be responsible for un-metered electricity charges with effect from the date of commissioning (Part 2 certificate stage). The Developer will be responsible for advising WPD of this date. Prior to Part 2 certificate stage the developer shall be responsible for all energy charges associated with illuminated street lighting equipment within the development (as per services section within introduction to this document)

6.3.2 TESTS ON COMPLETION

The Developer shall, on completion of the installation, submit to the Engineer Completion Certificates for the testing and commissioning of the installed street-lighting system, in accordance with WPD's statutory requirements and standing agreements with Devon County Council. In addition, where NICEIC contractors have submitted Completion Certificates to WPD, it will be necessary for NICEIC certificates to be submitted to the Engineer.

6.3.3 COMPLETION AND COMMISSIONING

The Developer shall inform Devon County Council when a street lighting system is completed, in whole or in part, and in operation. Commissioning shall not be deemed to have taken place until the installation has been inspected and accepted, in whole or in part, by the Engineer.

6.3.4 MAINTENANCE

The Developer will remain responsible for the replacement of any part of the installation found to be defective or damaged during a period of 12 months from the date of commissioning. This includes the replacement of any defective lamps. Devon County Council will operate and maintain the street lighting system with effect from the end of the 12 month maintenance period.

6.4 UPON ADOPTION

Provided that the installation has been installed in accordance with this specification and as per the supplied street lighting design plan, Devon County Council will add to its streetlighting inventory all the items of illuminated street lighting equipment that Devon County Council specified upon the original scheme plans and assume full ownership. This does not include items of illuminated equipment that the developer might have installed to provide illumination to private areas of the development that has and will not be adopted by Devon County Council.

SECTION 14

MATERIALS

14.1 CONCRETE

General Requirements	14.1.0 Ready mixed concrete shall be supplied by a company certificated for the design and supply of the relevant mixes, e.g., the Quality Scheme for Ready Mixed Concrete (QSRMC). Delivery tickets and mix design information will be made available to the Engineer upon request.
Concrete Grade C30P	14.1.1 Concrete grade C30P shall be an ordinary prescribed mix complying with BS 8500-2 AND BS EN 206-1. The nominal maximum size of aggregate shall be 20mm and the mix shall have medium workability. In accordance with Table 1 of BS 8500-2 AND BS EN 206-1 the mix shall contain 460kg of dry aggregate per 100kg of cement.
Concrete Grade C20P	14.1.2 Concrete grade C20P shall be an ordinary prescribed mix complying with BS 8500-2 AND BS EN 206-1. The nominal maximum size of aggregate shall be 20mm and the mix shall have medium workability. In accordance with Table 1 of BS 8500-2 AND BS EN 206-1 the mix shall contain 600kg of dry aggregate per 100kg of cement.
Concrete Grade C8/10 and ST1	14.1.3 Concrete grade C8/10 or ST1 shall be an ordinary prescribed mix complying with BS 8500-2 AND BS EN 206-1. The nominal maximum size of aggregate shall be 20mm and the mix shall have medium workability. In accordance with Table 1 of BS 8500-2 AND BS EN 206-1 the mix shall contain 900kg of dry aggregate per 100kg of cement.
Water for Concrete	14.1.5 Water for concrete shall be obtained from a mains supply or otherwise comply with EN 1008. No additional water shall be added to ready mix concrete after the initial plant batching.
Aggregates	14.1.6 Unless otherwise specified or agreed with the Engineer, aggregates shall comply with EN 12620 Aggregates for concrete or EN 13055-1 Light-weight aggregates for concrete.:-
Admixtures	14.1.7 Unless agreed with the Engineer neither admixtures nor cements containing additives shall be used.
Ready Mixed Concrete	14.1.8 Ready mix concrete shall comply with the requirements of BS 8500-2 AND BS EN 206-1.
Curing of Concrete	14.1.9 Immediately after compaction and for 7 days thereafter, concrete shall be protected against harmful effects of weather, including rain, rapid temperature changes, frost and from drying out. The methods of protection used shall be subject to the approval of the Engineer. The method of curing used shall

minimise the loss of moisture for the concrete. On concrete surfaces that are to be waterproofed, curing membranes shall not be used. Details for all curing methods to be used shall be subject to the approval of the Engineer.

Cold Weather Working 14.1.10 Concreting shall not be continued when a descending air temperature in the shade falls below 3°C, nor shall it be resumed until an ascending air temperature in the shade reaches 3°C

14.2 REINFORCEMENT

General 14.2.1 Steel reinforcement shall be stored in clean conditions. It shall be clean and free from loose rust and loose mill scale at the time of fixing in position and subsequent concreting. Only reinforcement supplied by a manufacturer/fabricator registered with the CARES quality scheme shall used.

Bending of Reinforcement 14.2.2 Reinforcement shall be bent to the dimensions given in the Bar Schedules. All reinforcement shall be bent at temperatures in the range of 5°C to 100°C.

Placing of Reinforcement 14.2.3 Reinforcement shall be placed and maintained in the position shown in the Contract. Unless otherwise permitted by the Engineer, all bar intersections shall be tied together and the ends of the tying wires shall be turned into the main body of the concrete. 1.2mm diameter stainless steel wire shall be used for in-situ members having exposed soffits. 1.6mm diameter soft annealed iron wire shall be used elsewhere.

Cover Block 14.2.4 Concrete cover blocks to ensure that the reinforcement is correctly positioned shall be as small as possible consistent with their purpose, of a shape acceptable to the Engineer, and designed so that they will not overturn when the concrete is placed. They shall be made of concrete with 10mm maximum aggregate size. Tying wire shall be cast in the block for the purpose of tying them to the reinforcement.

14.3 BRICKWORK

Bricks 14.3.1 Bricks shall be of a type approved by the Engineer for the purpose for which they are required, and shall comply with the particular requirements of BS3921. Bricks for the construction of manholes, inspection chambers, catchpits, public utility boxes etc., shall, unless otherwise approved by the Engineer, be clay engineering bricks conforming the requirements of BS3921 for Class B bricks.

Mortar 14.3.2 Cement mortar used shall be composed of 3 parts sand to 1 part cement and all joints shall be flushed up solid. Sand for mortar shall be a natural sand or crushed natural stone or a

combination of both, as specified in BS1200.

14.4 MISCELLANEOUS MATERIALS

Re-constructed stone

14.4.1 Reconstructed stone shall conform to the requirements of BS 6457.

Timber Preservation

14.4.3 All timber shall comply with the 300 Series of the SHW. Copies of all treatment certificates shall be forwarded to the Engineer. Preservative treated timber will only be accepted from sources certificated as complying with National Quality Assurance Sector Scheme 4: "The Natural and Conferred Durability of Timber."

APPENDICES

APPENDIX 4A

STANDARD CONSTRUCTION DETAILS

The following standard drawings are included, being the most commonly needed details in highway construction. Other details can be obtained from the Department of Transports publication Highway Construction Details

Figure Description

- 4A-1 Precast Concrete Manhole - depth to soffit 1.35m to 3.0m
- 4A-2 Precast Concrete Manhole - depth to soffit 3.0m to 6.0m
- 4A-3 Brick Manhole - depth to soffit not exceeding 1.0m, pipe diameter not exceeding 450mm
- 4A-4 Brick Manhole - depth to soffit not exceeding 1.0m, pipe diameter 450mm to 900mm
- 4A-5 Typical Vertical Backdrop Detail
- 4A-6 Subsoil Drain and French Drain
- Gully
- 4A-7 Block Paving Details
- 4A-8 Block Paving Details (showing fin drain)

APPENDIX 4B

Location of Services in Straight Routes on Estates

NOTES:

1. The layout of mains is in accordance with the Recommended Positioning of Utilities Mains and Plant for New Works (1986) published by the National Joint Utilities Group.
2. The dimensions shown represent the preferred arrangement in straight routes on residential and commercial estates. Variations may be necessary at curves and changes of gradient.
3. The space allocated is considered to be the absolute minimum and in certain circumstances e.g. where both high voltage and low voltage cables are laid the low voltage cable will be laid in the alternative position and additional width may be required.
4. Where buildings are to be connected to gas mains, a minimum instance of 2.0m is required between the building and the centre line of the main.
5. The prior approval of each of the utilities with plant present is required before the dimensions shown are varied to suit wider footways or verges which may be present in some estate layouts.

APPENDIX 4C

RECOMMENDED TREES AND SHRUBS

TREES		Location Suitability					Design Factors				Soil Suitability								
Botanical Name	English Name	Local distributor	R1, C1.	R2, R31, R32, C2.	R33 Shared Surface	Private drive	Slope	Mass or Screen	Group	Specimen	Rapid growth	Height(m)	Deciduous	Evergreen	Coastal margin	Most soils	Clay soils	Chalk soils	Light acid soils
Acer campestre	Field Maple	•					•	•	•			14	•			•	•	•	
Acer platanoides	Norway Maple	•	•						•	•		20	•			•	•	•	
Acer pseudoplatanus	Sycamore	•					•			•		25	•		•	•	•	•	
Acer rubrum	Red Maple	•	•				•			•		20	•			•	•	•	
Aesculus indica	Horse Chestnut	•					•		•	•		25	•			•	•	•	•
Ailanthus altissima	Tree of Heaven	•	•				•			•		22	•			•	•	•	
Alnus cordata	Italian Alder	•	•	•			•	•	•	•		16	•		•	•	•	•	
Alnus incana	Grey Alder	•	•	•			•		•	•		13	•		•	•	•	•	•
Arbutus unedo	Strawberry Tree	•	•	•	•	•	•	•	•	•		10		•	•	•	•	•	
Betula pendula	Common Silver Birch	•	•	•	•	•	•	•	•	•		15	•			•	•	•	•
Betula pubescens	White Birch	•	•	•	•	•	•	•	•	•		13	•			•	•	•	•
Carpinus betulus	Common Hornbeam	•	•	•			•	•		•		16	•			•	•	•	
Castanea sativa	Sweet Chestnut	•					•		•	•		25	•		•	•	•	•	
Cotoneaster frigidus	Himalayan Tree-cotoneaster		•	•	•	•	•	•	•	•		6	•		•	•	•	•	
Crataegus crus-galli	Cockspur Thorn	•	•	•	•	•	•	•	•	•		6	•		•	•	•	•	
Crataegus prunifolia	Broad-leafed Cockspur Thorn	•	•	•	•	•	•	•	•	•		5	•		•	•	•	•	
Fagus sylvatica	Common Beech	•					•	•	•	•		27	•			•	•	•	
Fraxinus excelsior	Common Ash	•	•				•	•	•	•		30	•		•	•	•	•	
Fraxinus ornus	Manna Ash	•	•				•		•	•		22	•			•	•	•	
Gleditsia triacanthos	Honey Locust	•	•		•		•		•	•		24	•			•	•	•	•
Ilex aquifolium	Common Holly	•	•	•	•	•	•	•	•	•		12		•		•	•	•	
Juglans nigra	Black Walnut	•					•			•		20	•			•	•	•	
Koelreuteria paniculata	Pride of India		•	•	•	•				•		12	•				•	•	
Larix decidula	European Larch	•			•		•	•	•	•		25	•			•	•	•	•
Larix Kaempferi	Japanese Larch	•			•		•	•	•	•		25	•			•	•	•	•
Ligustrum lucidum	Chinese Privet		•	•	•	•	•		•	•		14	•		•	•	•	•	
Liriodendron tulipifera	Tulip Tree	•	•				•			•		28	•			•	•	•	
Malus hupehensis	Hupeh Crab		•	•	•	•		•	•			7	•		•	•	•	•	
Malus sylvestris	Crab Apple		•	•	•	•		•	•			8	•			•	•	•	•
Morus nigra	Black Mulberry				•	•	•			•		7	•			•	•	•	
Pinus nigra var maritima	Corsican Pine	•				•			•			25		•	•	•	•	•	
Pinus radiata	Monterrey Pine	•					•			•		27		•	•	•	•	•	
Pinus sylvestris	Scots Pine	•			•		•	•	•	•		25		•	•	•	•	•	
Platanus x hispanica	London Plane	•	•				•			•		30	•		•	•	•	•	
Prunus avium	Wild Cherry	•					•		•	•		20	•			•	•	•	
Prunus padus	Bird Cherry	•				•	•		•	•		15	•			•	•	•	
Pterocarya fraxinifolia	Caucasian Wing -nut	•				•	•		•	•		22	•			•	•	•	
Quercus carris	Turkey Oak	•					•		•	•		30	•		•	•	•	•	
Quercus ilex	Holm Oak	•	•				•		•	•		30	•		•	•	•	•	
Quercus palustris	Pin Oak	•	•		•		•	•	•	•		20	•			•	•	•	
Quercus petraea	Sessile Oak	•	•				•		•	•		30	•		•	•	•	•	
Quercus robur	English Oak	•	•				•		•	•		30	•		•	•	•	•	
Quercus rubra	Red Oak	•	•				•		•	•		25	•			•	•	•	
Robinia pseudoacacia	False Acacia	•	•	•	•	•	•	•	•	•		22	•		•	•	•	•	
Salix alba in var	White Willow	•					•	•	•	•		20	•		•	•	•	•	
Salix pentandra	Bay Willow	•					•			•		22	•			•	•	•	
Sorbus aria	Whitebeam	•	•	•	•	•	•	•	•	•		6	•		•	•	•	•	
Sorbus aucuparia	Rowan	•	•	•	•	•	•	•	•	•		7	•		•	•	•	•	
Sorbus terminalis	Wild Service Tree	•	•	•	•	•	•	•	•	•		10	•			•	•	•	
Taxus baccata	English Yew	•					•	•	•	•		10		•		•	•	•	
Tilia cordata	Small-leaved Lime	•					•		•	•		23	•			•	•	•	•
Tilia euchlora	Caucasian Lime	•			•		•		•	•		18	•			•	•	•	
Tilia petiolaris	Silver Pendent Lime	•					•		•	•		28	•			•	•	•	
Tilia platyphyllos "tubra"	Red-twigged Lime	•			•		•		•	•		30	•			•	•	•	

APPENDIX 4C

RECOMMENDED TREES AND SHRUBS (cont.)

SHRUBS	Design Factors								Soil Suitability									
	Visual screen	Barrier hedge	Formal hedge	Informal hedge	Ground cover	Climbers	Coastal margin	Vandal Tolerant	Dominance	Height	Spacing	Maintenance	Deciduous	Evergreen	Most soils	Clay soils	Chalk soils	Shade tolerant
Acer ginnala	•								•	4.00	4.00				•			
Amelanchier lamarckii	•								•	4.00	3.00				•			•
Aralia alata										3.00	3.00				•			•
Aucuba japonica	•		•							2.00	1.50			•	•			•
Berberis candidula		•		•	•			•		1.00	0.50			•	•	•		•
Berberis darwinii	•	•		•	•			•		2.50	2.50			•	•	•		•
Berberis julianae	•	•		•				•		2.50	1.00			•	•	•		•
Berberis panlanensia	•	•		•				•		1.50	3.00			•	•	•		•
Berberis X stenophylla	•	•		•				•		2.50	2.00			•	•	•		•
Berberis thunbergii		•		•				•		2.00	2.00			•	•	•		•
Berberis wilsoniae		•						•		1.00	1.00			•	•	•		•
Betula nana					•					1.00	0.50			•	•	•		•
Buddleia davidii	•			•				•		0.50	2.50	•	•		•	•		•
Buxus sempervirens	•	•	•							•	2.50	4.00	•	•	•	•		•
Calluna in var					•					0.50	0.40			•				•
Carpinus betulus	•		•							•	2.50	0.30		•	•	•		•
Chaenomeles japonica		•		•				•		1.50	1.50			•	•			•
Choisya ternata		•		•				•		2.00	1.50			•	•			•
Cornus alba		•						•		2.00	2.00	•		•	•			•
Cornus sanguinea		•						•		2.00	2.00			•	•			•
Cornus stolonifera		•						•		2.00	2.00			•	•			•
Corylus avellana	•									•	3.00	0.40	•	•	•			•
Corylus maxima	•									•	3.00	3.00		•	•			•
Cotinus coggyria	•			•				•		•	2.50	2.50		•				•
Cotoneaster horizontalis					•			•		0.50	1.50			•	•			•
Cotoneaster lacteus		•		•				•		4.00	2.00			•	•			•
Cotoneaster simonsii		•		•				•		3.50	2.00			•	•			•
Cotoneaster 'Skogholm'					•			•		0.50	1.00			•	•			•
Crataegus monogyna/oxycantha	•	•	•	•				•		•	3.00	0.30	•	•	•			•
Eleagnus X ebbingei	•	•		•				•		2.00	3.00			•	•			•
Eleagnus pungens		•		•				•		1.50	2.50			•	•			•
Erica var					•					0.50	0.40			•				•
Escallonia macrantha		•		•				•		2.00	2.50			•	•			•
Euonymus alatus		•								2.00	2.50			•	•			•
Euonymus fortunei radicans					•			•		0.30	0.40			•	•			•
Euonymus japonicus	•	•	•	•				•		2.50	1.00			•	•			•
Fagus sylvatica	•		•							2.50	0.30	•	•		•			•
Garrya elliptica		•		•				•		1.50	1.00			•	•			•
Genista hispanica		•			•			•		0.50	1.00			•	•			•
Hebe brachysiphon					•			•		1.00	0.50			•	•			•
Hebe cupressoides					•			•		0.50	0.50			•	•			•
Hebe pinguifolia 'Pagei'					•			•		0.50	0.50			•	•			•
Hedera canariensis					•	•					1.00			•	•			•
Hedera colchia					•			•			0.50			•	•			•
Hedera helix 'Hibernica'					•			•			0.50			•	•			•
Hippophae rhamnoides	•	•		•				•		•	4.00	2.50		•	•			•
Hydrangea 'Bluewave'								•		1.00	1.00	•		•	•			•
Hydrangea petiolaris						•				1.00	1.00			•	•			•
Hydrangea paniculata						•				1.00	3.00	•		•	•			•
Hydrangea 'Whitewave'						•				1.00	1.00	•		•	•			•
Hypericum calycinum					•			•		0.50	0.50			•	•			•
Hypericum 'Hidcote'					•			•		0.50	0.50			•	•			•

APPENDIX 4C

RECOMMENDED TREES AND SHRUBS (cont.)

SHRUBS	Design Factors								Soil Suitability									
	Visual screen	Barrier edge	Formal hedge	Informal hedge	Ground cover	Climbers	Coastal margin	Vandal Tolerant	Dominance	Height	Spacing	Maintenance	Deciduous	Evergreen	Most soils	Clay soils	Chalk soils	Shade tolerant
<i>Ilex aquifolium</i>	•	•	•	•			•	•	•	3.00	0.60	•	•		•	•	•	•
<i>Laurus nobilis</i>	•		•				•	•	•	3.00	0.40	•	•		•	•	•	•
<i>Lavatera olbia</i>							•			1.00	0.50		•		•	•	•	
<i>Lavendula spica</i> 'Hidcote'					•		•			0.50	0.30		•		•	•		
<i>Lonicera nitida</i>		•	•				•	•		2.00	0.50	•	•		•	•	•	•
<i>Lonicera pileata</i>					•		•	•		0.50	0.50		•		•	•	•	•
<i>Mahonia aquifolium</i>		•		•				•		1.50	1.00		•		•	•	•	•
<i>Mahonia</i> 'Charity'		•		•				•		1.50	1.00		•		•	•	•	•
<i>Parthenocissus quinquefolia</i>							•			4.00			•		•	•	•	
<i>Parthenocissus tricuspidata</i>							•			4.00			•	•	•	•	•	
<i>Polygonum baldschuanicum</i>							•			5.00			•		•	•	•	
<i>Potentilla arbuscula</i>					•			•		1.00	1.00		•		•	•	•	
<i>Potentilla fruticosa</i> in var			•					•		1.00	1.00	•	•		•	•	•	
<i>Prunus cerasifera</i>	•	•	•	•					•	2.50	0.30	•	•		•	•	•	
<i>Prunus laurocerasus</i>	•		•	•					•	3.50	0.50	•	•		•	•	•	•
<i>Prunus lusitanica</i>	•	•		•				•	•	3.00	1.00	•	•		•	•	•	•
<i>Prunus spinosa</i>	•	•		•			•	•		2.50	0.30	•	•		•	•	•	•
<i>Pyracantha</i> 'Oranage Glow'				•			•	•		2.50	0.50	•	•		•	•	•	
<i>Pyracantha rogersiana</i>		•		•			•	•		2.50	0.50	•	•		•	•	•	
<i>Rhamnus cathartica</i>	•								•	3.00	2.50		•		•		•	
<i>Rhododendron ponticum</i>	•		•	•					•	4.00	1.00	•	•		•	•		•
<i>Rhus typhina</i>									•	4.00	2.50		•		•	•	•	
<i>Rosa canina</i>							•	•		1.50	1.00		•		•	•	•	
<i>Rosa pimpinellifolia</i>							•			1.50	1.00		•		•	•	•	
<i>Rosa rubrifolia</i>							•	•		1.50	1.00		•		•	•	•	
<i>Rosa rugosa</i>							•			1.50	1.00		•		•	•	•	
<i>Rosmarinus officinalis</i>							•			1.50	1.00		•		•	•	•	
<i>Rubus cockburnialis</i>		•					•	•		2.00	1.00		•		•	•	•	
<i>Rubus tricolor</i>					•		•	•		0.50	1.00		•		•	•	•	
<i>Salix caprea</i>	•						•	•	•	4.00	2.00		•		•	•	•	•
<i>Salix daphnoides</i>	•						•	•	•	5.00	3.00		•		•	•	•	
<i>Salix purpurea</i>	•						•	•	•	4.00	2.00	•	•		•	•	•	
<i>Salix viminalis</i>	•						•	•	•	5.00	3.00		•		•	•	•	
<i>Sambucus nigra</i>							•	•	•	4.00	2.00		•		•	•	•	•
<i>Sambucus racemosa</i>							•	•		2.50	1.50		•		•	•	•	•
<i>Senecio greyii</i>					•		•			1.00	1.00		•		•	•	•	
<i>Spirea X arguta</i>		•		•			•	•		1.50	1.50		•		•	•	•	
<i>Spirea X bumalda</i>				•			•	•		0.50	0.50		•		•	•	•	
<i>Symphoricarpus X chenaultii</i> 'Hancock'					•		•			0.30	0.50		•		•	•	•	•
<i>Viburnum davidii</i>				•			•			0.50	1.00		•		•	•		
<i>Viburnum lantana</i>	•			•			•			2.00	1.00		•		•	•	•	
<i>Viburnum opulus</i>	•			•						2.00	1.00		•		•	•	•	•
<i>Viburnum rhytidophyllum</i>							•			3.50	2.00		•		•	•		
<i>Viburnum tinus</i>	•	•		•			•	•		2.00	1.00		•		•	•	•	•
<i>Vinca major</i> /minor					•		•	•		0.30	0.50		•		•	•	•	•
<i>Villis cognetti</i>						•				4.00			•		•	•	•	•

APPENDIX 4D

CARRIAGEWAY CONSTRUCTION DESIGN PRINCIPLES

D.2.1 Carriageway design is based on the principles in the Highways Agency's Design Manual for Roads and Bridges, Volume 7 Pavement Design and Maintenance.

Road Pavement: The total depth of construction of all layers supported by the sub-grade. It distributes the traffic loads over the sub-grade and protects it from the weather.

Sub-grade: The in-situ ground surface or top of fill which, together with the sub-base, forms the foundation for the pavement.

Formation: The surface of the sub-grade or capping layer prepared to receive the pavement.

Sub-base: A second part of the foundation of the road, which also serves as, a frost protective layer of material placed directly on the formation.

Base (Roadbase): The principal load carrying layer of material which distributes the applied traffic loading and which supports the surfacing in a flexible pavement

Surfacing: The top load-carrying and water-proofing layer(s) of a flexible pavement which enables a good ride quality to be achieved; it comprises:-

- (a) **surface course** - the layer which carries the traffic, and gives appropriate levels of safety, e.g., resistance to skidding etc.
- (b) **binder course** - the layer immediately beneath the surface course.

D.2.2 Design is based on two main factors:

- 1) the quality of the sub-grade, expressed in terms of the California Bearing Ratio (CBR) etc..
- 2) the total number of commercial vehicles (i.e. exceeding 1500 kg unladen weight) expected to run on it throughout its design life, expressed in million standard axles.

For convenience, acceptable construction thicknesses are set out in a table in Section 7.

D.2.3 To ascertain the subgrade conditions the Developer shall request the County Materials Laboratory to carry out a site investigation. An assessment should also be made of the frost susceptibility of the sub-grade. No material within 350 mm of the road surface should be frost susceptible.

D.2.4 If a preliminary investigation is made during the design process, the assessment of the CBR value etc. is also to be confirmed at

the time of excavation.

D.2.5 The water table is to be prevented from rising to within 600mm of the formation level by either using sub-soil drainage or raising the formation by embankment whenever practicable. If neither is practicable the appropriate construction thicknesses shown in brackets tables 4 and 5 must be used.

D.2.6 In summary, the design process is as follows:-

- i. Establish the mechanical, physical & chemical properties (including hydraulic properties where appropriate) of the subgrade.
- ii. Obtain the thicknesses of sub-base, base and surfacing appropriate to the type of road from relevant guidance, including Tables 3 and 4 in Section 7.
- iii. Check that if the sub-grade is frost susceptible at least 350mm of pavement thickness is provided by increasing the sub-base thickness as necessary.
- iv. Determine the appropriate PSV of the aggregate for the surface course or the performance capabilities of the paving bricks or blocks where appropriate.

APPENDIX 4E

List of Documents Referred to in the Guide to the Specification

Highways Agency Manual of Contract Documents for Highway Works Volume 1, Specification for Highway Works 1998 with any subsequent amendments

BRE Reports 365 & 436

Control of Pollution Act 1974

Chapter 8 of the Traffic Sign Manual Traffic Safety Measures for Roadworks, published May 1991.

The Construction (General Provisions) Regulations 1961

Guidance Note GS7 (Revised 1989) issued by the Health and Safety Executive

The New Roads and Street Works Act 1991

British Standard Specifications (BS)

European Specifications (EN)

Simplified Tables of External Loads on Buried Pipelines

Code of Practice for Laying Precast Concrete Block Pavements, published jointly by the Cement and Concrete Association, the County Surveyors Society and the Interlocking Paving Association (Interpave).

Recommended Positioning of Utilities Mains and Plant for New Works (1986)

Highways Agency Design Manual for Roads and Bridges, Volume 7 "Pavement Design and Maintenance".



When publications referred to in this document are revised or replaced, the current editions or replacement documents shall apply unless otherwise agreed with the Engineer.

Developers' attention is drawn to all current legislation relative to construction sites. Nothing stated in this document shall be taken to relieve Developers or their agents of responsibility in this respect.