APPROACH PRINCIPLES COLLABORATION DEVELOPMENT

the Kent design guide

making it happen - **highways**
(pavement & specification)

overview

This part of making it happen includes advice, guidance and information about the highway pavement and specification requirements for residential and industrial developments.


pavement and specification

General

The information in this section must be read in conjunction with the advice given in the main document and other sections of making it happen.

For work in environmentally sensitive areas, early joint discussions with the local District Planning Authority are essential to achieve good design solutions.

All materials and workmanship must be in accordance with the appropriate European Standard or British Standard Specification and Volume 1 of the Highways Agency's Manual of Contract Documents for Highway Works, current at the time of completion of the appropriate Agreement, as amended by the Kent Standard Contract. Where available all materials must have a CE mark.

Amendments and additions to the Specification are included here, but it will be necessary for you to prepare certain appendices relating to the site, for approval by us, and for incorporation into the relevant agreement.

Where documents are superseded or amended our Model Agreement may be adjusted with our permission.

Material Types

Roads are generally constructed in hydraulic, bitumen bound or block paving materials. Concrete construction, with Portland Cement binder will only be acceptable where conditions preclude hydraulic bitumen bound or or block paving types of construction.

Footways are generally constructed in bituminous bound, block paving or small element paving materials. Paving slabs larger than 400 x 400 mm sq and other surfacing materials may be used, in appropriate locations, with our approval.

Materials and techniques specified in this section are those that are commonly used. However, alternative materials and techniques for road construction, that are not included within this section, may become widely available.

Where you propose to use such materials or techniques, you must make a detailed proposal to the Divisional Manager in good time to permit their evaluation and approval prior to the relevant work proceeding.

Tests

You are advised to make arrangements with a laboratory approved by us for such site tests and investigations as may be required in advance of the design, for example CBR tests or stiffness modulation for sub-grade and percolation tests for soakaways.

You must:

- ensure that the test results, materials' source approval and any necessary manufacturers' certificates are submitted to the Divisional Manager for approval;

- make available during the construction of the works, such samples of materials as may be required for testing, and where necessary permit our inspection staff access to carry out in situ tests of road materials and checks on finished construction to verify compliance with the Specification; and
- provide such assistance and equipment as we may require - such as a chainman, labourers, instruments or tools. You are responsible for the costs associated with all such tests and assistance.

Any work considered suspect by our inspection staff, may result in you opening up the works to take cores or dig trial holes, and carry out tests at your own expense to determine the quality of the works to our satisfaction.

Road Preliminaries

General

All areas of the highway to be adapted must be designed and constructed in accordance with the approved plans, the agreement and the requirements of this document.

Wherever possible road designs must include alternative construction thicknesses, which make the maximum use of the material available on the site for capping layer, sub-base or base by using permitted binders.

Additionally, the use of construction materials from sources that maximise the amount of recycled materials is strongly recommended. We can advise you further on suitable recycled materials and techniques.

The road construction must satisfy 4 structural functions. These are:

1. provide construction access routes for the building works;
2. provide a layer of sufficient stiffness so that subsequent layers can be compacted properly;
3. ensure that traffic loads during the life of the road do not exceed the capability of the construction to resist them without rutting or cracking; and
4. provide adequate protection for frost susceptible soils.

We have provided alternative designs in this section tables to assist you in selecting the most appropriate construction to satisfy all these requirements. Additionally, we are committed to sustainable construction practices, whereby methods which use the minimum amount of quarried aggregate, use recycled materials and waste as little of the site arising material as possible, are preferred and recommended.

Where the road is to be used for short term construction access, you must ensure that the subgrade and paving materials are not overloaded, as evidenced by surface rutting. This will require that you have knowledge of the strength, measured by Dynamic Stiffness, of the existing subgrade at the time of construction.

Long term strength of the subgrade may be considerably different from that existing at the time of construction. In the summer months it is likely to be higher, at other times possibly lower. The long term strength of the subgrade is evaluated using the equilibrium CBR or Dynamic Stiffness modulus. This may be estimated in the Laboratory from the properties of the subgrade soils.

You will be expected to prepare road designs for both the construction phase and the long term condition, and then choose the more conservative thickness of construction materials to be provided.

Site Investigations

Before your proposals are submitted for approval, a geotechnical investigation must be carried out in order to assess a number of design issues, including the following:

Disposal of surface water run-off:

- Depth to water table/perched water table;
- Chemical contamination risk assessment;
- Suitability of strata for soakaway discharges in accordance with our Soakaway Design Guide;
- Suitability of strata for features designed to delay discharge to watercourses e.g swales and lagoons;

- Consultation with the Environment Agency; and
- Impact on adjacent developments landslips, slopes etc.

Sub-soil drainage:

- Depth to water table/perched water table;
- Possibility of chemical attack on concrete pipes;
- Control of piping of fine grained soils;
- Treatment of solution features below drainage runs; and
- Impact on adjacent developments landslips, slopes etc.

Earthworks:

- Cutting/embankment fill side slopes;
- Frequency and treatment of solution features in cutting slopes;
- Limits for earthworks acceptability/recycling on-site materials;
- Chemical contamination risk assessment;
- Need for ground improvement of foundation soils;
- Impact on adjacent developments; and
- Geotechnical certification for strengthened embankments/reinforced structures.

Road pavement thickness:

- Short term construction sub grade strength*;
- Long term equilibrium sub grade strength*;
- Frost susceptibility of sub grade;
- Frequency of treatment of soft spots, features, underground caves etc;
- Differential settlement risks/ need for ground improvement;
- Suitability of subgrade soils for in-situ lime/cement stabilisation (if required); and
- Shrinkage swelling potential over consolidated clays (particularly where trees are removed).

The geotechnical site investigation must be carried out in accordance with the requirements set out in 'Guidelines for Good Practice in Site Investigation'. The scale of the investigation will depend upon the scale of the project, but should typically comprise a desk study followed by a ground investigation.

The desk study is beneficial, even for small developments, with valuable data available from Well Records, published records, geological maps and memoirs, aerial photographs, local libraries, local District Planning Authority landfill databases, Speleological Society records and aquifer protection maps.

This literature search will help you optimise and accelerate the planning of the ground investigation and the subsequent design and construction process.

A separate chemical contamination risk examination must be undertaken for the whole development where necessary.

An environmental assessment study must be carried out to identify flora and fauna affected by the development and the steps to be taken to protect and conserve the species at risk. You should discuss any specific requirements with the Divisional Manager.

The road design is based on the strength of the sub-grade to satisfy structural functions, both in the construction phase (the short term) and the post construction phase (the long term). The long term California Bearing Ratio (CBR) or Stiffness Modulus (Ms) of the subgrade, at equilibrium moisture content, must be obtained. This must be measured in accordance with the methods described in our Road Pavement Design Guide.

For construction traffic the CBR or Ms at the time of construction is the determining parameter and must be determined in accordance with the methods described in our Road Pavement Design Guide.

Prior to laying the capping layer and/or sub-base materials, the existing ground must be checked to ensure the construction material thicknesses are correct and the sub-grade can carry the required loads.

* Further information relating to the short term and long term strength of the subgrade is included in our Road Pavement Design Guide, which is included in the reference section on our website.

Sub-soil drainage

Where there is a posibility of the water table rising to within 600mm of the formation level, you must design a suitable drainage system to prevent this happening.

Earthworks

All turf and topsoil must be removed from the formation of the new road. It must be stored carefully on site up to a maximum of 2m in height to prevent deterioration and contamination with sub-soil etc and wherever possible be reused within the site.

Less material needs to be removed where in-situ stabilisation methods are used on the existing soil. This prevents large amounts of granular capping layer being imported.

All other organic materials within the site must be identified, removed and disposed of with our approval. Wherever possible these materials must be reused within the site, in the construction of appropriate mounds or landscaping features.

All highway areas must be excavated or filled to ascertain the agreed formation level. Where local areas are uncovered, which are softer than the general sub-grade, they must be excavated out to a depth appropriate for the soft area and backfilled with material similar to the surrounding formation.

Where soft areas exceed 25% of the total area of the highway, the whole area must be reduced in level and backfilled with suitable material.

All unsuitable materials, other than organic materials, must be considered where treatment permits, for use in the carriageways, footways, verges or other parts of the site. You can only remove surplus materials from the site with our permission.

Fill material must comply with the guidance on 'acceptable material'.

Service ducts and pipework

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

Road Sub-Base and Capping Layer

Design thickness

For Industrial and Commercial Roads, the thickness of sub-base must be determined in accordance with the Design Manual for Road and Bridge Works (Volume 7, Section 2, Part 2 HD25), for the estimated volume of traffic, as agreed with us.

For all other roads only flexible pavements or pavements constructed with slow setting hydraulic materials are permitted, i.e cement bound materials.

The design process is as follows:

- Carry out four thickness designs 2 using the equilibrium CBR of the formation for the long term condition and 2 for the anticipated CBR at the time of construction for the short term condition. The latter will need to be rechecked at the time of construction;
- Select the thickness for sub-base alone and for capping layer options that are the more conservative; and
- Determine on economic practicality or sustainability grounds whether to use the sub-base option or the capping layer option.

For the purposes of this document the traffic figures shown in Table A have been assumed and are based upon a 40-year design life.

The surface of the sub-base must not be used for access purposes by construction traffic when the buildings are being constructed. All construction traffic must use the surface of the base or binder courses where appropriate, prior to the surfacing layer or block paving semi laid.

On frost susceptible soils a minimum thickness of 450mm road construction of 450mm is required. The sub-base thickness may need to be

increased or the sub-grade made non-frost susceptible by use of a capping layer.

Where the works are carried out by a company holding a 3rd Party Quality Assurance Scheme certificate, satisfying BS EN ISO 9001 for this activity, the thickness of sub-base alone or capping layer beneath the sub base (see tables) can be reduced by 20%.

Where the CBR is less than 3%, a non-woven geotextile separation layer is required between the sub-base and the capping layer/sub-grade. Records of the CBR at the time of construction, thickness and compliance data of laid materials and the compaction plant used, must be made available to us.

Table A Assumed Traffic for Design Purposes

Road Designation	**Road Type Definition**	**Construction Traffic/ Standard axles**	**Commercial Vehicles/ Per day**	**Standard axles over design life- (millions)**
Local Distributor Road	LDR	1000	120	1.2
Major Access Road/ Country Lane	MAR/CL	1000	50	0.5
Minor Access Road/ Homezone: (through road)	MIR/HZ	500	10	0.3
Minor Access Way/ Homezone: (cul de sac)	MIW/HZ	200	1	0.05
Shared Access Way / Mews Court	SAW /MC	50	0.3	0.01

Note: Road types shown in Table A are described in more detail in the main part of the document.

Table B Sub-Base Thickness only Short Term Condition						
CBR (%) at time of construction	**< 2**	**2 to 3**	**>3 to <5**	**5to <10**	**10 to <15**	**15+**
Road Type Def						
LD or MAR/CL		480*	370	270	220	180
MIR/HZ		420*	330	240	190	180
MIW/HZ	500*	370*	290	220	180	140
SAW/MC	420*	300*	230	190	180	140

Note: TABLE B shows the thicknesses required where a quality assured contractor is using the top of the base or binder course as a site access and using Category A sub-base or equivalent bound/stabilised material as the foundation material.

Table C Sub-Base Thickness only Long Term Condition						
Equilibrium CBR (%)	**< 2**	**2 to 3**	**>3 to <5**	**5 to <10**	**10 to <15**	**15+**
Road Type Def						
LD or MAR/CL	n/a	200*	180	180	180	180
MIR/HZ	n/a	200*	180	180	180	180
MIW/HZ	450*	200*	180	170	160	150
SAW/MC	360*	200*	180	170	160	150

Notes: Table C shows the thicknesses required for long term conditions where the foundation is constructed using Category A sub-base.

Table D Capping Layer Thickness - Short Term Condition						
CBR (%) at time of construction	**< 2**	**2 to 3**	**>3 to <5**	**5 to <10**	**10 to <15**	**15+**
Sub base thickness	150mm sub base shall be laid on Capping Layer Thicknesses below					
Road Type Def						
LD or MAR/CL	600*	540*	420	300	220	0
MIR/HZ	540*	380*	300	240	180	0
MIW/HZ	400*	250*	180	180	0	0
SAW/MC	190*	180*	180	0	0	0

Note Table D shows the ticknesses required where a quality assured contractor is using the top of the base or binder course as site access. A lesser Category A sub-base or equivalent bound/stabilised material is used as the foundation material which is strengthened with a capping layer.

Table E Capping Layer Thickness - Long Term Condition						
CBR (%) at time of construction	**< 2**	**2 to 3**	**>3 to <5**	**5to <10**	**10 to <15**	**15+**
Sub base thickness	150mm sub base shall be laid on Capping Layer Thicknesses below					
Road Type Def						
LD or MAR/CL	600*	180*	180	180	0	0
MIR/HZ	550*	180	180	180	0	0
MIW/HZ	480*	250*	180	0	0	0
SAW/MC	250*	180*	0	0	0	0

Note Table E shows the thickness requires for long term conditions where the foundation is constructed using category A sub-base which is strengthened with a capping layer.

Where the works are carried out by a company that has 3rd Party Certified Quality Assurance satisfying BS EN ISO 9001 for this activity, the thickness of sub-base and capping can be decreased by 20%

Materials for Capping Layer

Wherever possible the capping layer should be constructed using stabilisation techniques on the existing ground, using a suitable binder in accordance with Clauses 613, 614, 615 or 643. A demonstration area may be required to show that the equipment, techniques and binder used are capable of achieving the bearing value or stiffness modulus required.

Although lime stabilised cohesive materials are frost susceptible, where used less than 450mm below the surface of the road, they must be further treated with cement.

Where it is proven to be uneconomic or impractical to use stabilised material, we may give approval to the use of imported capping material in accordance with Clause 689AK.

At least 2 weeks before the material is due to be laid, details must be submitted to us about the source of the material and the methods intended to be used.

The Environment Agency must be consulted over the use of any material that could contain contaminants, which could generate an unacceptable leachate.

Materials for Sub-Base

Sub base materials must comply with the following:

- Category A Material in accordance with Clause 888AK;
- Hydraulically bound (pozzolanic) materials (HBM) and Cement bound materials (CBM) in compliance with any of the 800 series clauses of the Specification for Highway Works with a compressive strength class C(3/4) (Hydraulic binders include Fly Ash, Blast furnace, Air-cooled and Phosphoric Slag.) They may need to be combined with activators such as lime or gypsum to produce adequate compressive strength. Aggregate interlock is also essential to enable the surface of HBM to resist rutting; or
- Clay, stabilised with lime plus cement or ground granulated blast furnace slag in accordance with Clause 840 and a compressive strength class C (1.5/2).

Granular sub base materials must not be susceptible to frost when tested in accordance with the Specification for Highway Works Clause 801. Stabilised, hydraulically bound and cement bound materials must not be susceptible to frost when tested in accordance with BS 1924 with a maximum frost heave of 5mm.

Materials must be compacted with vibrating rollers before drying out or segregation, so that they achieve 95% of the density required when compacted in accordance with BS 1377 Part 14. You need to get our approval to the tests, which must be measured in-situ using a calibrated nuclear density meter at a rate of 1 test per 50 lin m of road.

Where any material is tested within 24 hrs of installation, it will require our approval and must achieve an in-situ Stiffness Modulus measured by a Portable Dynamic Plate, of 100MPa, measured at a rate of 1 test per 50 lin m of road.

The surface of the sub base material, prior to laying the bituminous material, must not have any ruts exceeding 10mm in depth, measured using a 3m straight edge.

The Environment Agency must be consulted over the use of any material that may contain contaminants, which could generate an unacceptable leachate.

At least 2 weeks before the material is due to be laid, details must be submitted to us about the sources of the material and the methods intended to be used.

You will need to demonstrate, through suitable Laboratory testing at least 6 months prior to use, that all sub base materials, including those made with quarried (virgin) aggregates, meet the requirements of the specification.

Stabilised materials must be tested in the Laboratory using a sample of the material to be used. Where in-situ processes are agreed, this may require material to be excavated from the site or its environs for test purposes.

Laboratory approval does not automatically mean that a material will perform satisfactorily on site. Satisfactory performance is a combination of additional parameters within the control of the supplier and the contractor.

Geotextile separation layer

A geotextile is a layer of fabric complying with Clause 686AK. Its purpose is not to strengthen the road, but to ensure the integrity of granular material overlaying soft ground is maintained, without contamination from migrating fine material.

The layer must be laid on the prepared ground without tearing or punching. All joints must be lapped by a minimum of 300mm.

Road Construction

Road construction using flexible pavements consists of surfacing, binder course, base, sub-base and capping layers.

Sub-base and capping layers

Sub-base and capping layer requirements are detailed on page 7.

Construction thickness – Roads surfaced without modular paving

For Industrial and Commercial Roads the thickness of road construction must be determined in accordance with the Design Manual for Road and Bridge Works (Volume 7, Section 2, Part 3 HD26), for the estimated volumes of traffic as agreed with us. It is based upon a Class 2 Foundation (100MPa) measured by the Portable Dynamic Plate.

Cement Bound Material must not be used.

Hydraulic Bound, Hot Mix Bitumen Bound Materials and structural grade cold recycled bitumen bound materials are permitted as alternatives.

For all other road types the thickness of road construction must be determined from Table F.

Table F Thickness of road layers (mm)										
Road Type/ Layer		**LDR**	**MAR/CL**	**MIR/HZ**		**MIW/HZ**		**SAW/MC 3**		
Base	Permanent cold lay base	120	110	100		90		100	100	-
	Hydraulic bound 1	100	100	80		70		-	-	55
	Hot mix Bitumen Bound 2	100	90	80		70		85	65	-
Binder course	Hot mix Bitumen Bound 2	70	60	50	55	50	55	-	-	50
	Permanent cold lay base	90	75	55	75	55	75	-	-	-
Surfacing	Asphalt Concrete 6 dense surf 100/150	-	-	30	-	30	-	15	-	-
	Thin surfacing 3	20 3	20 3		20 3		20 3		35	
	Surface Dressing /slurry surfacing /Resin bonded	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	- 4

Notes on Table F:

1 Hydraulic bound material must only be used with hydraulic bound sub-base and may be laid at the same operation.

2 Hot mix bitumen bound material must only be used with our prior approval and an explanation for why the selection is being made. Cold Mix material is preferred because of its contribution to our sustainability policy.

3 Thin surfacing 30mm minimum thickness may be substituted with no reduction in binder course thickness.

Construction thickness - Roads surfaced with modular paving

For Industrial and Commercial Roads the thickness of carriageway construction shall be determined in accordance with BS 7533 Part 1 or BS 7533 – 10.

For all other road types the thickness of pavement materials must be determined from Tables G and H.

Table G Thickness of block paving (mm) flexible construction (2)

Road Type		LDR	MAR/CL	MIR/HZ	MIW/HZ	SAW/MC
Base	Asphalt Concrete 20 dense bin 40/60 Cement bound 1 Hydraulic bound 1	90	90	70	70	**50**
Sand laying course		30 mm for concrete blocks clay pavers and sawn stone setts; and 40mm for cropped stone setts				
Surfacing	Concrete blocks	80min	60min	60min	50min	50min
	Clay pavers	65min	60min	50min	50min	50min
	Sawn Stone Setts 3	70min	70min	70min	60min	60min
	Cropped Setts	n/a	n/a	n/a	70min	60/40 min

Table H Thickness of block paving (mm) rigid construction (2)

Road Type		LDR	MAR/CL	MIR/HZ	MIW/HZ	SAW/MC
Base	Cement bound 1 Hydraulic bound 1	90	90	70	70	50
Mortar Bed		40	40	40	40	40
Surfacing	Concrete blocks	80min	60min	60min	50min	50min
	Clay pavers	60min	60min	60min	50min	50min
	Cropped Setts	100min	100min	100min	70min	70min

Notes on Tables G&H

1 Cement bound and hydraulic bound base material must only be used in conjunction with the same CBM or hydraulic bound sub-base, In the case of MIR/HZ, MIW/HZ or SAW/MC this must be laid at the same time as the sub-base.

2 Block and Sett paving may be thicker than the minimum but with no reduction in the thickness of Base. For suitable module sizes refer to BS 7533 –10. This may be applicable where heavy vehicles (dustcarts etc) are likely expected to manoeuvre.

3 Concrete flags and natural stone slabs may be used with our approval. The pavement thickness design must be in accordance with BS 7533 Part 8 or Part 12 for the design traffic given in Table A.

Materials for base and binder courses

Base materials must comply with the following subject to the restrictions stated earlier:

- Material complying with Clause 948 Ex-Situ Cold Recycled Bound Material;
- Material complying with the Specification for Highway Works Clause 929 designated Asphalt Concrete 32 dense base 0/60 des or Asphalt Concrete 32 HDM base 40/60 des or Asphalt Concrete 20 dense bin 40/60 des or Asphalt Concrete 20 HDM bin 40/60des binder course as appropriate, may be used in exceptional circumstances and with our prior approval;
- Cement bound material (beneath modular paving) must satisfy the requirements of the 800 Series of the Specification for Highway Works and Clause 822 now designated CBGM B Class C(12/15) (R) to BS EN14227-1. (Previously designated CBM3R);
- Hydraulic Bound materials must satisfy the requirements of the appropriate Clause in the 800 Series of the Specification for Highway Works and 0/32 mm graded mixture to Clause 830 and compressive strength Class C15/20 to BS EN14227. It may contain slag bound, fly ash bound or hydraulic road binder bound material where available. We would strongly recommend using these types of materials; or
- CBGM and HBM material with different strength characteristics may be used with the thickness adjusted as described in TRL Report 615. Further design and specification advice is available from us if required.

All materials must have demonstrated, by site installation trials independently monitored, that the requirements of the Specification have been met in the last 12 months prior to use.

Road surfacing materials

Surfacing materials must comply with the following subject to the requirements shown in Table J:

- Thin Surfacing suitable for trafficked use (We require that the material has a Certificate of Compliance with HAPAS);
- Asphalt Concrete 6 dense surf 100/150 to EN 13108-1;
- Surface Dressing to the Specification for Highway Works Clause 922SK;
- Slurry Surfacing to the Specification for Highway Works Clause 918;
- Concrete block paving to BS EN 1338. Blocks must be rectangular in shape. Secondary treatment of corners and edges may be permitted where appropriate to the development;
- Clay Pavers to BS EN 1344. Pavers must be rectangular in shape; and
- Stone Setts to BS EN 1342. Setts must have cropped sides or sawn sides where appropriate for the design.

With our approval the following may be used:

- Concrete slabs to BS EN 1339. Slabs must be rectangular in shape; and
- Stone slabs to BS EN 1341. Slabs must be rectangular in shape.

The colour of the blocks and the shape and finish must be approved by us in consultation with the local District Planning Authority, where appropriate.

A sample of 0.5m2 of blocks is required to determine the colour, which must be consistent throughout the scheme.

Bituminous Bound materials and surface dressing must satisfy the detailed requirements in Table J & K.

Coloured Bituminous Bound materials, Slurry Surfacing and Resin Bound materials must have both the binder pigmented and the aggregate appropriately coloured.

We will, in consultation with the local District Planning Authority, approve the colour and finish of the material. Where appropriate, it may be necessary to view the surface laid elsewhere. The colour must be consistent throughout the scheme.

Coloured Resin Bonded surfacing materials must have a certificate of compliance with HAPAS for use in trafficked roads. It may be used as an alternative to surface dressing or slurry surfacing where appropriate.

All hard surfacing in the public realm needs to be fit for purpose. This applies to the parts you can't see as well as the parts that you can. A very expensive finishing material will be ruined without appropriate construction materials. Applied coloured surfaces can help define a range of uses for carriageways and footways.

The colour and type of surfacing materials used must be carefully chosen to designate the role of the relevant piece of road in the hierarchy and must be agreed with us, in consultation with the local District Planning Authority.

Construction of roads - flexible surfacing

The dimensions of the Grid required for checking surface levels of road courses (Clause 702) must be as follows:

- Transverse dimension 1m;
- Longitudinal dimension 5m.

It kerbs are not laid prior to surfacing, the datums for level control must remain in place to permit checks.

Surface regularity must accord with Clause 702.7 and 8 and Table 7/2 for Category B.

All materials must comply with Clause 901 and the information included in this section.

Hot mix bituminous materials, where approved, must only be supplied by plants satisfying the requirements of the National Highway Sector Scheme 14 and Clause 104K and 901K. The latter clause, inter alia, refers to the minimum quality to be achieved by the asphalt plant before it can be used.

Surface Dressing or Slurry Surfacing must only be installed by contractors approved under the National Highway Sector Scheme 13A or 13B.

Bituminous materials can only be laid by contractors approved under National Highway Sector Scheme 16. They must be laid in accordance with the relevant British Standards or HAPAS Guidelines and method statements.

The delivery and rolling temperatures for cold mix are not relevant as the material can be stored and laid at ambient temperatures. However, the material must be protected from drying out in the sun and from heavy rain.

For hot mix materials the minimum delivery temperature and temperature immediately prior to rolling, must be in accordance with BS594987 Table A1 i.e . 120ºC and 95ºC for material with 100/150 grade binder. In the case of materials with a 40/60 grade binder, the minimum delivery temperature and temperature immediately prior to rolling must be 135ºC and 125ºC respectively'.

The satisfactory performance of asphalt surfacing depends upon a good bond between the layers. Binder courses must wherever possible be laid in conjunction with the base material.

Any damage to the surface of this layer must be made good with binder or surfacing materials.

Before a subsequent layer is laid all loose material or other material adhering to the surface of the base or binder course, must be removed by mechanical broom and where necessary water jetting. A tack coat/bond coat must then be applied at the rate described in BS 594987 Table 3 or 4 or the HAPAS Certificate.

Materials for base and binder courses must be checked on site for density and composition. For the purpose of compositional analysis, the tonnage or length of road, as appropriate, is per project with a minimum of one set of tests. The density/air voids must be checked using a calibrated nuclear density meter, at a rate of 1 test per 25 linear meters of road.

The surface macrotexture must comply with the requirements of our specification for low texture initially and retained for 2 years.

The surfacing provides an impermeable and skid resistant layer for the road and is constantly visible to the public. It defines their view of the quality of construction and any visible defects will require remedial works prior to adoption; the scale of these is at our discretion.

Construction of roads - block paved surfacing

Block paving is particularly suitable for new developments as they can be reinstated quickly and efficiently following disturbance by Statutory Undertakers. Adoptable areas are also easier to define using block paving.

Sett paving is suitable for shared surfaces, for delineation purposes, or for areas of vehicle overrun e.g. where the road layout is primarily designed for small vehicles, but access for service vehicles can be accommodated.

For road tyres LDR, MAR/CL and MIR/HZ, block paving must be laid in a 45° herringbone pattern. For MIW/HZ and SAW/MC any pattern is acceptable and can be used accordingly.

For all block paving two stretcher courses adjacent to kerbs and a single stretcher course around ironwork are required.

Block paving must be laid in accordance with BS 7533.3 (Code of Practice for laying precast concrete paving blocks and clay pavers for flexible pavements). Blocks may also be laid using the rigid construction method described in BS 7533.7.

All flag and slab paving must be laid in accordance with BS 7533.4 (Code of Practice for the construction of pavements of precast concrete flags or stone slabs).

Setts and cobble paving must be laid in accordance with BS 7533.7 (Code of Practice for the construction of pavements of natural stone setts) in a flexible or rigid application as detailed in Tables G & H.

The structural strength of a road with block paved surfacing, bedded and jointed with sand, depends upon the thickness of the layer of sand not exceeding the permitted tolerances.

All low areas in the base material must be made good with well rammed hot dense asphalt concrete prior to surfacing. Significant areas outside the permitted tolerances will require the affected base material to be removed and reinstated to the correct tolerances.

Block paved surfaces provide an attractive and practical alternative to flexible surfacing materials. Colours and the choice of materials play an important part in defining the highway.

Block, sett and slab paving shall have a minimum Polished Paver Value of 45.

Junction with Concrete Road

Where a flexible construction road meets an existing rigid concrete road, a double row of granite setts bedded on at least 150mm of ST2 concrete and jointed fully with strong cement mortar, must be laid across the full width of the joint.

The full depth of construction must be maintained beneath the sett paving.

Table J Flexible Construction Materials								
Clause	**Material**	**Thickness (mm)**	**MIX**	**Coarse aggregate**			**Binder**	**Remarks**
				Size mm	Min PSV	Max AAV	Pen	
948	Base/Binder course	120, 110, 100, 90, 75, 55,	See relevant clause	20	n/a	n/a	n/a	The materials shall be material QVE for road types LDR, MAR/CL with trafficking trial. For all other roads the material may be QVE or SVE
		50, 45,		14				
929	Base/ Binder course	100, 90, 85, 80	See relevant clause	32	n/a	n/a	50	There are no requirments for deformation resistance
		70, 65, 50		20				
912	Surface course	35	AC 10 close surf 100/150	10	50	12	125	Close Graded Surface Course material
912	Surface course	15	AC 6 close surf 100/150	6	45	12	125	Traffic Category B

Notes:
Gravel aggregates are not permitted

Table K Other Surfacing Materials (can be used with our permission ONLY)
Thin Surfacing must have a minimum PSV of 50. It must incorporate 0/10 or 0/6mm aggregate and have a low retained texture of site stress level 1
Surface dressing must be 6mm nominal size using Flint Gravel or other aggregate with a Minimum PSV 45, AAV 12 must be applied with a Premium Polymer Modified Binder applied at a rate agreed with us in accordance with Clause 922.
Slurry Surfacing /Microasphalt must be a proprietary system approved by us, size 0/4 with a Minimum PSV 45, AAV 12 in accordance with Clause 918 (footway) or 942 (Carriageway).

Use of Commuted Sums for Materials

New or innovative construction methods and materials may be permitted where this is not likely to increase future maintenance costs or detract from the quality and sustainability of the environment.

Where maintenance costs are likely to be sufficicantly increased, but the materials are otherwise acceptable, we may require the payment of commuted sums based upon the estimated life of the material.

The estimated life of some materials is shown in Table L. Other materials may be acceptable and will need to be approved by us, where appropriate.

Table L - Estimated life of road construction

Material	Estimated life years [E_L]	Remarks
Surface Dressing	15	When used on roads other than SAW/MC
Slurry Surfacing	10	When used on roads other than SAW/MC
Coloured Resin Bonded Surfacing	10	When used on roads other than SAW/MC
Imprinted concrete	8	Where permitted
Stone and Concrete Slabs	10	Where permitted

The commuted sum payable to us is calculated using the following formula: $CS = I \times 40 / E L$

Where:

C s - is the commuted sum to pay;

I - is the initial installation cost; and

E L - is the estimated life from shown in Table L

Kerbing, Channels and Edge Restraint

General

Kerbing is required to protect pedestrians on footways and verges from vehicle overrun and provide a means of directing surface water to gulleys.

Kerbs also define the inside edge on bends and at other locations where inadvertent vehicle overrun could damage the verge. They should only be provided where necessary and must be selected to satisfy the aesthetic requirements of the development.

The use of special kerbs - such as granite effect, exposed aggregate or granite setts - may be required by the local District Planning Authority in conservation areas or where the use of such materials would reinforce the character and identity of the locality. The use of such kerbs may be required where normal kerbs would conflict with the requirements of conservation areas.

Extruded kerbs of concrete or asphalt laid onto the completed surface or binder course may be used where appropriate or for economic reasons. These types of kerbs are particularly useful in minimising the risks from the manual handling of pre-cast products.

Channels not only provide a means of directing surface water to gulleys, they also provide linear features in the construction.

Channels must be either granite setts, proprietary channel and grating sections or small pre-cast concrete or clay units set rigidly in concrete. Pre-cast concrete channels of lengths greater than 300mm must not be used where heavy vehicle over-run is likely.

Where kerbs or channels are removed it must be done in such a way as to minimise any damage to the road surface and allow the materials to be reused within the site.

Kerbs, Channels and Edgings

Precast concrete kerbs, channels and edgings must comply with the requirements of BS EN 1340 and Clause 1101 of the Specification.

The maximum kerb length to be used is 450mm.

Clay paver type kerbs must comply with the requirements of BS EN 1344.

For road types LDR and MAR/cl the kerb type will generally be 125mm x 255mm half battered HB2.

For road types MIR/HZ, MAW/HZ and SAW/MC the kerb types must be small unit block kerbs or, subject to our approval, 125mm x 225mm half battered kerb types HB2.

Alternatively, the use of special kerbs and channels, manufactured in-situ from granite setts bedded on concrete ST2 may be acceptable. The layout and location of these must be agreed with the local District Planning Authority at the planning stage and ourselves.

With the approval of the Divisional Manager, proprietary combined kerb/channel units may be used.

For footways, footpaths and cycleways edging types will generally be 50mm x 150mm type EF bedded and surrounded with concrete ST2.

Pre-cast concrete kerbs, channels and edgings must be laid in accordance with BS 7533.6.

Kerb Face

For road types LDR and MAR/CL, kerbs will normally show a 125mm face above the finished road surface. The only exception will be through certain traffic calming measures, where required, and at vehicular and pedestrian crossings.

In such cases, where it is necessary to vary the kerb face to facilitate drainage of the road, the limits must be between 75mm and 150mm.

For road types MIR/HZ, MAW/HZ and SAW/MC, kerbs will normally show a 100mm face above the finished road surface. The only exception being through the entry ramp, through certain traffic calming measures, where required, and at vehicular and pedestrian crossings.

Where small unit block kerbs are used, this height may be reduced to a minimum of 50mm.

Vehicular crossings and vehicle overrun areas

At vehicular crossings or places adjacent to the road where vehicles are likely or permitted to over-run, the kerbing must be lowered for the full length of the crossing or bend to show a 25mm face above the finished road surface.

When using pre-cast concrete kerbs, tapered kerbs are normally required at either end. Where appropriate small unit block kerbs may be used.

A minimum of 2.7m between crossings is desirable. Where the length is less than 1.8m, the crossing must be laid as one continuous crossing.

Temporary arrangements must in place for vehicular access to occupied dwellings, where the finished surface blocks are laid.

Construction details for vehicular crossings must be in accordance with Tables M&N.

Pedestrian Crossings

All pedestrian crossings must be designed in accordance with our Pedestrian Crossing Design Guide.

The establishment, alteration or removal of a pedestrian crossing requires an advertisement under S.23 of the Road Traffic Regulation Act 1984. You are expected to pay all costs incurred by us for advertising such needs.

Tactile Paving

At all pedestrian crossing points situated along local distributor roads and other places where pedestrian flows are likely to be high, such as main routes to shops, pedestrian crossing ramps must be provided with tactile

The choice of materials can help determine how the highway operates. Colour and texture are important in defining edges, delineating safe areas and uplifting appearance.

surfacing in accordance with the 'Guidance on the Use of Tactile Paving Surfaces' produced by the DETR.

Where a cycleway runs alongside a footway or footpath, consideration must be given to providing tactile markings in accordance with Traffic Advisory Leaflet 4/90 'Tactile markings for segregated/shared use by cyclists and pedestrians' published by the Department of Transport.

Footways, Footpaths, and Cycleways

General

The layout of footways, footpaths and cycleways must be agreed with us before the development is started.

Footway and footpath requirements for particular road types are included in the main part of the document.

Whilst the road may have deviations introduced as part of traffic calming measures to reduce speeds, you must take into consideration the fact that pedestrians tend to walk in straight lines between two points, wherever possible. The layout should be sympathetic to the needs of pedestrian and recognise this by the careful siting of verges and planted areas.

A footway or cycleway also provides a service bay for Statutory Undertakers' apparatus. You must ensure that all services are installed in accordance with the requirements of the New Roads and Streetworks Act 1991, prior to footway surfacing carried out.

A cycleway may be distinguished from a footway or footpath by an appropriate selection of surfacing materials or colour and appropriate markings on the surface.

Cycleways may abut footways or footpaths or be separate from them.

The construction details for footways, footpaths and cycleways must be in accordance with Tables M & N.

Preparation of Formation

Earthworks will normally be carried out in conjunction with road works.

Additional filling and shaping of the footway formation may be required after kerb have been laid. This must be carried out to the requirements of the Specification, without damage to any kerbing or services laid beneath the footway.

Unless the formation is in chalk it is not necessary to ensure 450mm of frost resistant material.

Edging

Edge restraint must be provided where footpaths or cycleways do not abut a kerb, channel or boundary wall.

Pre-cast concrete edgings are normally used for most types of edge restraint.

Alternatively, engineering bricks, clay pavers, concrete blocks or stone setts - rigidly laid in concrete - may be used where appropriate, with our approval.

Edge restraints consisting of kerbs, blocks or setts must have an upstand of 25mm to prevent water flowing onto private land and provide a tapping rail for those with visual impairment, where appropriate.

Drainage

Where necessary surface water run-off must be drained from footpaths and cycleways that do not abut the road.

Alternatively, the vertical alignment must be adjusted to ensure that no puddles form on the surface, making due allowance for the laying tolerance on surfacing materials.

Depending on site conditions landscaped areas may be used for drainage areas from footpaths and cycleways.

Surface water run-off must be prevented from draining into private property and curtilages at all times.

Construction thickness

For industrial and commecial vehicle crossovers, the pavement layers must be designed using the table of construction thickness for the appropriate road type, as described in Table A, using the predicted traffic for the premises.

Construction thickness for footways, footpaths, cycleways and all other vehicle crossings must be in accordance with Tables M and N

Table M	Flexible construction thickness (mm) (footways, footpaths, cycleways and vehicle crossovers)		
Location	**Footways, footpaths and cycleways**	**Residential vehicle crossover**	**Corners or where over-run possible**
Sub-base on formation with CBR 2% or less	100 (150 for Industrial or Commercial roads adjacent to road)	250	150
CBR 3% to 5%		200	
CBR >5%		150	
Ex-situ cold recycled bound material SVE or QVE	50 (140 for Industrial or Commercial roads adjacent to road)	50	140 in 2 layers
Surfacing	20	20	20

Notes on Tables M & N

1. Slurry Surfacing/Microasphalt resin bonded surfacing may be substituted where the bound base material is increased in thickness by 20mm.
2. Bound material base only required for residential vehicle crossover.
3. Where a CBR of <3% is present a non-woven geotextile must be laid to protect the sub base from contamination.
4. Slabs must not be used for cycleway surfacing except for delineation purposes.

Table N	Block paving and slab construction thickness (mm) (footways, footpaths, cycleways and vehicle crossovers)		
Location	**All footways, footpaths and cycleways**	**Residential vehicle crossover**	**Corners or where over-run possible**
Sub-base on formation with CBR 2% or less	100 (150 for Industrial or Commercial roads adjacent to road)	250	150
CBR 3% to 5%		200	
CBR >5%		150	
Base CBGM B Class C12/15 (R) or HBM or	n/a (120 for Industrial or Commercial roads adjacent to road)	n/a	120
Ex-situ cold recycled bound material SVE or QVE	n/a (70 for Industrial or Commercial roads adjacent to road)	50	70
Surfacing blocks as adjacent road on	50 sand	30 sand	30 sand
or Slabs on	25 sand	25 sand	25 sand

Sub-base for footways, footpaths, cycleways and vehicle crossovers

Sub-base must accord with category A material to Clause 888AK.

Base and Surfacing for footways, footpaths, cycleways and vehicle crossovers

Base materials must be either:

- Cold Mix asphalt to Clause 948 Ex situ cold recycled bound material either QVE [structural grade] or SVE [storage grade].

Surfacing materials must comply with the following:

- Asphalt Concrete 6 dense surf 100/150 to EN 13108-1;
- Surface dressing to the Specification for Highway Works Clause 921SK;
- Slurry Surfacing to the Specification for Highway Works Clause 918 SK;
- Concrete block paving to BS EN 1338. Blocks must be rectangular in shape. Secondary treatment of corners and edges may be permitted where appropriate to the development; or
- Clay Pavers to BS EN 1344. Pavers must be rectangular, normally 200mm by 100mm.

Where permitted and with our approval you may use:

- Concrete slabs to BS EN 1339. Slabs must be rectangular in shape with a maximum dimension 450mm; or
- Stone slabs to BS EN 1341. Slabs must be rectangular in shape.

The colour and type of surfacing materials used must be carefully chosen to designate the role of the relevant piece of footway, footpaths or cycleway in the hierarchy and must be agreed with us, in consultation with the local District Planning Authority.

Wherever possible we will require you to use brindle coloured blocks because it is a lot easier to match these when carrying out reinstatements. However, you may use other colours with our approval where appropriate.

A sample of 0.5m2 of blocks must be provided to determine the colour, which must be consistent throughout the scheme.

Blocks, flags and slabs (where permitted) must be laid in accordance with the relevant part of BS 7533.

Bituminous mixtures and surface dressing materials must satisfy the detailed requirements in Tables J & K. They must be laid in accordance with BS 594987.

Coloured Bituminous mixtures and Slurry Surfacing must have both the binder pigmented and the aggregate appropriately coloured.