



Northumberland  
County Council

# Specification for Highways Works

## Ver 1.1

# Contents

- 1 Introduction ..... 3
- 2 General ..... 8
- 3 Earthworks..... 15
- 4 Carriageway Capping and Sub-Base Layers..... 23
- 5 Kerbs, Channels and Edgings..... 29
- 6 Concrete, Reinforcement, Brickwork, Stone and Timber ..... 32
- 7 Bituminous Materials ..... 40
- 8 Block Paving ..... 48
- 9 Footpaths, Footways and Cycleways ..... 53
- 10 Reinstatement..... 60
- 11 Appendices ..... 61
- 12 List of Standards Used ..... 67
- 13 Glossary ..... 69
- 14 Index..... 70

# List of Tables and Figures

Table 2-1	Pavement Construction Thicknesses .....	10
Table 3-1	Compaction Requirements .....	20
Table 4-1	Capping and Sub-base requirements .....	24
Table 4-2	Capping Grading requirements .....	24
Table 4-3	Sub-base Grading requirements .....	25
Table 4-4	Compaction Requirements for Granular Materials .....	26
Table 4-5	Compaction Guidance .....	27
Table 6-1	Concrete Grades and Mix Requirements .....	33
Table 6-2	Typical Applications for Concrete .....	34
Table 7-1	Preferred Asphalt Concrete (Macadam) Materials .....	41
Table 7-2	Preferred Hot Rolled Asphalt Materials .....	41
Table 8-1	Minimum block thicknesses .....	49
Table 9-1	Flexible Footway Construction .....	54
Table 9-2	Typical Modular Paving Construction .....	55
Figure 1	Stairway Minimum Requirements .....	58

# 1 Introduction

## Contents

- 1.1 Foreword
- 1.2 Safety
- 1.3 Nuisance and Noise
- 1.4 Notice for Inspection
- 1.5 Standards of Materials and Samples
- 1.6 Developer's Responsibilities

## 1.1 Foreword

**This document summarises Northumberland County Council’s minimum technical requirements for the design, construction and maintenance of adoptable roads, footways, footpaths and cycleways within the county.**

**Minimum and absolute minimum guidance should be interpreted as not to be constructed below this. Design tolerances will need to be taken into account to ensure that minimums and absolute minimums are met.**

**These standards apply for any highways adoption process administered under the Highways Act 1980. In so far that they apply, inter alia, to S37, S38, S228 or any other recognised power in this or any form of legislation pertaining to the adoption of highways for maintenance at public expense.** The document details the standards that should be followed, specification requirements, construction thicknesses for roads, construction details, permitted materials and standards to be used in the construction of the development.

The Developer should use this specification as a guide but should check that the specification is appropriate for each situation. Use of this document does not relieve the Developer of any responsibility to ensure that his development will be constructed safely and to the latest standards and regulations.

The following documents represent the design suite of documents that Northumberland County Council promote to ensure the highest commitment to continuous improvement for sustainable transport modes and must be followed to ensure that development proposals give priority first to pedestrian and cycle movements, both within the scheme and with neighbouring areas; and second – so far as possible – to facilitating access to high quality public transport, with layouts that maximise the catchment area for bus or other public transport services, and appropriate facilities that encourage public transport use:

- National Design Guide
- LTN 1/20
- Inclusive Mobility

- DMRB geometric guidance or Manual for Streets geometric guidance (to be advised)
- Departures from Standards: Procedures for Local Highway Authorities
- GG119 Road Safety Audit
- Waste Collection - Manual for Streets and associated standards e.g. BS5906 / Building Regs
- Fire Safety - Manual for Streets and associated standards
- Local Parking Standards

Any design guidance or documents which do not represent national standards would require approval in writing to be relied on including Residential Roads and Footpaths in Northumberland - 1980.

Any reference to *the Engineer* in this specification shall mean the Head of Technical Services of Northumberland County Council or any representative appointed by the County Council including officers within Highways Development Services. Throughout the design and construction of the development, the secondary contact for Northumberland County Council will be:

[highwaysplanning@northumberland.gov.uk](mailto:highwaysplanning@northumberland.gov.uk)

The highway specification which follows relates to the Department of Transport Specification for Highway Works. *The Engineer* must approve in writing any elements of the development which do not comply with this specification.

This specification represents the current approach of Northumberland County Council as Highway Authority, particularly in interpreting Government documents “Manual for Streets” and “Manual for Streets 2”. The specification provides specific local requirements to supplement national guidance. Further guidance on Highway Adoption is contained in the Department for Transport Advice Note – Highways Adoptions, April 2017.

It must be noted that under a S38 agreement the developer is deemed to be working co-operatively and as such the technical approval process and technical approval shall result in a practical completion certificate with a maintenance period. At the end of the maintenance period, should the construction continue to be to the satisfaction of *the Engineer* then a final completion certificate will be issued, and any remaining financial balances resolved, in accordance with the terms

of the agreement. If for any reason *the Engineer* requires further works the final completion certificate issuing will be delayed until such time that all outstanding matters are satisfied.

When a S38 is not secured the requirements to demonstrate that the highway is to an adoptable standard will be more onerous on the proposer. In these instances additional surveys and reports are likely to be required. NCC encourages any new roads construction to be undertaken in a co-operative manner. We are unable to dedicate public funded resource towards developments that do not have a secured agreement or suitable financial sums to cover the cost of officer time associated with private street works.

Any intention to proceed via Section 37 of the Highways Act must be done so by serving notice of the intention to build a road and dedicate it as a highway maintainable at public expense. The Notice must be accompanied by plan(s) at 1:500 scale describing the location and width of the proposed highway.

It is intended that this specification shall be read alongside the Council's "Highway and Transportation Design and Delivery Guide" when this is published.

A highway structure is any bridge, subway, culvert, pipe, tunnel, manhole chamber, wall, reinforced soil embankment, piece of street furniture, building or other structure built in, over, under or adjacent to any part of the highway for which it materially affects the support of that highway and/or the safety of the travelling public. All works relating to new or existing highways structures shall be referred to the Northumberland County Council Structures team.

## 1.2 Safety

The developer shall ensure that all relevant safety legislation is complied with during the course of the works, including the current version of the Construction, Design and Management Regulations. Safety planning shall consider the public as well as the workforce.

Traffic management on roads which may be used by the public or visitors to sites shall comply with Chapter 8 of the "Traffic Signs Manual".

All materials and rubbish shall be securely stored to prevent dispersal in adverse weather conditions.

The developer shall ensure that mud and other materials are not deposited on the public highway by vehicles leaving the site. The local authority reserves the right to charge the Developer for cleaning highways if it considers it necessary to arrange for cleaning to be undertaken.

### 1.2.1 Use of Explosives

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 which 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 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.

### 1.2.2 Children and Construction Sites

Developers should take account of the serious dangers to children on construction sites particularly when the site is 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:-

- liaison with school heads and publicity visits to schools.
- exclusion of all children from the site during working hours, except for properly supervised educational visits.
- provision of perimeter fencing to the site.
- guarding the edges of excavations.
- safe stacking of materials.
- removal of access to elevated areas.
- isolation of electricity and other energy sources.

- correct storage of hazardous materials.

### 1.3 Nuisance and Noise

The developer shall contact the County Council to establish noise limits and restrictions to working hours. Permissible working hours may vary from site to site. However, generally on Mondays to Fridays the working hours are 8 am until 6 pm. On Saturdays work will generally be permitted between 9.30 am and 1.30 pm. Working is not normally permitted on Sundays or Bank Holidays.

The developer shall generally carry out the works in such a manner as to not create a nuisance or danger to adjacent residents, businesses or users of adjacent highways and other spaces.

The developer shall give written notification in advance to those affected by the works and shall during the course of the works keep those people informed of progress and future activity.

The developer shall submit to *the Engineer* proposals for minimising nuisance and for notifying those affected by the works.

Mud, debris, dust and rubbish must be contained within the site and the site and adjacent area must be cleared daily to remove any material escaping from designated areas on the site.

The local authority may take action to reduce nuisance and charge the Developer for undertaking this work.

### 1.4 Notice for Inspection

The Developer shall give *the Engineer* ten working days notice in writing of the date upon which works will start and provide a programme of works identifying key milestones for site inspections including, inter alia:

- Road formation
- Highway Drainage works
- Gully Installation
- Kerb lines / chainage / levels / alignments
- Depths to carriageway / footpath / shared routes
- Final surfacing

Should any works depart from the submitted programme then a minimum of 5 working days notice will be required to arrange alternative or unplanned site inspections, and then five 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 Engineer's* approval. Where work is covered up without *the Engineer's* approval, it is at the Developer's risk, and the Developer will bear any costs in demonstrating that the work is satisfactory. The demonstration of conformity will include as a minimum, pairs of 150mm diameter cores at 25m centres.

It is the Developer's 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.

### 1.5 Standards of Materials and Samples

Unless otherwise specified, all materials shall comply with the current edition of the appropriate British Standard Specification or equivalent and shall be transported, stored and used in accordance with the requirements or recommendations of that Specification. Where available, materials and articles produced under Kite Mark, CE Mark or Safety Mark or other independently certified scheme, or by a Firm of Assessed Capability, are to be used as required.

The Developer will supply a construction material testing schedule and will arrange for the necessary tests to be carried out during construction at their expense. 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* prior approval. Bituminous materials may only be obtained from plants accredited to the National Highway Sector Scheme 15. When any material or article is required to comply with a British Standard such material or article or its container shall bear the stamp of the registered certification trade mark of the British Standards Institution. 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 County Council Materials Laboratory.

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.

## 1.6 Developer's Responsibilities

### 1.6.1 Damage to Highways

The Developer shall be responsible for any damage to existing roads, footways, verges, drains, highway structures (eg bridges, retaining walls, fords and footbridges) and Statutory Undertakers' property, whether forming part of the works or not, which have arisen from the works, the transport of workforce, 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 surveys.

Where works may impact on third parties, such as the placing/removal of fill to construct embankments, the Highway Authority will require baseline groundwater/SI/topographical data and a period of monitoring to protect both the Highway Authority and third party interests.

### 1.6.2 Mud, Materials or Equipment on Highway

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 in the vicinity of the works free from mud, debris or dust arising from

the works. Surface water from the works shall not be permitted to flow onto any existing public highway.

### 1.6.3 Clear up on Completion

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.

### 1.6.4 Maintenance Period

For a period of at least 12 months after completion of the works 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 which may arise. Such repairs shall be carried out to *the Engineer's* satisfaction.

### 1.6.5 Hazardous Waste

On developments where existing roads are to be wholly or partly removed as part of the main works or any S278 works, care should be taken during the removal, disposal and overlay of existing materials with regard to Asphalt Waste Containing Coal Tar (AWCCT) i.e. Tar Bound Material.

AWCCT has been highlighted as having the potential to release Polycyclic Aromatic Hydrocarbons (PAH). It is categorised in the Environment Agency's Technical Guidance note WM3, as a HAZARDOUS MATERIAL, which requires licensed, specialist disposal if removed from site. THE MATERIAL SHOULD NOT BE SUBJECTED TO HEAT.

### 1.6.6 Works near Structures

Works which are within 15m of an existing Highway Structure (bridge, retaining wall, footbridge etc) will be subject to Special Engineering Difficulty under the New Roads and Street Works Act (1991) (NRSWA).

Developers should consider if they require approval for work adjacent to existing Highway Structures.



# 2 General

## Contents

- 2.1 Terms and Definitions
- 2.2 Ground Site Investigation Report
- 2.3 Construction Thickness
- 2.4 Quality of Materials and Workmanship
- 2.5 Testing of Materials
- 2.6 Acceptable Materials
- 2.7 Notification of Start of Works
- 2.8 Quality of Work
- 2.9 Statutory Undertakers Apparatus
- 2.10 Temporary Signs/Signals
- 2.11 Protection of Carriageways
- 2.12 Work on Public Highways
- 2.13 Order of Work
- 2.14 Traffic Calming Features

## 2.1 Terms and Definitions

Carriageway design is based on the principles in the Department for Transport's Design Manual for Roads and Bridges, Volume 7 "Pavement Design and Maintenance". The definitions of the various layers which make up the road construction are as follows:-

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

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

**Capping:** Capping is an inexpensive material used to improve the subgrade in order to provide a suitable foundation platform.

**Formation:** The surface of the subgrade 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:** 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:-

- Surface course – the layer which carries the traffic, and gives appropriate resistance to skidding, etc.
- Binder course – the layer between base and Surface course.

**Geogrid /Geotextile:** Synthetic fabric laid in/on the foundation or asphalt to provide stabilisation/reinforcement or layer separation.

## 2.2 Ground Site Investigation Report

### 2.2.1 Ground Investigation - General

The developer shall undertake a soils investigation and supply to *the Engineer* a Factual Report incorporating trial pit logs, borehole logs, if available, and the results of testing for soil classifications, moisture content, water table levels, California Bearing Ratio (CBR) values, etc., in sufficient detail to enable *the Engineer* to check the adequacy of the design of drainage, road construction, etc. All testing shall be undertaken by a laboratory with the (United Kingdom Accreditation Service) UKAS accreditation for the tests required. If an interpretative report is available, it shall also be forwarded to *the Engineer*.

### 2.2.2 Contaminated Land

The ground investigation must identify the type, distribution and concentration of any contaminants with sufficient certainty to enable their significance to be assessed in relation to the intended use of the site. Further information on the assessment of contaminated ground is included in Clause 3.3. Advice on the design of the ground investigation for potentially contaminated sites should be obtained from specialist consultants.

### 2.2.3 Sulphates

The Factual Report must include the testing for concrete in aggressive ground for both groundwater and soil in accordance with BRE Special Digest 1 Concrete in Aggressive Ground 2005, 3rd edition, BRE Digest 363 - "Sulphate and acid resistance of concrete in the ground" and the requirements of BS 8500 (2015+A1:2016).

If the Developer, for whatever reason, is unable to supply a ground investigation factual report, then all concrete, pre-cast concrete products and cement bound materials placed below ground must be manufactured to resist sulphates with a Design Chemical Class 3 (DC3) as given by the BS 8500-1 Table A.12 giving due regard to groundwater movement.

### 2.2.4 Embankments/Cuttings

Engineered slopes designed to carry Highway loading shall be subject to Technical Approval. Where the road construction involves the construction of an

embankment or cutting then the consultation with and guidance from a Geotechnical Engineer is required to plan and oversee the site/ground investigation.

The Developer shall check the stability of embankments and cuttings and shall submit these calculations to the Northumberland County Council before work commences on site.

Should the Developer propose to construct any embankment or cutting above 2.5m in height or depth, or with side slopes steeper than 1 in 3 then reference must be made to Design Manual for Roads and Bridges Volume 4 “Geotechnics & Drainage”. All designs are to be submitted to *the Engineer* for approval prior to any work commencing on site.

### 2.2.5 Carriageway Construction

The carriageway construction shall be in accordance with the following notes and Table 2-1

- a) generally be of a flexible construction designed in accordance with the principles of Road Note 29 (TRL).
- b) where the number of commercial vehicles per day (cvd) is likely to exceed 175 in both directions or has been identified by the Highways Engineer as being a HGV route the carriageway should be designed in accordance with Design Manual for Roads and Bridges Volume 7 in consultation with *the Engineer*.
- c) be a minimum thickness of 450mm and constructed such that all materials within 450mm of the finished surface are non-frost susceptible.
- d) achieve a design life of 40 years.
- e) Formation Strength Determination by California Bearing Ratio - Where there is a requirement for carriageway construction design, the subgrade formation strength shall be determined by CBR in accordance with the method for undisturbed samples stated in BS 1377.

Such samples must be taken prior to the commencement of construction activities.

Table 2-1 Pavement Construction Thicknesses

Carriageway Layer	Material	Local Distributor Road Thickness (mm)	Access Road and Shared Surface Road Thickness (mm)
<b>CAPPING</b> Subgrade CBR Values	Imported Granular Fill		
>5%		Nil	Nil
2.5% to 5% (inc)		275	275
<2.5% See Clause 4		525	525
SUB-BASE See Clause 4	Type 1	300(min)	300(min)
BASE See Clause 7.1	Asphalt Concrete (Dense Bitumen Macadam)	150	90
BINDER COURSE See Clause 7.1	Asphalt Concrete (Dense Bitumen Macadam)	60	60
SURFACE COURSE See Clause 7.1	Hot Rolled Asphalt	50	50
	Dense Asphalt Concrete (Dense Bitumen Macadam)	N/A	30

Carriageway Layer	Material	Local Distributor Road Thickness (mm)	Access Road and Shared Surface Road Thickness (mm)
Other surface course	By written agreement only	TBA	TBA

*Notes:*

- a) For design purposes depths specified are minimums.
- b) The sub-base thickness is to be increased to give a minimum total construction depth (excluding capping) of 450mm.
- c) In areas where a capping layer has been used a minimum CBR value of 15% is to be achieved.
- d) The positions of the CBR samples shall be agreed with *the Engineer* prior to sampling and testing. For CBR values of less than 2.5% the design proposals are to be submitted to *the Engineer* for approvals, the table values are not to be relied on.
- e) Block paving in shared surfaces replaces the surface course only.

The use of geosynthetics to provide ground or foundation improvement or asphalt reinforcement is permitted. The geosynthetics must be CE marked and only be used for the CE recommended use.

The number of samples taken will be such as to represent the variability and extent of the site such that a safe and economic design can be achieved.

Samples shall be taken at a depth equal to the proposed formation level.

Undisturbed samples shall be obtained by the method given in BS 1377-4: (1990) Section 7 - clause 7.2.5 and BS 1377-9: (1990) Section 2 - clause 2.4.

Testing shall be in accordance with BS 1377-4: Section 7 and shall be carried out at in situ moisture content.

**Note:** *Where the CBR testing is carried out without the involvement of the Engineer and the Engineer considers that there is insufficient information then a supplementary investigation will be required, at the Developer's expense, with additional CBR information obtained as directed by the Engineer.*

Copies of the CBR test results shall be submitted as part of the Section 38 Agreement process or other adoption processes, or technical approval, pursuant to the entering into of a S38 Agreement or considering adoption via other sections of the Highways Act.

### 2.2.6 Soil Classification

The ground/site investigation report shall include classification of the soil, using the British Soil Classification System for Engineering Purposes as given by BS 5930 (2015), on which any footpath, footway or footpath/cycletrack kerb line is to be founded. Soil classification is determined using the liquid limit, plastic limit and plasticity index as determined by BS 1377-2 Classification Tests.

The soil classification will give an indication of the clay shrinkage into categories of CH - indicating high shrinkage, CI - indicating medium shrinkage, CL - indicating low shrinkage. The plastic limit will also determine if soils are non-plastic which will indicate non-shrinkable soils.

Where the soil classification is determined as:-

- a) CH/CI then the depth of foundation shall be 600mm.
- b) CL or non-plastic then the depth of foundation shall be 300mm.

### 2.2.7 Laboratory testing of soil samples

A soils investigation and testing service is available from the Northumberland County Council Laboratory at Cramlington. However, the Developer would be charged for the use of the service.

## 2.3 Construction Thickness

The thickness of materials, or layers of material given in this document, shall be the thickness after compaction and shall be determined from agreed measurements (dips). The material thickness must comply with those specified including tolerances, although the total minimum pavement thickness must not be less than 450mm.

## 2.4 Quality of Materials and Workmanship

In circumstances identified by the *Engineer*, certain materials, goods and workmanship may be required to conform to a quality management scheme, product certification scheme, have a British Board of Agrément Roads and Bridges Certificate or have certification under the Highway Authorities Product Approval Scheme.

The Developer shall refer to the Department of Transport Specification for Highway Works, Series 100, Clause 104 and Appendices A, B and C for further details.

In respect of any British Standard (BS or BS EN), a BSI Kitemark Certification Scheme (if available), all materials required to comply with that Standard, or containers of such materials, shall be marked with the BSI Certification Trade Mark (the Kitemark).

The mark of conformity of any other certification body accredited by UKAS or equivalent may be an acceptable alternative to this requirement by agreement with *the Engineer*.

*The Engineer* may reject any material and/or goods which do not comply with the specified standard or which are considered “not fit for purpose”.

**Note:** *Test Certificates issued by the supplier will not normally be accepted as providing satisfactory proof of compliance to specification. However, those test certificates which form part of an approved quality assurance scheme may be considered by the Engineer.*

## 2.5 Testing of Materials

Before the commencement of works, the *Engineer* will require samples and/or sample loads of the various materials and/or goods to be used in the construction to be sampled and tested at the Developer’s expense. If approved, these samples shall then be taken as representative of the standard required by the *Engineer*.

The *Engineer* reserves the right to instruct the sampling and testing at any time during construction of any materials and goods that will form part of the permanent works to ensure compliance with the specification requirements, at the expense of the contractor.

The Developer shall ensure that all assistance is provided to obtain any sample at any time before or during the works.

All sampling and testing used for construction design purposes and to judge compliance to specification shall be carried out by a laboratory which holds UKAS accreditation for the appropriate test.

A list of sampling procedures and test methods requiring UKAS accreditation is given in Appendix A.

Where the Developer submits to *the Engineer* sampling and/or test certificates for any goods or materials for which there is a requirement for UKAS accreditation, then the certificates shall be accompanied by the UKAS testing schedule for the test laboratory and shall include the following:-

- a) Address of the permanent laboratory.
- b) Laboratory.
- c) Issue date of schedule and issue number.

## 2.6 Acceptable Materials

The use of slag (blast furnace or steel slag) must be from a source approved by the *Engineer* and must comply with the requirements given in notes (a) and (b) of clause 7.3.1. Blast furnace slag shall be current production slag.

Materials and/or workmanship found not to comply with the specification requirements and deemed not to be fit

for purpose shall not be included in the permanent works.

*The Engineer* shall determine if materials and/or workmanship are fit for purpose.

## 2.7 Notification of Start of Works

The Developer must inform the *Engineer* in writing at least 28 days before the work starts. If construction work is to stop for more than three months then the Developer must notify the *Engineer* in writing and confirm the proposed date for the restart of the work.

## 2.8 Quality of Work

Where Codes of Practice, British Standards or equivalent or European Standards indicate standards of workmanship, these shall be the minimum quality of work acceptable.

## 2.9 Statutory Undertakers Apparatus

The Developer is advised to consult with the Statutory Undertakers regarding existing services and for the provision of new services.

Before undertaking any works which may affect existing apparatus belonging to a Statutory Undertaker or Water Authority, the Developer must give at least 28 days notice to the appropriate body. If permission is refused, *the Engineer* must carry out the works at the Developer's 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.

The installation of all services must be completed prior to surfacing works.

Statutory Undertakers and other bodies apparatus should wherever possible be located in verges, footpaths, footways or cycleways and preferably laid in the following sequence from the kerb line; telephone, other communications, water, gas, electricity in accordance with the National Joint Utilities Group (NJUG) recommendations, unless prior approval of *the Engineer* has been obtained for an alternative location.

The location of any Undertaker's apparatus above ground, or any street furniture, shall be agreed with *the Engineer*.

The Developer shall comply with the requirements of the NRSWA 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.

Where privately owned services pass through the site the Developer shall provide an alternative service to the satisfaction of the owner of the service and *the Engineer*.

The Developer shall be responsible for the coordination of all Statutory Authorities' works related to the development.

The Developer is responsible for the satisfactory installation of all mains and services and all associated backfilling of trenches and reinstatements within the area to be adopted. Refer to specification Clauses 3.4, 9.16 and 10.

On completion of the development the Developer must supply to *the Engineer* a Health & Safety file including a plan identifying the location and position of all Statutory Undertakers apparatus, in accordance with the Construction, Design and Management Regulations 2015 and NRSWA 1991.

## 2.10 Temporary Signs/Signals

For all works carried out within the development, the Developer shall ensure that all signing is to the satisfaction of the *Engineer* and complies with Chapter 8 of the Department of Transport's "Traffic Signs Manual".

The Developer has a civil law liability to warn road users of obstructions on the highway, as a consequence of the development.

## 2.11 Protection of Carriageways

The Developer shall employ mechanical equipment and/or labour to keep all roads, footpaths and footways clean and free from dust, mud, slurry and any obstruction to the satisfaction of the Police and Highway Authority.

Should the Developer fail to comply with this requirement, *the Engineer* will invoke Section 148, 149 and/or 151 of the Highways Act 1980 (see Clause 4.6).

## 2.12 Work on Public Highways

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 Section 278 Agreement with the County Council as Highway 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 fees. A permit to open up excavations in a public highway may need to be given in accordance with the NRSWA 1991.

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 the existing means of access, the Developer shall, at the Developer's own expense, provide adequate temporary means of access.

Road closures require a **minimum of six weeks** notification to *the Engineer*, and the Developer is to supply, erect and maintain diversionary signing at the Developer's own expense.

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 and within working hours as agreed with *the Engineer*.

## 2.13 Order of Work

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.

## 2.14 Traffic Calming Features

Where ramps, plateaux and other sections where texture changes are required in estate roads, the sub-base and temporary asphaltic running layer shall be laid to provide a smooth running 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.

# 3 Earthworks

## Contents

- 3.1 Site Clearance
- 3.2 Excavation
- 3.3 Unsound Ground and Fill Materials Below Formation
- 3.4 General Fill Material
- 3.5 Compaction of Embankments and Fill
- 3.6 Standing Water
- 3.7 Road and Footpath Formation
- 3.8 Groundwater Levels



## 3.1 Site Clearance

### 3.1.1 Trees

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.

Stumps and tree roots within the vicinity of road works 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.

Trees and hedges shall where necessary be removed from the site of the works, the roots shall be completely grubbed out and the resulting hole filled and compacted to the satisfaction of *the Engineer*.

**Note:** *The Developer is required, where possible, to work within the guidelines given in BS 5837 (2012) - Trees in Relation to Construction.*

Before depositing any fill material all turf and vegetable soil within the adoptable works shall be excavated and removed to stockpiles.

### 3.1.2 Obstructions

Underground structures and chambers shall be demolished, properly cleaned out, filled with acceptable material and compacted in compliance with Clause 4.4 unless agreed otherwise with *the Engineer*.

Disused foul and surface water drains within 1.0m of formation level shall be removed and trenches backfilled in accordance with Clause 3.3. Other disused drains shall be effectively stopped up.

### 3.1.3 Topsoil

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*.

## 3.2 Excavation

Excavation shall be to the line, level and profile shown on the approved drawings or to such other dimensions as may be considered necessary by the Engineer. Excess excavation shall be made good with material in accordance with Clause 2.2.3 or capping material in accordance with Clause 2.3.2 or sub-base material in accordance with Clause 2.3.3 and placed and compacted to the satisfaction of the *Engineer*.

Excavation in a cohesive material shall stop a minimum 150mm above the formation level until the sub-base material is ready to be placed in order to avoid damage to the formation.

## 3.3 Unsound Ground and Fill Materials Below Formation

Unsound ground, unsuitable material or soft spots found within the road/footpath formation shall be removed as directed by the *Engineer* and replaced with approved granular fill material and placed and compacted to the specification. Low areas shall be drained with additional land drains.

This granular fill material shall be chosen to suit the particular problems encountered and may be any of the following types:-

- a) uniformly graded material having a uniformity coefficient of less than 10.
- b) well graded material having a uniformity coefficient exceeding 10.

The nominal size of the material shall be chosen with due regard for the site conditions but should not be less than 40mm.

When using well graded material the material shall be spread in layers not exceeding 200mm thick and compacted to refusal.

The compaction technique used shall be such as not to cause further instability within the formation.

Compaction shall be completed as soon as possible after the material has been spread. The material shall be transported, laid and compacted without undue segregation.

Any subsequent construction settlement due to the failure of the subgrade will remain the Developer's responsibility.

## 3.4 General Fill Material

### 3.4.1 Classification and Use of Earthwork Materials

The classification and confirmation of acceptability of earthworks materials shall be carried out by the *Engineer* based on soils information to be provided by the Developer in accordance with Clause 2.2.

If pre-construction testing was undertaken during design, a reassessment of the CBR and moisture content of soils will be necessary at the commencement of works, and any changes to construction thicknesses, etc., are to be made where required.

#### 3.4.1.1 Unacceptable Material

Unacceptable material shall not be used in the Permanent Works. Unacceptable material includes:

- a) Peat.
- b) bogs, stumps and perishable material.
- c) material in a frozen condition.
- d) clay having a liquid limit determined in accordance with BS 1377-2 (1990) exceeding 90 or plasticity index determined in accordance with BS 1377-2 exceeding 65.
- e) material susceptible to spontaneous combustion.
- f) non-hazardous materials other than those permitted in Table 6.1 and Appendix 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.

#### 3.4.1.2 Acceptable Material

Acceptable material is material excavated from within the site or imported onto the site which meets the requirements of Table 6/1 and Appendix 6.1 in the Specification for Highway Works for acceptability for use in the Permanent Works.

### 3.4.2 Embankments

Embankments shall be constructed with acceptable earthworks materials in accordance with the Department of Transport Specification for Highway Works (SHW) - Series 600 - Earthworks.

Class 1B uniformly graded granular material in accordance with table 6/1 of the SHW has shown in the past not to perform well as embankment fill and therefore will not be permitted.

Where embankments traverse areas subject to flooding they shall be constructed in granular material up to 300mm above anticipated flood level and shall be protected where erosion could occur.

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 construction traffic shall be made good by the Developer.

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.

### 3.4.3 Contaminated Land

Advice on the remediation of contaminated land should be obtained from specialist consultants. Attention is drawn to the following documents:-

- Design Manual for Roads and Bridges - Volume 4, Section 1, Part 7 - "Site Investigation for Highway Works on Contaminated Land".

- Interdepartmental Committee On The Redevelopment Of Contaminated Land (ICRCL) Guidance on the assessment and redevelopment of contaminated land.
- ICRCL Notes on the redevelopment of landfill sites.
- ICRCL Notes on the redevelopment of gas works sites.
- BS 5930 Code of Practice of site investigations.
- DC Wilson and C Stevens Problems arising from the redevelopment of gas works and similar sites.
- The Developer must provide a minimum breaklayer of 1000mm thickness. The aggregate used for the breaklayer shall be unbound, inert and non-water susceptible graded to the requirements of SHW, Series 600 Table 6/2 Class 6F1 or 6F2.
- The breaklayer shall be placed and compacted in accordance with the method compaction requirements of Clause 612 and method 6 of Table 6/4 given in SHW 600 series.
- The breaklayer thickness may be reduced to a minimum thickness of 600mm subject to approval by *the Engineer* on the material source, material type and grading and the use of end product compaction requirements as given by Clause 612 of the SHW. Examples of permitted material types for a reduction to 600mm are whinstone, carboniferous limestone, magnesium limestone, blast furnace or steel slag from an approved source.
- The use of permanent hard surface cover as a breaklayer will be considered depending upon the nature of the contaminants and the concentrations of such contaminants.

### 3.4.3.1 Remedial Action

Where a site/ground investigation has shown that contaminants are present over the whole or part of the site, in concentrations that indicate that remedial action may be necessary the Developer must provide *the Engineer* with the following information:-

- a) the nature and concentrations of contaminants
- b) the hazards associated with those contaminants
- c) the intended remedial action

**Note:** *The remedial action will normally be one or a combination of the following methods, all of which would require the Engineer's approval.*

- contaminated material is excavated and removed for disposal off site and replaced (if necessary) by uncontaminated imported fill.
- the contaminated material is isolated beneath, (and where necessary laterally) by a suitable thickness of imported, clean cover material at the interface with the contaminated material.
- the material is chemically or physically treated without removal to reduce the contamination.

### 3.4.3.2 Breaklayer

Where the remedial action involves the covering of contaminated material with a breaklayer then the breaklayer shall be as follows:-

The Developer shall provide to *the Engineer* all relevant materials testing information after construction of the breaklayer indicating that all aspects of the above specification have been achieved and this shall include the following as a minimum:-

- a) aggregate source and type.
- b) grading.
- c) compaction achieved (where applicable).

Where the use of a breaklayer has been approved, then information is required by *the Engineer* to assess compliance with the Specification in respect of the permanent hard surface cover.

Embankments above a breaklayer must be constructed with imported material from a source approved by *the Engineer*. The use of in situ reclaimed material will not be permitted.

### 3.4.4 Fill to Structures

Prior to backfilling structures a permeable backing layer shall be placed against the back of the wall of the structure using either of the following:

- a) granular material 20mm to 5mm in accordance with BS EN 12620 (2002+A1:2008). Coarse Aggregate to a minimum thickness of 300mm and maximum of 500mm.
- b) precast porous concrete blocks laid in stretcher bond with dry joints in 225mm thick walling.
- c) proprietary geotextile drainage layer.

Fill to structures shall be in accordance with the requirements of the Specification for Highway Works (SHW) - Series 600 - Clause 610 with the exception that the material shall be normally restricted to Class 6N (selected well graded granular material) or 7B (selected conditioned pulverised fuel ash).

Where the Developer wishes to use other fill material approval must be given by *the Engineer* and the fill must comply with the requirements of clause 610 and table 6/1 of the SHW.

### 3.5 Compaction of Embankments and Fill

Fill shall be acceptable excavated material or granular filling as described in Clause 3.4. It shall be spread and compacted as soon as practicable after deposition in layers in accordance with Table 3-1.

*The Engineer* may at any time carry out comparative field density tests by a NAMAS accredited laboratory

determined in accordance with BS 1377-9: (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*.

The Developer shall, not less than 24 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.

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

If more than one class of material is being used in such a way that it is not practicable to define the areas in which each class occurs, the compaction plant shall be operated as if only the material which requires the greater compactive effort is being compacted.

Table 3-1 Compaction Requirements

D = Maximum depth of compacted layer (mm); N = Minimum number of passes							
Type of compaction plant	Category	Cohesive Soils		Well graded granular and dry cohesive soils		Uniformly graded material	
		D	N	D	N	D	N
Smooth wheeled roller	<b>Mass per metre width of roll:</b> over 2100kg up to 2700kg	125	8	125	10	125	10*
	over 2700kg up to 5400kg	125	6	125	8	125	8*
	over 5400kg	150	4	150	8	Unsuitable	
Grid roller	<b>Mass per metre width of roll:</b> over 2700kg up to 5400kg	150	10	Unsuitable		150	10
	over 5400kg up to 8000kg	150	8	125	12	Unsuitable	
	over 8000kg	150	4	150	12	Unsuitable	
Tamping roller	<b>Mass per metre width or roll</b> over 4000kg	225	4	150	12	250	4
Pneumatic tyred roller	<b>Mass per wheel:</b> over 1000kg up to 1500kg	125	6	Unsuitable		150	10*
	over 1500kg up to 2000kg	150	5	Unsuitable		Unsuitable	
	over 2000kg up to 2500kg	175	4	125	12	Unsuitable	
	over 2500kg up to 4000kg	225	4	125	10	Unsuitable	
	over 4000kg up to 6000kg	300	4	125	10	Unsuitable	
	over 6000kg up to 8000kg	350	4	150	8	Unsuitable	
	over 8000kg up to 12000kg	400	4	150	8	Unsuitable	
	over 12000kg	450	4	175	6	Unsuitable	

Table 3-1 Compaction Requirements continued

D = Maximum depth of compacted layer (mm); N = Minimum number of passes							
Type of compaction plant	Category	Cohesive Soils		Well graded granular and dry cohesive soils		Uniformly graded material	
		D	N	D	N	D	N
<b>Vibrating roller</b>	<b>Mass per metre width of a vibrating roll:</b>						
	over 270kg up to 450kg	Unsuitable		75	16	150	16
	over 450kg up to 700kg	Unsuitable		75	12	150	12
	over 700kg up to 1300kg	100	12	125	12	150	6
	over 1300kg up to 1800kg	125	8	150	8	200	10*
	over 1800kg up to 2300kg	150	4	150	4	225	12*
	over 2300kg up to 2900kg	175	4	175	4	250	10*
	over 2900kg up to 3600kg	200	4	200	4	275	8*
	over 3600kg up to 4300kg	225	4	225	4	300	8*
	over 4300kg up to 5000kg	250	4	250	4	300	6*
over 5000kg	275	4	275	4	300	4*	
<b>Vibrating-plate compactor</b>	<b>Mass per unit area of base-plate:</b>						
	over 880kg up to 1100kg	Unsuitable		Unsuitable		75	6
	over 100kg up to 1200kg	Unsuitable		75	10	100	6
	over 1200kg up to 1400kg	Unsuitable		75	6	150	6
	over 1400kg up to 1800kg	100	6	125	6	150	4
	over 1800kg up to 2100kg	150	6	150	5	200	4
over 2100kg	200	6	200	3	250	4	
<b>Vibro-tamper</b>	<b>Mass:</b>						
	over 50kg up to 65kg	100	3	100	3	150	3
	over 65kg up to 75kg	125	3	125	3	200	3
over 75kg	200	3	150	3	225	3	
<b>Power rammer</b>	<b>Mass:</b>						
	100kg up to 500kg	150	4	150	6	Unsuitable	
over 500kg	275	8	275	12	Unsuitable		
<b>Dropping weight compactor</b>	<b>Mass of rammer:</b>						
	over 500kg						
	<b>Height of drop:</b>						
over 1m up to 2m	600	4	150	6	Unsuitable		
over 2m	600	2	275	12	Unsuitable		

Note: For items marked \* the roller shall be towed by track-laying tractors. Self-propelling rollers are unsuitable.

### 3.6 Standing Water

The Developer shall arrange for the rapid dispersal of water shed onto or entering the works from any source at any time during construction. Where necessary temporary ditches, watercourses, pumping or other means of maintaining the works free from standing water shall be used. The water shall be discharged only to locations approved by the *Engineer*.

Care must be taken to prevent solid matter or matter in suspension from entering any drains or sewers. Any obstruction shall be removed by the Developer. Temporary provisions such as silt barriers may need to be erected.

### 3.7 Road and Footpath Formation

The *Engineer* will require notification from the Developer prior to the commencement of the following works.

All trenches in the subgrade shall be backfilled in accordance with Clause 3.3 to the satisfaction of the *Engineer* prior to the final preparation of the formation which shall be carried out as follows:-

- a) All formations shall, after reinstatement of any soft areas, be clean and free from mud and slurry. Soft and unstable areas within the formation are often highlighted by rolling and/or construction traffic.
- b) The carriageway formation shall be compacted in accordance with Clause 3.5.
- c) During completion of the footpath formation, due regard shall be made to service installations and be compacted by at least 4 passes with a 2.5 tonne deadweight roller to the satisfaction of the *Engineer*.
- d) The formation shall be regulated and trimmed (by hand if necessary) to the correct levels and profiles. Trimmed formations shall be rolled in accordance with Clause 3.5 as appropriate.

On completion, the formation (unless directed otherwise by the *Engineer*) shall be sprayed, with an approved

weedkiller. This operation shall be completed before overlaying the formation with capping (where required) or sub-base.

When completed, the prepared formation shall be clean, free from mud and slurry, shaped to the required level and be within the specified surface tolerances (see Clause 2.3.1).

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 caused to the formation (by any means) shall be rectified to the satisfaction of the *Engineer* prior to the placing of capping (where required) or sub-base material.

The Developer must plan the work so that the earthworks, formation preparation, capping layer (where required) and sub-base laying proceeds as a continuous operation.

Where the formation is not immediately covered with sub-base or base 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.

The side slopes of cutting 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*.

### 3.8 Groundwater Levels

Subsoil drains or sub-base drains shall be used to prevent groundwater levels rising above 600mm below formation level.

# 4 Carriageway Capping and Sub-Base Layers

## Contents

- 4.1 Capping Layers
- 4.2 Sub-Base Material and Grading (Type 1)
- 4.3 Compaction
- 4.4 Frozen Materials
- 4.5 Frost Susceptible Material
- 4.6 Use of Surfaces by Traffic and Construction Plant
- 4.7 Use of Geogrids and Geotextiles



## 4.1 Capping Layers

A capping layer must be provided where the CBR value of the formation is less than 5% at a thickness as indicated in Table 4-1.

The treatment of subgrades with a CBR less than 2.5% will require the specific approval of *the Engineer*.

Table 4-1 Capping and Sub-base requirements

Subgrade CBR%	Capping Thickness (mm)	Sub-Base (Type 1) Thickness (mm)	
		Local Distributor Road	Access Road and Shared Surface Road
> 5%	Nil	250	280
2.5% - 5%	275	250	280
< 2.5%	525	250	280

**Note:** *The capping layer is not a substitute for the sub-base and it is not to be considered as forming part of the carriageway construction thickness.*

Where a capping layer is required it shall achieve a CBR value of not less than 15% when tested in accordance with Test Method 7 of BS 1377.

Selected granular fill material shall be used in capping layers and the material shall be well graded complying with Table 4-2.

Table 4-2 Capping Grading requirements

Permitted Aggregate	BS Sieve Size	Percentage Passing
Any material or combination of materials other than unburnt colliery spoil and argillaceous rock	125 mm	100 - 100
	90 mm	100 - 80
	75 mm	100 - 65
	37.5 mm	100 - 45
	10 mm	60 - 15
	5 mm	45 - 10
	600 µm	25 - 0
	63 µm	12 - 0

Capping layers shall be compacted in accordance with Clause 4.4 and Table 4-4.

Aggregates for capping shall be from a source approved by *the Engineer* and on approval shall be classed as permitted aggregates. All such permitted aggregates shall be free from detritus such as slag (from any source other than that approved by *the Engineer*), clay, plaster, wood, domestic waste and industrial refuse. The aggregate used as capping shall have a soaked 10% fines (TFV) of 50kN or more when tested in accordance with BS EN 1097-2 (2010).

## 4.2 Sub-Base Material and Grading (Type 1)

The sub-base material shall be crushed rock (excluding shale), crushed blastfurnace slag (from a source approved by the Engineer) or crushed concrete complying with the grading of Table 4-3.

The material must not be frost susceptible when tested in accordance with BS 812-124 (2009).

The particle size shall be determined by the washing and sieving method of BS EN 933-1 (2012).

Table 4-3 Sub-base Grading requirements

Sieve size, mm	Percentage by mass passing		
	Overall grading range	Supplier declared value grading range	Tolerance on the supplier declared value
63	100		
31.5	75 – 99		
16	43 – 81	54 – 72	± 15
8	23 – 66	33 – 52	± 15
4	12 – 53	21 – 38	± 15
2	6 – 42	14 – 27	± 13
1	3 – 32	9 – 20	± 10
0.063	0 – 9		
Grading of individual batches – differences in values passing selected sieves			
Retained sieve size, mm	Passing sieve size, mm	Percentage by mass passing	
		Not less than	Not more than
8	16	7	30
4	8	7	30

The sub-base shall be granular material Type 1 to Clause 803. A certificate of frost heave compliance shall be provided. The test will have been carried out no longer than 12 months prior to supply.

The material 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 4-4 below.

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 20mm nominal size dense bitumen base-course macadam shall be laid to a minimum thickness of 50mm and sealed with Bitgrit or similar performing product. Any damage or deformation to the carriageway shall be made good to *the Engineer's* 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 6mm clean chippings prior to laying paving blocks.

Table 4-4 Compaction Requirements for Granular Materials  
(Table 8/4 of the Specification for Highway Works)

Type of Compaction	Category	Number of passes for layer thicknesses not greater than		
		110 mm	150 mm	225 mm
Smooth wheeled roller	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
Vibrating plate compactor	Mass per unit area of base-plate over 1400kg/m <sup>2</sup> up to 1800kg/ m <sup>2</sup>	8	Unsuitable	Unsuitable
	over 1800kg/ m <sup>2</sup> up to 2100 kg/ m <sup>2</sup>	5	8	Unsuitable
	over 2100kg/ m <sup>2</sup>	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 - 500kg	5	8	Unsuitable
	over 500kg	5	8	12

During the compaction the surface profile shall be rammed so that the finished surface levels are within plus 10 mm and minus 30 mm of those shown on the approved plan.

### 4.3 Compaction

The material shall be placed, spread in layers not exceeding 150mm thick and compacted to the satisfaction of *the Engineer*.

Table 4-5 gives a guide to compaction requirements but *the Engineer* may require further compaction to be carried out.

Table 4-5 Compaction Guidance

Type of Compaction Plant	Category	Number of Passes for	
		Not Greater than 110 mm	Not Greater than 150 mm
Smooth wheeled Roller	2.5-5.5 tonne	16	Not suitable
	over 5.5 tonne	8	16

#### Notes

- a) The use of vibrating rollers will not be permitted.
- b) All loose, or segregated, areas shall be made good to the full thickness of the layer and re-compacted. Where clay or other subgrade material has worked through the sub-base the area shall be dug out together with any defective formation and replaced with new material and compacted as described in Clause 3.3 and Clause 3.5.
- c) The Base should be laid as soon as possible after the sub-base has been prepared. If by using the sub-base as a “working platform” contamination, damage or deterioration to the formation and/or sub-base occurs, then this shall be rectified to the satisfaction of *the Engineer* before the Base material is laid.

Where a final trim to the sub-base is required, then the Base shall not be laid until this final trim has been inspected and approved by *the Engineer*.

Only those vehicles and equipment necessary for the laying of the Base material shall be allowed to traffic the area during the laying operations.

The sub-base thickness may have to be increased to ensure a minimum carriageway thickness of 450mm (Clause 4.6).

### 4.4 Frozen Materials

Frozen material shall not be used but may be retained on site for use when free from frost and ice, subject to the approval of *the Engineer*. No material shall be laid on any surface that is frozen or covered with ice.

### 4.5 Frost Susceptible Material

In accordance with MCHW Vol.1 Series 800 (2016) Cl.801.7 no material used within 450mm of the final surface level of the road shall be frost susceptible.

Developers should note that some crushed chalks and limestones and shales are particularly liable to frost heave. If the Developer is considering using these or other materials which may be susceptible, details must be submitted to *the Engineer* who will determine the testing needed to be carried out.

### 4.6 Use of Surfaces by Traffic and Construction Plant

Where the Developer proposes to use the sub-base for construction plant, they shall improve the sub-base to accommodate the method of construction and the type of plant and vehicles which they propose 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 subgrade.

#### Note:

- a) Slag material shall comply with the stability requirements of BS EN 12620 with the exception that an analytical test for dicalcium silicate unsoundness shall satisfy both conditions of sub-clause E3.1 of that British Standard. The bulk density of slag shall not be less than 1100 kg/m<sup>3</sup>.
- b) The soluble sulphate content of all materials placed within 500 mm of concrete structures and pavements or cement bound materials shall not exceed 2.0 g of sulphate (expressed as SO<sub>3</sub>) per litre when tested in accordance with BS EN 1744-1 (2009 +A1:2012) Section 10.
- c) The aggregate used for sub-base material shall be from a source approved by *the Engineer*. Where a source is proposed by the Developer which is unknown to *the Engineer*, then all of the requirements of the Specification for Highway Works Series 800 shall apply and approval will only be given when full compliance with these requirements is shown.
- d) The particle size shall be determined by BS EN 933- 1. The material passing the 525 µm sieve when tested in accordance with BS 1377-2 Method 5 shall be non-plastic.
- e) The sub-base material shall have a 10% fines value of 50kN or more when tested in accordance with BS EN 1097-2 except that samples shall be tested in a saturated and surface dried condition. Prior to testing the selected test portions shall be soaked in water at room temperature for 24 hours without previously having been oven dried.
- f) The material shall be transported, laid and compacted without drying out or segregation.

#### 4.7 Use of Geogrids and Geotextiles

The use of geotextiles is permitted subject to the explicit approval of *the Engineer*.

The Developer shall provide *the Engineer* with details of the proposed geogrid/geotextile to be used including technical documentation and calculations to prove the suitability of the proposed material for each individual application.

# 5 Kerbs, Channels and Edgings

## Contents

- 5.1 Pre-Cast Concrete Products
- 5.2 Natural Stone Kerbs
- 5.3 Edgings
- 5.4 Foundations
- 5.5 Installation
- 5.6 Mortar Bedding

## 5.1 Pre-Cast Concrete Products

The manufacture of pre-cast concrete kerbs, channels and edgings shall comply with the requirements of BS EN 1340 (2003).

The products shall be hydraulically pressed using granite or whinstone aggregate. Reconstituted stone kerbs may also be used subject to the approval of *the Engineer*.

## 5.2 Natural Stone Kerbs

Natural stone kerbs shall only be used with the approval of *the Engineer* and shall comply with BS EN 1342 (2012) and BS EN 1343 (2012).

Samples shall be submitted to and approved by *the Engineer* prior to their use and the kerbs used shall be equivalent or superior to the approved sample.

## 5.3 Edgings

Flat top edging kerbs shall be hydraulically pressed precast concrete products to BS EN 1340 with granite or whinstone aggregate.

They are to finish flush with the footpath level and laid with butt joints bedded on 15mm thickness 3:1 cement mortar (see Clause 5.6) or laid directly onto the concrete foundation. (See Standard Detail)

## 5.4 Foundations

The foundations shall be constructed using ST4 concrete complying with the requirements of BS 8500 and shall be constructed with formwork set to the required line and level. The concrete shall be well compacted to provide a dense homogeneous mass.

Kerb foundations shall have hooped mild steel bars 10mm diameter by 350mm long at 600mm centres which are to be set into the foundation as the concreting proceeds to provide a key for the concrete backing.

Foundation widths must not be wider than that required to carry the kerb channel (where required) and backing (see Standard Detail)

For foundations to footpath or footpath/cycle track, the requirements of Clause 2.2.6 in respect to soil classification must be noted.

## 5.5 Installation

Kerbs and Channels - Kerbs and channels shall be laid in accordance with BS EN 1340 in full lengths. Where lengths need to be cut down to size, no one shall be cut down to less than half the original length.

Should the Developer wish to omit the kerb until building works are substantially complete, then the channels must be temporarily backed with ST 4 concrete to the satisfaction of *the Engineer*.

After buildings works are substantially complete and the Developer wishes to complete the kerbing works, the temporary concrete backing shall be removed.

Kerbs and channels are to be laid with butt joints on a mortar bed (see Clause 5.6) not less than 10mm or greater than 40mm thickness to comply with the finished level and in the case of kerbs face above finished carriageway level.

On bridges a 10mm Joint shall be formed between kerbs using polyethylene sheeting with a rebate retained 10mm deep for an approved sealant. Wide joints may be required at bridge expansion joints.

In shared surfaces a kerb face of 50mm may be acceptable, with the approval of *the Engineer* and in these situations only small element units complying to BS EN 1340 shall be used.

Kerbs laid to provide a 125mm kerb face shall be 125mm x 255mm half battered. Kerbs laid to provide 150mm kerb face shall be 150mm x 305mm half battered.

Kerbs laid to provide 6mm, 12mm or 40mm upstand shall be 125mm x 150mm bullnose or 150mm x 150mm bullnose to match the full height kerb in use.

Taper kerbs shall be used to reduce kerb face to 6mm (0mm to 6mm) at pedestrian crossings and 12mm at vehicular crossings. These taper kerbs are to be 0.5m long maximum in Shared Surface roads.

The correct radius kerbs shall be used for all radii of 12m and less. Channels shall be of 150mm x 100mm section for Residential Estates or 225mm x 125mm section for Commercial Estates.

For channels less than 6m radii, straight shall be used having a minimum length of 300mm. Gaps formed by this construction method shall be tilled and sealed using a material to be approved by *the Engineer*.

Damaged kerbs and/or channels will be inspected by *the Engineer* and those considered as having minor damage, may be repaired using a material to be approved by *the Engineer*.

Kerbs and/or channels shall be laid to the design level  $\pm 6$ mm. Any kerb and /or channel found to be more than 3mm out of line and level over a 3m length shall be lifted and re-laid.

Kerbs shall not be backed until installation works have been approved by *the Engineer*. Backing shall be concrete Grade C7.5P or ST1 to BS 8500.

Quadrants shall be used at all external right angles and shall be of 455mm radius x 255mm deep to figure NA3(d) BS EN 1340.

Internal right angles shall be informed from kerbs saw-cut at 45° to their front face and butt-jointed.

At vehicular crossings kerbs shall be bullnosed. Drop kerbs shall be used to accommodate variations in kerb height at crossings.

Edgings - Edgings shall finish flush with the footpath level and shall be laid with butt joints. They shall be bedded on a mortar bed of thickness not less than 10mm and not greater than 20mm.

Alternatively, the edging may be bedded in wet concrete with a minimum 125mm base. Where required for piecing up they must not be less than 300mm in length.

Edgings shall be of 50mm x 150mm either square section to figure NA3(b) or bullnosed section to figure NA3(c) of BS EN 1340. Where footpath or footway edging kerbs are within 1.0m of the top of an embankment, a 255mm x 125mm bullnosed kerb shall be used with full bedding and backing.

## 5.6 Mortar Bedding

Mortar bedding layers shall consist of freshly mixed moist mortar of 3:1 sand : cement (proportions by volume) using a sand complying with BS EN 12620. Cement mortars which have been mixed and not used for more than 2 hours shall be discarded.



# 6 Concrete, Reinforcement, Brickwork, Stone and Timber

## Contents

- 6.1 Mixes and Quality
- 6.2 Structural Concrete
- 6.3 Concrete Grades
- 6.4 Constituent Materials of Concrete
- 6.5 Properties of Fresh Concrete
- 6.6 Ready Mixed Concrete
- 6.7 Formwork
- 6.8 Placement
- 6.9 Cold Weather Working
- 6.10 Compaction
- 6.11 Sampling and Testing
- 6.12 Defects in Concrete
- 6.13 Reinforcement
- 6.14 Cover Blocks
- 6.15 Reinforcement for Lay-bys
- 6.16 Air-Entrained Concrete
- 6.17 Rigid Pavement Construction
- 6.18 Curing of Concrete
- 6.19 Thermal Gradients
- 6.20 Joint Filler and Sealant
- 6.21 Brickwork
- 6.22 Timber
- 6.23 Reconstituted Stone

Table 6-1 Concrete Grades and Mix Requirements

## 6.1 Mixes and Quality

All concrete shall be design mix or equivalent standard in accordance with the requirements of BS 8500 and BS EN 206 (2013+A1:2016).

Concrete design mixes must be submitted to *the Engineer* for approval.

**Note:** *As part of the Engineer's approval design mixes may require plant and site trials or, in the absence of such trials, the concrete supplier will be required to submit to the Engineer documented evidence which demonstrates that the mix, as proposed, can fulfil the specification requirements.*

## 6.2 Structural Concrete

Concrete which is to be used for structural work (bridges, headwalls etc) shall comply with the requirements of the current Department for Transport Specification for Highway Works or the Water Authorities Association Sewers for Adoption Specification as applicable.

Where the volume of concrete is less than 80cu.m then the following test regime shall apply. Two test cubes shall be made from each of two representative samples taken from each batch of concrete selected for testing. The cubes shall be tested for 28 day compressive strength and the mean of the results shall be accepted as the compressive strength of the batch.

The average compressive strength of the two test cubes taken from the same batch of concrete shall exceed the specified strength.

## 6.3 Concrete Grades

Table 6-1 gives examples of concrete grades and mix requirements:

Designated Mix	Standard Mix	Characteristic Strength (N/mm <sup>2</sup> )
GEN 1	(ST1/ST2)	10
GEN 2	(ST3)	15
GEN 3	(ST4)	20
GEN 4	(ST5)	25
FND 2		35
FND 3		35
FND 4		35
PAV 1		35
PAV 2		40
RC 30		30
RC 35		35
RC 40		40
RC 45		45
RC 50		50

Table 6-2 gives typical applications for the above concrete grades

Table 6-2 Typical Applications for Concrete

Application	Designated Mix	Standard Mix	Workability mm
<b>FOUNDATIONS</b>			
Blinding and mass concrete till	GEN 1	ST1/ST2	75
Strip footings (non-aggressive soils)	GEN 3	ST 4	75
Mass concrete foundations (non-aggressive soils)	GEN 3	ST 4	75
Trench fill foundations (non-aggressive soils)	GEN 3	ST 4	125
Reinforced foundations in Class 1 sulphate conditions	RC 35	-	75
Foundations in Class 2 sulphate conditions	FND 2	-	75
Foundations in Class 3 sulphate conditions	FND 3	-	75
Foundations in Class 4 sulphate conditions	FND 4	-	75
<b>GENERAL APPLICATIONS</b>			
Kerb Bedding and backing	GEN 3	ST4	Very low
Drainage works to give immediate support in non-aggressive soils	GEN 3	ST 4	Very low
Other drainage works in non-aggressive soils	GEN 3	ST 4	50
Oversite below suspended slabs - non-aggressive soils	GEN 2	ST 3	75
<b>PAVING</b>			
House drives, domestic parking and external paving	PAV 1	-	75
Heavy duty external paving	PAV 2	-	50
<b>OTHER REINFORCED AND PRE-STRESSED CONCRETE APPLICATIONS</b>			
Reinforced or pre-stressed concrete:			
mild exposure	RC 30	-	75
moderate exposure	RC 35	-	75
severe exposure	RC 40	-	75
most severe exposure	RC 50	-	75

## 6.4 Constituent Materials of Concrete

### 6.4.1 Cement

Cement shall comply with the requirements given in Table 1 of BS 8500-2 (2015+A1:2016).

The use of rapid hardening cement to allow early trafficking of the concrete requires the approval of *the Engineer*.

### 6.4.2 Aggregates

Aggregates shall comply with the requirements of BS EN 12620 (2016) and/or BS EN 12620 as appropriate and shall be 20 mm nominal maximum size unless otherwise stated.

Structural concrete may require 10mm aggregate to assist workability around dense reinforcement in exceptional circumstances.

### 6.4.3 Water

Only water from a water company supply shall be used.

### 6.4.4 Admixtures

No admixture other than an air-entrained admixture where specified, complying with BS EN 480-1 (2014) and BS 8500-2 shall be incorporated in the concrete without specific written agreement of *the Engineer*.

Plasticisers or water reducing admixtures where permitted by *the Engineer* shall comply with BS EN 480.

Admixtures containing calcium chloride shall not be used.

### 6.4.5 Chloride Content

The limits of chloride content of the concrete shall be as given in Table 15 of BS EN 206.

### 6.4.6 Alkali - Silica Reaction (ASR)

To minimise the risk of ASR the concrete supplier shall use either:

- a) non-reactive aggregates
- b) limit the equivalent sodium oxide content in the concrete mix to not greater than 3.0 kg/m<sup>3</sup>.

## 6.5 Properties of Fresh Concrete

### 6.5.1 Workability

For normal concrete mixes the workability of the concrete will be low to medium corresponding to a nominal slump value for 50mm to 75mm respectively.

Where a high workability concrete is required (e.g. concrete section containing congested steel) then the nominal slump can be as high as 125mm with the approval of *the Engineer*.

**Note:** (a): *Guidance on the workabilities appropriate to different uses is given in BS 8500-1: Table A.18 and the recommendations are to be adopted unless otherwise agreed by the Engineer.*

**Note:** (b): *The workability of designed mixes for structural use shall be selected by the Developer with regard to the method of placement, congestion of steel within the formwork, surface finish specified and method of compaction employed.*

The workability selected for each different mix shall be approved by *the Engineer* before concrete placement operations commence.

### 6.5.2 Additional Water

No additional water shall be added to the mix during transit or on site.

### 6.5.3 Air Content

The entrained air content for concrete manufactured with 20mm nominal size aggregate and subjected to cycles of freezing and thawing and subjected to de-icing salts shall be 5.5% ±0.5%.

For concrete manufactured with differing nominal aggregate sizes then the air content shall be as follows:-

14mm nominal size - 6.5% ±0.5 % 40mm nominal size  
4.5% ± 0.5%.

## 6.6 Ready Mixed Concrete

### 6.6.1 Manufacture

Concrete shall be batched and mixed in accordance with BS EN 206.

The Developer shall afford all reasonable opportunity and facility to *the Engineer* to inspect the constituent materials and the manufacture of the concrete and if required to take samples.

### 6.6.2 Changes in Materials and/or mix composition

The Developer shall inform *the Engineer* of any proposed changes in the source or nature of any of the mix constituents and any changes in mix composition which can affect the requirements of the hardened concrete.

Any such changes shall not take the cement content, water:cement ratio or chloride content outside the specified limits or increase the risk of ASR.

### 6.6.3 Transport Delivery

Concrete shall be transported in purpose-made truck mixers except in special circumstances where *the Engineer* may permit delivery by other types of delivery vehicle.

All such circumstances shall be agreed with *the Engineer* before concrete delivery commences.

## 6.7 Formwork

The Developer shall provide all necessary formwork which shall be thoroughly cleaned and coated with an approved material to prevent adhesion of fresh concrete and set so as to ensure that there is no loss of material.

Formwork shall only be struck when the concrete has attained adequate strength and with the approval of *the Engineer*.

**Note:** *Adequate strength shall be determined by site curing at least one test cube in the same environmental conditions as the concrete. The compressive strength of the cube shall not be less than 40% of the characteristic compressive strength before the formwork is removed.*

## 6.8 Placement

The concrete must be placed and compacted within two hours of the introduction of water to the cement/aggregate.

Concrete shall not be dropped into place from a height exceeding 1.3m. It shall be placed so that there is no contamination, segregation or loss of the constituent material or displacement of any reinforcement. Compaction is to be completed within 30 minutes of discharge from the mixer.

Fresh concrete shall not be placed against concrete which has been in position for more than 30 minutes, without the approval of *the Engineer*. When concrete has been placed for more than 2 hours, no further concrete shall be placed against it for another 24 hours.

The Developer must submit proposals to *the Engineer* for approval before any further concrete pour takes place.

Concrete must not be placed in flowing water.

## 6.9 Cold Weather Working

Concreting at an ambient temperature below 5°C may only be carried out with the agreement of *the Engineer* and if the following conditions are met:-

- a) the aggregates and water used in the mix are free from snow, ice and frost
- b) any formwork reinforcement and surface with which the concrete will be in contact are to be free from snow, ice and frost and be at a temperature above 0°C.
- c) the temperature of the concrete at the time of placing shall not be less than 5°C.
- d) the temperature at the surface of the concrete must be maintained at not less than 5°C

measured at any location until the concrete strength reaches a strength of 5N/mm<sup>2</sup> as confirmed by test cubes cured under similar conditions.

- e) where required, thermal insulation blankets are employed immediately after placing and finishing the concrete and shall be retained in place for a minimum of 3 days or until the concrete has reached 50% of the specified characteristic compressive strength.

## 6.10 Compaction

All concrete shall be compacted to produce a dense homogeneous mass.

Unless otherwise agreed by *the Engineer* it shall be compacted by using vibrators and a sufficient number should always be on site as replacements in case of breakdown.

Where immersion type vibrators are used contact with reinforcement and all inserts is to be avoided. Care must be taken not to over vibrate the concrete and cause segregation or damage to work that has set. This compaction must be completed within 2 hours of the addition of water.

Concrete must not be further vibrated after compaction.

## 6.11 Sampling and Testing

All sampling, curing of cubes and testing of concrete, fresh or hardened, shall be carried out in accordance with the relevant Parts of BS 1881.

**Note:** (a) *Sampling shall take place at the point of delivery into the construction unless otherwise agreed by the Engineer.*

**Note:** (b) *Where required, the temperature of fresh concrete shall be measured in accordance with the methods given in BS EN 206.*

## 6.12 Defects in Concrete

Any defects which in the opinion of *the Engineer* may be detrimental to the safety and/or durability of the

concrete construction may be rejected even if satisfactory test results have been obtained.

Minor surface defects may be made good subject to *the Engineer's* approval. Any remedial works carried out without *the Engineer's* approval may be liable to rejection as defective work.

## 6.13 Reinforcement

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 be used.

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.

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 end 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.

## 6.14 Cover Blocks

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 or other approved material. Samples shall be submitted to *the Engineer* for approval.

## 6.15 Reinforcement for Lay-bys

The reinforcement may be steel mesh or fibre reinforcement.

Steel mesh reinforcement shall comply with the requirements of BS 4483 (2005) and shall be free from

oil, dirt, rust and scale. The reinforcement shall be placed with 60mm cover from the finished surface.

The reinforcement shall terminate 125mm  $\pm$ 25mm from the slab edges and terminate 300mm  $\pm$ 50mm from the transverse joint.

Where fibre reinforcement is to be used then the Developer shall inform *the Engineer* of the type, size and dosage rate.

For typical details see MCHW Volume 3 (2005) Highway Construction Details.

## 6.16 Air-Entrained Concrete

Air-entrained concrete shall satisfy all of the specification requirements for the pavement grades (PAV 1 & PAV 2) in Table 6-2.

Unless otherwise permitted by *the Engineer*, the fine aggregate used in the production of air-entrained concrete shall be uncrushed natural sand complying with the requirements of BS EN 12620.

The air-entrainment agent shall be added at the batching and its volume noted on the delivery ticket.

## 6.17 Rigid Pavement Construction

Concrete carriageway construction may be used in the following situations:

- a) Lay-bys
- b) Turning areas for buses and other heavy vehicles
- c) Vehicle accesses across footways, footpaths and cycleways

A typical Lay-by detail is shown in Standard Detail MCHW Vol.3 HCD Section C

Expansion/contraction joints shall be spaced at least every 21m. Every third joint shall be an expansion joint and the remainder contraction joints. They shall be constructed in accordance with Figure Standard Detail MCHW Vol.3 HCD Section C.

Longitudinal joints shall be vertical butt joints with 12mm diameter steel tie bars 1m long, placed in the mid-depth of the slab at 600mm centres. Half the length of the bar shall extend into each adjacent slab and they shall be embedded so as to form a complete bond.

A sealing groove 10mm wide and 60mm deep shall be provided along the length of the joint, constructed and sealed as described for compaction joints.

Construction joints shall be arranged to coincide with expansion or construction joints but where, due to mechanical breakdown or adverse weather conditions, it is necessary to form construction joints, they shall not be formed less than 3m from any expansion or contraction joint.

Construction joints shall be formed as specified for longitudinal joints, except that the reinforcement shall project for at least 750mm across the joint. On resumption of concreting, the next reinforcement shall completely overlap and be tied to the projecting reinforcement.

For typical details see MCHW Volume 3 Highway Construction Details.

## 6.18 Curing of Concrete

Immediately on completion of the placing and compaction, the concrete shall be cured. i.e. protected against the harmful effects of weather, including: rain, rapid temperature changes, frost and from drying out. The method of curing shall provide a suitable environment for the concrete to mature and prevent harmful loss of moisture.

The concrete shall be cured for a minimum period of 7 days unless otherwise agreed by *the Engineer*.

The use of all curing liquids, compounds, membranes and methods used shall be submitted to *the Engineer* in writing for approval and shall not be employed until approval is given. On concrete surfaces which are to be waterproof, curing membranes shall not be used.

During the curing period the concrete shall be protected from use of traffic or any other form of loading which may adversely affect its future performance.

Details for all curing methods to be used shall be subject to the approval of *the Engineer*.

### 6.19 Thermal Gradients

In concrete pours thicker than 1.75m, temperatures shall be monitored at the core and surface of the concrete to ensure that thermal gradients are kept within the desirable maximum figures. Proposals for additional insulation to the top and side surfaces shall be submitted to *the Engineer* for prior approval

### 6.20 Joint Filler and Sealant

For concrete lay-bys the joint fillers shall be pre-formed and of an approved quality. Joint sealants shall be either hot or cold poured or pre-formed. However, due regard should be given during the design for the designer's obligations under CDM. Whichever method is used it must be approved by *the Engineer*.

If poured sealants are used any spillage or surplus must be removed to the satisfaction of *the Engineer*.

### 6.21 Brickwork

Bricks shall be of a type approved by *the Engineer* for the purpose for which they were required and shall comply with the particular requirements of BS EN 772-3 (1998).

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 to the requirements of BS EN 771-1 (2011+A1:2015) (UK National Annex) for Class B bricks.

### 6.22 Timber

Timber for fences (fencing) shall comply with the relevant current part of BS 1722. All other timber shall comply with BS 4978 (2007+A2:2017), GS grade.

All timber shall comply with BS 8417 (2011 +A1:2014), performance category 4 and shall be treated in accordance with Table 4 to 6 where required. In those species having sap wood classed as permeable or moderately resistant, the preservation process shall result in complete penetration. Loadings in treated zones shall be not less than required to achieve a minimum penetration class NP5. Copies of all treatment certificates shall be forwarded to *the Engineer*. Preservative treated timber will only be accepted from Quality Assured sources.

### 6.23 Reconstituted Stone

Reconstituted stone shall conform to the requirements of BS 771-5 (2011 +A1:2015).



# 7 Bituminous Materials

## Contents

- 7.1 Preferred Materials
- 7.2 Alternative Materials
- 7.3 Aggregates
- 7.4 Bituminous Binders
- 7.5 Bituminous Sprays
- 7.6 Coated Chippings
- 7.7 Shared Surfaces and Cycleways
- 7.8 Adjustment of Manhole Covers
- 7.9 Tying into Existing Work
- 7.10 Surface Level Tolerances
- 7.11 Transporting
- 7.12 Laying
- 7.13 Compaction Requirements
- 7.14 Surface Regularity
- 7.15 Rectification Due to Non-Compliance
- 7.16 Surface Dressing (Sealing Grit)
- 7.17 Construction Traffic

## 7.1 Preferred Materials

Bituminous materials shall comply with the requirements of BS EN 594987 (2015+A1:2017) and the BS EN 13108 (2016) family of standards (in conjunction with PD6691 (2015+A1:2016)) with the exceptions as given in the following clauses.

Table 7-1 and Table 7-2 define the preferred bituminous mixtures for Base, Binder Course and Surface Course manufactured in Asphalt Concrete and Hot Rolled Asphalt. Nominal layer thickness should be in accordance with the requirements of BS EN 594987. Mixtures other than those listed below can only be used with the approval of *the Engineer*.

**Note: 1** For surfaces which require a “red” bituminous Surface Course see Clause 7.7.

**Note: 2** The use of slag based materials must be in accordance with Clause 7.3.1.

Table 7-1 Preferred Asphalt Concrete (Macadam) Materials

Asphalt Concrete Mixes	Nominal Aggregate Size Mm
AC32 HDM/dense base (Heavy Duty Base/ Dense Base)	32
AC20 HDM/dense base (Heavy Duty Base)	20
AC20 dense bin (Dense Binder Course)	
AC 14 close surf (Close Graded Surface Course)	14
AC 10 close surf (Close Graded Surface Course)	10

Asphalt Concrete Mixes	Nominal Aggregate Size Mm
AC 6 dense surf (Dense Surface Course)	6
AC 4 fine surf (Fine [Sealing Grit])	4

Table 7-2 Preferred Hot Rolled Asphalt Materials

Asphalt Mixes	% Stone Content and Nominal Size mm
HRA 60/32 base (HRA Base)	60/32
HRA 60/20 Bin (HRA Binder Course)	60/20
(HRA Regulating Mixtures)	50/20
HRA 50/14 reg (HRA Regulating Mixtures)	50/14
HRA 50/10 reg (HRA Regulating Mixtures)	50/10
HRA 30/14 F surf (Hot Rolled Asphalt Surface Course)	30/14

Hot Rolled Asphalt Surface Course mixtures shall be of the design mix type F and shall be designed in accordance with the requirements given in BS 598-107 (2004). The design procedure shall be used to select a target binder content. The composition shall comply with the requirements of Table 4 of BS EN 13108-4 (2016). All such designs will require the approval of *the Engineer*.

Stability and flow requirements for rolled asphalt Surface Course for the complete mix at the target binder content shall be as follows:-

- Stability - 4kN minimum to 10kN maximum.
- Flow - 5 mm maximum.

The above design requirements shall be verified using materials obtained from the plant and shall be carried out either by the supplier and witnessed by *the Engineer*.

## 7.2 Alternative Materials

Where the Developer is required to produce a Surface Course material which, when laid, will have increased skidding resistance value, then alternative materials having a skidding resistance value equivalent to that of Hot Rolled Asphalt Surface Course with coated chippings must be submitted to *the Engineer* for approval.

All such submissions shall include information on coarse aggregate rock type, aggregate source, polished stone value (PSV), aggregate abrasion value (AAV), binder penetration and softening point, any binder modifiers and all in grading limits of the aggregates if different from equivalent mixtures given in BS EN 594987 and any other information *the Engineer* may require.

## 7.3 Aggregates

Rock belonging to the limestone group must not be used in the manufacture of Surface Course macadam mixtures.

The minimum PSV of the coarse aggregate for asphalt Surface Course mixtures shall be 50.

All aggregates shall be clean, hard and durable and not contain any material which can prevent proper coating or affect the durability of the mixed materials.

### 7.3.1 Hardness

Coarse aggregates for bituminous materials shall have the following properties:-

- a) a ten percent fines value not less than 140 kN for natural crushed and uncrushed aggregate and not less than 85 kN for blastfurnace slag, when

tested in a dry condition in accordance with BS EN 1097-2;

- b) an aggregate impact value of not greater than 30 percent for natural crushed and uncrushed aggregates and not greater than 35 percent for blastfurnace slag when tested in a dry condition in accordance with BS EN 1097- 2.

### 7.3.2 Durability

The aggregate source shall be tested in accordance with BS 812-121 (1989) and shall have a soundness value greater than 75.

**Note:** *The soundness value of an aggregate source need only be determined and submitted to the Engineer on an annual basis. Thereafter, for routine testing of such aggregates, the water absorption value shall be used as determined by the method given in BS EN 1097-3 (1998). If the water absorption value of the coarse aggregate is greater than 2% for natural aggregates and 4% for blast furnace slag, then the aggregate source is to be re-tested for soundness as given above.*

### 7.3.3 Cleanliness

The fraction of material passing a 75 µm sieve for coarse or fine aggregates shall not exceed the limits given in BS 594987 when tested in accordance with the washing and sieving method of BS EN 933-1.

## 7.4 Bituminous Binders

### 7.4.1 Hot Rolled Asphalt Mixtures

The binder shall comply with those listed in clause 4.2 of BS EN 13108-4.

**Note:** *The normal binder shall be penetration grade 40/60 binder.*

### 7.4.2 Dense and Heavy Duty Asphalt Concrete (Macadam) Mixtures

The binder grades shall be as given below:-

Machine laid materials

- a) Dense Macadam – 100/150 pen.

- b) Heavy Duty Macadam – 40/60 pen.
- c) Penetration grade bitumen of 160/220 pen. May be used in machine laid operation in extreme circumstances, with the approval of *the Engineer*.

**Note:** *It is preferable to use penetration graded bitumen for all works. However, advantages can be gained from using cut-back bitumen in footpath locations which are hand laid and therefore binder viscosity of 200 secs may be permitted for footpaths only, and only with the prior approval of the Engineer. Cut-back bitumen is not permitted for carriageway constructions.*

## 7.5 Bituminous Sprays

A bond coat shall be applied to all surfaces prior to overlaying.

Bond coats shall be specified in accordance with BS EN 594987 and MCHW Vol.1 Series 900 (2018) cl920 and applied with minimum rates of spray conforming to BS EN 594987 Table 2. The surface shall be dry or barely damp immediately prior to application.

Surfaces receiving a Thin Surface Course System (TSCS), shall be treated in accordance with the requirements of the BBA HAPAS certificate for that TSCS.

The bond coat shall not be allowed to collect in hollows and shall be allowed to turn from brown to black before being overlaid.

If *the Engineer* requires proof that adhesion exists between layers then 150mm diameter core samples shall be taken at locations indicated by *the Engineer*.

## 7.6 Coated Chippings

Requirements for the supply and use of chippings shall be as stated in BS 594987 with the following additional requirements:-

When using Hot Rolled Asphalt Surface Course, the surface roughness shall be obtained by using pre-coated chippings. The method of application of the coated chippings shall be in accordance with the requirements of BS 594987.

The chippings shall be delivered to site not more than 3 days before or less than 1 day before application in order that the rate of spread can be determined by a UKAS laboratory prior to the Surface Course work commencing.

The chippings shall be clean and free from any contamination which may prevent permanent retention in the asphalt.

The maximum AAV of the chippings shall not exceed 12 and the minimum PSV is to be 60 unless otherwise specified by *the Engineer*.

The chippings shall be applied to the rolled asphalt surfacing by a mechanical chipper unless otherwise agreed by *the Engineer*.

The chippings shall be applied at a uniform rate to give an even distribution throughout the whole of the surface to be covered.

## 7.7 Shared Surfaces and Cycleways

The Surface Course material may be of a red colour to help assist identification of the status of the path.

Coloured bituminous materials by their nature are proprietary materials and not covered by BS EN 594987 and therefore the constituent materials requirements shall be devised by the supplier to ensure a product that will give adequate durability. The one exception is that the aggregate is to be red from a source approved by *the Engineer*.

The transporting, laying and compaction shall be generally in compliance with the requirements of BS EN 594987 and also the requirements of this specification. Where the supplier of these proprietary materials requires other specialist operations then they shall be followed.

The Developer shall submit to *the Engineer* the proposed supplier and the following minimum information of the proposed mix.

- the composition of the mix with compliance specification limits for binder content and grading.

- binder penetration and any binder modification.
- coarse aggregate source.
- fine aggregate source.

Where the supplier wishes to change any of the constituent components of the approved mix they must be submitted to *the Engineer* for approval.

All vertical joints must be treated with red bitumen or red bitumen emulsion.

**Note:** *It is recommended that those involved in the laying of red pigmented bituminous materials seek advice on acceptable laying practices from the supplier of such material before work commences on site.*

## 7.8 Adjustment of Manhole Covers

The Developer shall be responsible for the adjustment of all manhole covers, hydrants, service boxes and road gullies to suit the finished road level prior to the laying of the Surface Course.

Any part of these covers against which surfacing material is to be laid shall be cleaned and treated with hot bitumen or emulsion to the satisfaction of *the Engineer*.

## 7.9 Tying into Existing Work

Where new work abuts onto or ties into an existing carriageway the surface of the existing shall be scarified over a minimum length of 2m adjusted and reshaped as directed by *the Engineer* to comply with new camber and/or crossfalls. See Clause 7.12 for jointing requirements.

## 7.10 Surface Level Tolerances

The permitted deviation of the surface level of any pavement layer at any point from the true surface level shall not exceed the following values:-

- a) sub-base to receive Base +0 mm/-30 mm
- b) Base to receive Binder Course +/- 15 mm
- c) Binder Course to receive Surface Course +/- 6 mm

- d) Binder Course to receive Surface Course on areas other than roads
- e) Surface Course +/- 6 mm

The sum of the deviations in the levels of different pavement layers shall not result in a reduction of the required design thickness by more than 8.5% or in the overall Surface Course thickness by more than 5mm.

## 7.11 Transporting

Bituminous material shall be carried in clean insulated vehicles and shall be covered by double sheets until tipped.

The use of dust, coated dust or sand on the interior of the vehicles to help in the discharge of the material is allowed but must be kept to a minimum, with any excess removed prior to loading. The maximum delivery temperatures shall be in accordance with the requirements of Table B.17 of PD6691 (2016) (or the latest revision thereof).

Bituminous materials shall, on delivery to site, be fully and uniformly coated.

All bituminous materials shall be manufactured, transported, laid and compacted without segregation of the aggregates, separation of the binder and cracking/tearing of the layer.

Where any or all of these conditions occur and in the opinion of *the Engineer* they could adversely affect the performance of the construction then the material shall be removed and replaced.

**Note:** (a) *Removal of bituminous materials shall be full width and depth of the layer concerned by a length to permit replacement by machine laying.*

**Note:** (b) *Where longitudinal joints are sealed or "overbanded" then the Developer should be aware of the following safety requirements:-*

Where joint sealing/overband widths exceed 20mm then the wet skidding resistance value (SRV) shall be not less than 55 when measured using the portable skid-resistance tester. (Applied bitumen has wet SRV of approximately 30).

The width of any applied material shall not exceed 40mm with a thickness of not greater than 3mm.

## 7.12 Laying

The material shall, as soon as possible after arrival on site, be supplied continuously to an approved self-propelled paver, laid without delay and spread levelled and tamped on a clean dry surface.

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 or tearing of the material and minimum segregation.

All joints in the Surface Course must be cut back to a vertical face for the depth of the layer.

A cutting blade attached to a roller must be used for all longitudinal joints. For the Surface Course the vertical face of the joint must be coated with a hot bitumen or emulsion to the satisfaction of *the Engineer*.

The laying of material shall not commence until the rollers and their operators are at the place of laying and ready to commence compaction. Surface cracking due to poor rolling technique will result in the rejection of the material by *the Engineer*.

Alternatively the material may be laid by using pavers operating in echelon provided they are in close proximity for adjacent widths to be fully compacted by continuous rolling.

Hand laying of material will only be allowed with the permission of *the Engineer* and only in small areas where regulating layers are required in irregular shapes of varying thickness or in confined spaces where the paver is unable to operate.

All joints must be offset at least 300 mm from parallel joints in the layers beneath.

The Base material shall not remain uncovered by either the Binder Course, or surface treatment for more than 3 consecutive days and only construction traffic will be allowed on the carriageway during this time. (See Clause 7.17).

The vertical faces of manholes, gullies, kerbs and channels and similar projections against which bituminous material is to be laid shall be cleaned and painted with a hot bitumen or emulsion to the satisfaction of *the Engineer*.

Rollers shall not stand on newly laid material whilst there is a risk that it may deform. Any such deformed areas will be rejected, removed and replaced to the satisfaction of *the Engineer*.

### 7.12.1 Adverse Weather

The Contractor shall take account of the weather conditions when planning their working methods. The Contractor's working methods shall comply with all weather-related requirements of BS 594987 and any additional requirements of this clause. When laying is to be undertaken during winter (October to April) and/or night time (9 p.m. to 6 a.m.), the contractor shall work to a Quality Plan that allows for the specific issues raised by winter and/or night time working.

Laying operation shall cease while there is free-standing water on the surface to be covered and during periods of rain if in the opinion of *the Engineer* the conditions are likely to be detrimental to the performance of the bituminous material and/or cause any safety related issues.

Bituminous materials shall not be laid on any surface which is frozen or covered with ice or snow.

No Layer less than 80mm thick shall be laid onto a cold surface, when the air temperature is at or below 4°C. No layer shall be laid when the air temperature is at or below 0°.

Hot bituminous materials laid less than 50 mm thick, other than those supplied to MCHW c1942, shall be laid within the wind speed and temperature constraints of MCHW Figure 9/1.

## 7.13 Compaction Requirements

Compaction shall be carried out as given in BS 594987 including all notes and the following requirements:-



- a) Compaction shall be carried out using 8-10 tonnes deadweight smooth-wheeled rollers having a width of roll of not less than 450 mm, or by multi-wheeled pneumatic-tyred rollers of equivalent mass. The use of vibrating rollers will not be permitted for the compaction of any bituminous Surface Course laid in the carriageway.
- b) Material shall be compacted as soon as rolling can be effected without causing undue displacement or surface cracking of the mixed material and while it has at least the minimum rolling temperature as follows:
- c) Designed Mixes:
- Table 4 of BS EN 594987 for Hot Rolled Asphalt or;
  - Table 5 of BS EN 594987 for all other materials;
- d) Recipe mixes:
- Table A.1. of BS EN 594987 for all recipe mixes.
- e) The material shall be rolled in longitudinal direction from the sides to centre of the carriageway, overlapping on successive passes by at least half width of the rear roller and with the driven rollers nearest to the paver. Rolling shall continue until all roller marks have disappeared.
- f) Materials shall be laid and compacted in layer thicknesses which enable surface level and regularity requirements to be met and adequate compaction and strength of each layer to be achieved.
- g) *The Engineer* will ensure that adequate compaction has been achieved by checking the compacted density by use of a Nuclear Density Meter. This check must be carried out before the Surface Course is laid and will be based on having first established (before work commences) a site target density by agreement with the supplier. The finished compacted density shall be not less than 90% of this established site target density. Failure to comply

with this requirement will result in the material being rejected.

- h) In the case of disputes *the Engineer* will require that the Developer carries out the End Result Compaction test as given in Clause 9.5 of BS EN 594987 using a full percentage refusal density method (PRD) with the exception that the acceptance requirements will be that a site density of not less than 90% of the refusal density be achieved. The cost of this testing must be borne by the Developer.

## 7.14 Surface Regularity

Should *the Engineer* decide that there is a need to check the longitudinal regularity of any of the bituminous layers, the checking procedure detailed in the Department of Transport Specification for Highway Works - Clause 702 shall be followed to check longitudinal regularity and a 3 m straightedge used to check transverse regularity.

Irregularities shall not exceed 3mm for Surface Course, 6mm for Binder Course and 14mm for Bases.

On lengths of Surface Course in excess of 75m, a calibrated rolling straight edge may be used. The maximum number of irregularities for each asphaltic layer are as detailed in Table 7/2 of MCHW

## 7.15 Rectification Due to Non-Compliance

Where any carriageway does not comply with the Specification for regularity, layer thickness, texture depth, material properties or compaction, the full extent of the area which does not comply shall be rectified in the following manner:-

### 7.15.1 Binder Course and Base Materials

These materials shall have the full depth of the course removed and replaced with fresh material laid and compacted in accordance with the Specification. The area to be relaid shall be at least half the carriageway width and a minimum 15m long.

### 7.15.2 Surface Course Materials

The rectification shall be as above.

**Note:** *Where defects in Surface Course entail more than one remedial area and these areas if carried out as separate patches would, in the opinion of the Engineer, affect the safety and durability of the Surface Course the Engineer may require these remedials be combined to give one large rectified area thus avoiding a “patchwork” effect.*

### 7.16 Surface Dressing (Sealing Grit)

**IF THE SURFACE COURSE IS NOT TO BE LAID WITHIN 3 DAYS then a Fine graded surface course surface dressing (sealing grit) in accordance with Table 1A or BS EN 594987, must be applied to the Binder Course layer.**

The individual particles shall be free flowing to give an even scatter without lumps or bunching. Fine graded surface course shall comply with PD 6691:2015+A1:2016 Clause B.3.5.3.

This layer shall be removed prior to the laying of the Surface Course.

### 7.17 Construction Traffic

The carriageway shall not be used as a haul road for heavy construction loads until the base course has been laid, or after the Surface Course is laid.

Where the Binder Course or base has been used as a temporary running surface, the surface of the Binder

Course or base shall be thoroughly cleaned and a bond coat applied before the Surface Course or Binder Course is laid. A hardstone Binder Course may be required if it is trafficked for longer than 28 days.

If the Surface Course or Binder Course is not to be laid within 28 days,

[THEN EITHER]

the Binder Course or base shall be blinded to excess with Surface Dressing to Table 1A or BS EN 594987 (see Clause 7.16) prior to carrying such construction loads, and any surplus removed within 7 days.

[OR]

the Binder Course or base thickness shall be increased by 30mm to provide a sacrificial temporary surface layer which is to be planed off prior to the laying of the overlying layer.

[THEN]

Any damage or deformation to the carriageway shall be made good to *the Engineer's* satisfaction prior to the application of a bond coat in preparation of laying of the Binder Course.



# 8 Block Paving

## Contents

- 8.1 General
- 8.2 Laying Requirements
- 8.3 Edge Restraints
- 8.4 Laying Block Paving
- 8.5 Compaction of Block Paving
- 8.6 Surface Regularity
- 8.7 Sealing
- 8.8 Adverse Weather Conditions
- 8.9 Recessed Covers
- 8.10 Colour of Blocks
- 8.11 Drainage of Bedding Sand
- 8.12 Stone Setts

## 8.1 General

The use of block paving is generally restricted as an option in some particular situations in the following areas:-

- a) pedestrian areas
- b) shared pedestrian/edge areas
- c) laybys
- d) heavy vehicle turning areas
- e) parking bays
- f) traffic calming features
- g) verges between carriageway and footpath
- h) islands
- i) miscellaneous infill areas
- j) over-run areas

**Note:** *The successful use of block paving other than for lightly trafficked and pedestrian areas requires all of the following:-*

- a) structural design.
- b) an understanding of how block paving transmits the traffic loading.
- c) the use of a high quality of materials in the construction particularly the bedding sand.
- d) a high degree of knowledgeable supervision.

Failure to apply any of the above increases the risk of failure.

Pavements constructed with Block paving units shall be designed in accordance with the BS 7533 family of standards.

### 8.1.1 Block Paving Units

Block paving units shall comply with the requirements of BS EN 1338 (2003) for concrete paving units and BS EN 1344 (2013) for clay pavers.

### 8.1.2 Block Thickness

The minimum block thickness shall be as indicated in Table 8-1.

*Table 8-1 Minimum block thicknesses*

Area of Use	Concrete	Clay
Footway/pedestrian area	65 mm	65 mm
Any carriageway use	80 mm	65 mm

## 8.2 Laying Requirements

### 8.2.1 Bedding Course Sand

Bedding course sands shall comply with the overall requirements of BS EN 12620 and BS7533 with the following exceptions.

Sands shall be naturally occurring silica sands from the Quaternary geological series or sea dredged sands and graded in accordance with BS 7533-7 (2010).

The sand shall be free of deleterious contaminants.

Crushed rock fines shall not be used as a bedding sand material.

The approval of sands for bedding courses may require a geological assessment which may, if *the Engineer* requires it, include the use of micro-photography.

### 8.2.2 Moisture Content

The moisture content of the bedding sand shall be uniform and should be moist without being saturated.

Where bedding sand is stockpiled on site it must be sheeted to maintain a uniform moisture content.

Where bedding sand becomes saturated prior to the laying of paving units it shall be removed from the laying area, replaced with sand of an acceptable moisture content and allowed to dry until it attains a moisture content acceptable to be used for bedding paving units.

**Note:** *As a practical guide the moisture content of the sand can be assessed by selecting a representative sample of the sand and squeezing it in the hand for 5*

*seconds, releasing the pressure and assessing the ball of sand. The sand should show no free water and should bind together.*

### 8.2.3 Preparation of Laying Course

The laying course shall be screeded to specified levels and thickness not more than 3m in advance of block laying.

Where blocks are laid on an Asphalt Concrete the final sand bed shall be a uniform layer to the required depth of 30mm  $\pm$  5mm after compaction of the paving. Where blocks are laid on sub-base, the sand bed shall be 50mm  $\pm$  5mm after compaction.

#### 8.2.3.1 Pre-compaction Method

Spread the material in a loose uncompacted layer to approximately the required compaction depth and to the required surface profile. Compact this layer with a vibrating plate compactor. Spread a further layer of material about 15mm thick and screed to create a loose surface on which the blocks can be placed.

#### 8.2.3.2 Compaction After Laying Method

Spread the material in a loose uniform layer and screed it to the thickness required to give the specified design thickness after the paving blocks have been laid and vibrated into place.

If any disturbance of the prepared laying course occurs prior to placing the paving blocks those areas must be re-screeded and restored to the required profile.

## 8.3 Edge Restraints

Edge restraints shall be provided along the perimeter of all block paving which shall be adequate to support traffic loads and prevent the loss of the sand bed. Kerbs, channels and concrete foundations shall be constructed in advance of any block laying work.

All concrete foundations and haunching are to have a minimum of 72 hours curing before any vibratory compaction takes place. Concrete haunching to the paving face shall be vertical down to the level of the underside of the laying course.

## 8.4 Laying Block Paving

The laying of block paving shall be to the requirements of BS 7533-3 (2005+A1:2009) and BS 1344 and including the following:-

- a) Paving blocks shall be laid on the sand bed in an approved design pattern and in such a manner as to not disturb the bedding layer of the blocks already laid. In carriageways a 45° herringbone pattern using rectangular blocks shall generally be used with the pattern at 45° to the direction of traffic.
- b) Blocks shall be laid hand tight working only from the outer edge/face and care must be taken to ensure that the laying pattern is maintained.
- c) In each row all full units shall be laid first. Closure pieces which must not be less than 33% of a block, cut by mechanical means only and are to be placed with a 3mm joint to the edge constraint.
- d) Infilling to boundaries and obstructions should be completed as the laying of the blocks proceeds and prior to compaction.

The blocks shall be laid such that the surface levels and tolerances given in Clause 7.10 are complied with.

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 (BS7533-7). Blocks shall be cut so that no individual block shall be less than half of a block in length. To satisfy the 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.

Where insufficient depth is available at manhole cover frames and gully grating frames infill concrete may be used to provide a neat finish and surface level. However, if possible frames shall be chosen which allow blocks to be laid without infill concrete.

The concrete is to be PAV I - refer to Clause 6.3. Fine aggregate and pigment and mixtures shall be carefully selected to obtain an acceptable colour and texture match to be approved by *the Engineer*. The colour match is to be tested by trial before use on site by noting and recording the mix proportions and the record of the suitable mix is to be kept on site for future reference.

Boards shall be laid over the blocks to prevent any disturbance prior to the mechanical compaction. No construction traffic is to be allowed on the blocks at this stage of the work.

At the edges of the carriageway single header or soldier courses are to be used.

Around manholes, gullies, water meters, etc. a single header course is to surround the cover. At small covers such as at stop cocks the general bond pattern is to be taken up to the cover itself.

## 8.5 Compaction of Block Paving

After laying the paving blocks, they shall be fully compacted to the required line and level by not less than 3 passes of an approved plate compactor.

The compactor shall be a high frequency low amplitude mechanical rubber soled flat plate vibrator with an area of not less than 0.25 m<sup>2</sup> transmitting a force of 75 to 100 kN/m<sup>2</sup> of plate area when operating at a frequency of 75 to 100 Hz. The compactor shall not be used within 1 m of an unrestrained edge.

Compaction shall take place as soon as possible following the laying of the blocks and before any traffic is allowed on them.

All blocks to within 1m of the laying face must be fully compacted prior to the completion of the days' work.

Any paving damaged during compaction shall be immediately removed and replaced to the satisfaction of *the Engineer*. Compaction shall continue until there is no lipping between adjoining blocks.

After completion and before the finish of the days' work, sand for joint filling shall be spread over the blocks.

The sand, which shall be dry, shall comply with the requirements of BS 7533-7 and be free from all soluble deleterious salts and other contaminants and shall comply with the grading in Annex C thereof.

The sand, which must not stain the surface, shall be lightly brushed over the blocks to fill the joints prior to a further pass with the vibrating plate to compact the joint filling, the process being repeated until the joints are full. All surplus sand must be removed before traffic is allowed on the block paving.

Where there is evidence that, after initial trafficking the block paving jointing sand has not completely filled the joint, filling of the whole area as described above will be required.

## 8.6 Surface Regularity

The maximum permissible deviation from design level within the compacted area under a 3m straight edge shall not exceed 10mm (flatness).

The maximum permissible deviation from design level overall for the finished block paving is to be within the limits of +/- 6mm.

The maximum permissible deviation from design level between adjacent blocks shall not be greater than 2mm.

Adjacent to gullies, surface drainage, channels and outlets the maximum deviation shall be +6mm to 0m.

**Note:** *The permissible deviations for the upper level of drainage inlets and channels should be +/- 0mm to ensure positive drainage.*

Should there be any settlement of the block paving the Developer shall remove the affected area and investigate the sub-layers to determine the cause of the problem. The Developer must submit remedial proposals to *the Engineer* for approval.

## 8.7 Sealing

All block paved areas shall be sealed with a sealant approved by *the Engineer*. Before approval *the Engineer* may require a trial which could involve a test area of the proposed blocks and sealant to ensure no staining of the

blocks occur and that the sealant adequately stabilises the jointing sand.

## 8.8 Adverse Weather Conditions

Pavements constructed with Block paving units shall be laid in accordance with BS 7533-4 (2006) as a minimum.

Furthermore, if in *the Engineer's* opinion weather conditions are so adverse that the block paving works are affected then the laying operation shall stop.

Block shall not be laid on bedding sand which is in a frozen condition or where the moisture content of the sand is outside the limits of Clause 8.2.2

## 8.9 Recessed Covers

Where a manhole/inspection cover is located within a block paved area a galvanised steel recessed cover and complying with the appropriate British Standard should be used. Infilling the blocks should be in such a manner as to match the surrounding pattern.

## 8.10 Colour of Blocks

Coloured blocks may be used provided that there is sufficient contrast to provide clear definition between the carriageway and other areas and to assist partially sighted pedestrians with establishing the status of each area. Further guidance should be sought from "Inclusive Mobility".

## 8.11 Drainage of Bedding Sand

Drainage shall be incorporated to ensure that water does not collect in the bedding sand, shall comply with the

requirements of BS 7533-7. The sub-base layer or bituminous Base shall be graded to ensure that no local ponding will occur.

## 8.12 Stone Setts

Setts of natural stone shall conform in all aspects with BS EN 1342 and BS 7533-7, and should be hand-hewn and not show drill holes. The thickness of the setts shall be 100mm and laid on a 50mm layer of sand/cement mortar to MCHW Vol.1 Series 2400 (2008) cl2404 so as to extend approximately 30 mm above the base of the sett or bedded in wet concrete provided that the correct levels can be achieved.

The sub-base shall be in accordance with Clause 4. A bituminous Base will be required.

Laying should be to the same general tolerances and requirements as other carriageway surfacings.

The setts shall be laid in courses, with staggered joints. Joints are to be 10mm wide and filled with approximately 50mm dry class 1 mortar brushed into joints and watered in. Joints to be sealed with approximately 15mm hot poured sealant to C1017 to within 3-6mm of surface level.

# 9 Footpaths, Footways and Cycleways

## Contents

- 9.1 General
- 9.2 Formation - Inspection and Approval
- 9.3 Typical Flexible Construction
- 9.4 Typical Modular Paving Construction
- 9.5 Edge Restraint
- 9.6 Drainage
- 9.7 Sub-Base Materials
- 9.8 Flexible (Bituminous) Construction
- 9.9 Adhesion Between Layers
- 9.10 Footpath Vehicular Crossing
- 9.11 Surface Level Tolerances
- 9.12 Storage of Bituminous Materials
- 9.13 Laying of Bituminous Materials
- 9.14 Surface Regularity
- 9.15 Modular Construction
- 9.16 Drainage and Services
- 9.17 Tying into Existing Work
- 9.18 Steps and Ramps
- 9.19 Deterrent Tactile Paving
- 9.20 Barriers
- 9.21 Bollards
- 9.22 Signs and Markings - Cycleway

## 9.1 General

The construction of footpaths, footways and cycleways shall in general be in accordance with the requirements of Clause 7 - Bituminous Materials and/or in accordance with the following section.

The Developer must ensure that all relevant footpaths/footways are completed prior to the occupation of adjacent dwellings.

## 9.2 Formation - Inspection and Approval

The formation shall be prepared by removing all vegetable 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.

Trenches and other excavated areas below formation level are to be reinstated as follows:-

- a) using sub-base materials placed in layers not exceeding 150mm thick and compacted to refusal.
- b) using acceptable excavated materials.

Where the Developer proposes to use acceptable excavated materials as backfill to excavations, then notification must be given to *the Engineer* to enable inspections to be carried out as the backfilling operations progress.

Backfilling operations using acceptable excavated materials must be carried out in accordance with NRSWA.

Where excavated materials are to be used, then operatives need to be trained and certified in the identification of backfill materials, field identification tests for suitability to backfill materials and compaction of backfill materials in accordance with the NRSWA.

If, in the opinion of *the Engineer*, the operatives cannot fulfil the requirements of the NRSWA, then the use of excavated materials will not be permitted.

## 9.3 Typical Flexible Construction

The typical construction depths for flexible construction are given in Table 9-1.

Table 9-1 Flexible Footway Construction

Description	Material	Thickness
Surface Course	AC6 dense surf 160/220 (Close graded bituminous Macadam)	20mm
Base Course	AC20 dense base 100/150 OR AC20 dense base 160/220	60mm
Granular Sub-base	Type 1 or Type 2	150mm

The thickness of sub-base may be reduced to 100mm where it is not possible for any motor vehicles to use the surface. Even if the surface is only used for occasional maintenance vehicles 150mm thick sub-base must be provided.

## 9.4 Typical Modular Paving Construction

The typical construction depths for modular paving including concrete slabs, concrete blocks and clay paviours is shown in Table 9-2

Table 9-2 Typical Modular Paving Construction

Description	Material	Thickness
Slab/Block/Paviour	Pressed pre-cast concrete or clay paviour.	65 mm
Bed	Compacted sharp sand for concrete blocks/clay paviments	50 mm
	Class 2 mortar for paving slabs	25 mm
Sub-base	Granular Type 1 or Type 2	150 mm

The thickness of slabs/block/paviments shall be increased to 80 mm at crossings for private drives or other areas likely to be used occasionally by motor vehicles.

## 9.5 Edge Restraint

All edges to be supported by 150 x 50 mm rectangular section precast concrete edging, carriageway kerb or other concrete edging block.

## 9.6 Drainage

All footpaths and footways to be designed to fall from path to road channels or verge. Crossfalls shall be 1 in 40.

Drainage is to be provided where required due to back falls or other reasons by means of shallow blockwork channels discharging to lockable cast iron channel gullies.

Drainage to cycleways is to be provided to one side of the cycleway only and is to be located within the adjacent verge area wherever possible.

Channel inlet gullies are to be provided for each 200 m<sup>2</sup> of surface area.

Where cracking of the bituminous surfacing occurs then *the Engineer* will require remedial works to be carried out. An investigation of the cracked areas may also be required to ensure that the detail has been constructed correctly.

## 9.7 Sub-Base Materials

All footpath, footway and cycleways shall have a granular sub-base complying with the requirements of Clause 4.3.

The sub-base shall be of a nominal compacted thickness of 150 mm. The construction detail is given in the Standard Details section.

The detail given in Standard Details is required to prevent shrinkage of the underlying formation material (usually clay of medium or high shrinkage) from resulting in surface cracking particularly with bituminous construction.

## 9.8 Flexible (Bituminous) Construction

### 9.8.1 Binder Course

The Binder Course material shall be 20 mm nominal size dense macadam (AC20 dense bin) complying with the requirements of BS EN 594987 and the BS EN 13108 family of standards (in conjunction with PD6691).

For hand laying operations then the binder viscosity shall be selected from those given in Clause 7.4.

The Binder Course shall be laid to a nominal layer thickness of 50 mm, shall be fully compacted and free from areas of segregation, cracking and roller marks. Compaction shall be achieved using a static 2.5t dead weight roller applying a minimum of 4 passes.

### 9.8.2 Surface Course

The Surface Course material shall be 6 mm nominal size dense macadam (AC 6 dense surf) complying with the requirements of BS EN 594987 and the BS EN 13108 family of standards (in conjunction with PD6691).

For hand laying operations the binder viscosity shall be selected from those given in Clause 7.4.

The Surface Course shall be laid to give a nominal layer of thickness of 25 mm, shall be fully compacted and shall be free from areas of segregation, cracking and roller marks. The finished surface shall be laid flush with the kerb.

Compaction shall be achieved using a static 2.5t dead-weight roller applying a minimum of 4 passes.



### 9.8.3 Alternative Surface Course for Cycleway

The Surface Course shall be of 6 mm nominal size material. A red colour will be acceptable to *the Engineer* in accordance with Clause 7.7.

It shall be laid to give a nominal thickness of 25 mm, be fully compacted and be free from areas of segregation, cracking and roller marks. The finish surface shall be laid flush with the kerb.

Compaction shall be achieved using a static 2.5t dead weight roller applying a minimum of 4 passes.

It is recommended that those involved in the laying of red pigmented bituminous materials seek advice on acceptable laying practices from the supplier of such material before work commences on site.

### 9.9 Adhesion Between Layers

Prior to the laying of the Surface Course, the footpath Binder Course shall be cleaned and have a bond coat applied to the satisfaction of *the Engineer*. The bond coat specification and application shall be as given in Clause 7.5.

Where the Binder Course layer is to remain uncovered for more than 3 days after laying then it shall be sealed by the application of a Fine graded surface course surface dressing (sealing grit) in accordance with Table 1A of BS EN 594987 (see Clause 7.16). The rate of spread of the Fine graded surface course shall be such as to prevent the underlying Binder Course becoming contaminated with clay, dirt, etc. Failure to prevent contamination of the Binder Course may result in rejection of that layer.

### 9.10 Footpath Vehicular Crossing

At footpath crossings other than private drives to residential dwellings, additional strengthening of the construction is required by the use of concrete mix ST4 in lieu of the sub-base layer or a 200 mm thick air entrained concrete slab at ground level in with A142 mesh reinforcement or fibre reinforcement.

Where fibre reinforcement systems are to be used, then the Developer must provide *the Engineer* with all the

relevant information before the works commence. This information must include - fibre type, point of introduction into the concrete, dispersion throughout the concrete.

### 9.11 Surface Level Tolerances

The permitted deviation of the surface level of any footpath, footway or cycleway layer at any point from the true surface level shall not exceed the following values:-

- formation to receive sub-base +0mm/-30mm
- sub base to receive Binder Course +0mm/-15mm
- Binder Course to receive Surface Course +5mm/-5mm
- Surface Course +5mm/-0mm

### 9.12 Storage of Bituminous Materials

When stored on site, the material shall be retained in such a manner, as to ensure no deterioration of adjacent or underlying surfaces and that the material retains its workability.

### 9.13 Laying of Bituminous Materials

The conditions given in Clause 7.12 shall equally apply to the laying of footpath, footway or cycleway materials.

Laying shall proceed continuously so as to limit the number of joints, particularly in Surface Course operations, to a minimum. All joints shall be cut back to a sound edge prior to the commencement of the days work. All Surface Course vertical joints shall be coated with a joint sealant approved by *the Engineer*.

Compaction shall be applied uniformly across the full width of the footpath, footway or cycletrack and shall be substantially complete while the material is in a workable condition. Particular care will be required around footpath furniture which will necessitate hand compaction using a hand tamper.

Areas of segregation and/or surface cracking due to poor rolling technique will result in the rejection of the surfacing.

## 9.14 Surface Regularity

Where *the Engineer* considers that the surface regularity of the footpath, footway or cycletrack may affect the end use of these surfaces, then the surfacing layers (Binder Course and Surface Course) shall be checked using the apparatus and test method given in the MCHW cl702, (i.e. the rolling straight edge method) with the exception that it shall be carried out at any time specified by *the Engineer*. The surfacing shall not exhibit any irregularity greater than 5 mm.

## 9.15 Modular Construction

**The use of modular construction systems shall only be permitted with the approval of *the Engineer*.**

Pavements constructed with modular construction shall be designed in accordance with BS 7533.

### 9.15.1 Precast Concrete Flags (PCC) Including Tactile Crossing Flags

The PCC flags shall comply with the requirements of BS EN 1339 (2003) and shall be a minimum of 63mm thick. Tactile crossing flags shall be as defined in Annex E of DD CEN/TS 15209 (2008).

Precast concrete paving slabs shall be hydraulically pressed and shall be a maximum size of 400mm x 400mm square or 450mm x 300mm rectangular.

### 9.15.2 Laying of Precast Concrete Slabs

Precast concrete flags shall be laid in accordance with the requirements given in BS 7533-4, to give a finished construction as detailed in Figure 1 of BS 7533-4 with laying patterns in accordance with those presented in Annex A of BS7533-4.

Flags shall be laid on 25mm thick mortar complying with the requirements of BS7533-3 Table 3.

On circular work where the radius is 12m or less the paving shall be cut on both edges to the required line.

All joints shall be narrow butt joints approximately 3mm wide with a dry 10:1 sand/cement mortar well brushed into them and the joints between adjacent paving units shall be flush. The joints shall be at right angles to the

kerb. The surfaces shall be cleaned and all surplus material removed.

In areas where it is considered that the paving units will be subject to vehicle overrun small element paving of increased thickness shall be used.

All concrete paved footpaths shall have a PCC edging and those which are segregated from the carriageway shall be supported by an edging on both sides.

The flags shall be laid with a bonding system agreed with *the Engineer*.

### 9.15.3 Concrete or Clay Paving Blocks

**The blocks shall comply with the requirements of BS EN 1338 for concrete paving units and BS EN 1344 for clay pavers.**

### 9.15.4 Laying of Blocks

The blocks shall be laid in accordance with the requirements of Clause 8.

### 9.15.5 Sealing

**The paved area shall be sealed with a proprietary solution approved by *the Engineer*, after satisfactory joint sanding.**

## 9.16 Drainage and Services

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.

The Developer shall be responsible for the adjustment to all manhole covers, hydrants, service boxes, gullies, etc. to suit the finished footpath, footway or cycleway level to the satisfaction of *the Engineer*.

## 9.17 Tying into Existing Work

### 9.17.1 Bituminous

Where new work abuts existing work, then a butt joint shall be formed. The existing work, where required, shall be cut to form a vertical face which is clean and dust

free. This face shall be painted with a bituminous sealant to the satisfaction of *the Engineer*.

The new work shall be adjusted and/or reshaped as directed by *the Engineer* to match the existing.

### 9.17.2 Modular

Where a modular footpath is required to tie into existing then the new works shall match the existing in both line and level and any existing bonding pattern shall be maintained.

*The Engineer* may require the removal and replacement of existing modules to permit an acceptable tie in point.

### 9.17.3 Concrete

Where a new concrete footpath is required to tie into existing work then an expansion joint without a load transfer system, i.e. dowel shall be constructed as shown in Standard Detail MCHW Vol.3 HCD C2. Levels and falls shall match existing.

## 9.18 Steps and Ramps

When providing solutions to overcome level differences in public areas, due consideration should be given to the requirements of the Equality Act 2010 and inclusive mobility.

### 9.18.1 Access Ramps

Access ramps to form footpath crossing are to be provided to all kerbed footpaths adjacent to carriageways.

### 9.18.2 Steps

Steps shall be constructed of either precast or in situ concrete Grade C30P or of approved natural stone. 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 40mm of cover.

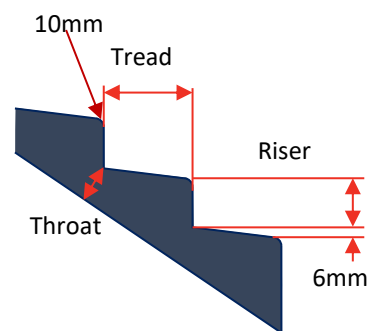
The steps shall normally be 1.8 metres wide. Landings shall be of the same width as the steps and have minimum length of 2m. A flight of steps shall consist of not more than 12 risers of 150mm, and where there are 4 or more risers a handrail shall be provided. Where the

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 a 10mm radius. The minimum throat dimension (i.e. the minimum thickness of the slab) shall be 150mm (see Figure 1).

All stairway designs shall be submitted to *the Engineer* for approval. Walls flanking the steps, bollards, free standing handrails and handrails attached to walls are to be to a design approved by *the Engineer*.

Adequate drainage and lighting shall be provided to steps, ramps, landings and approach paths.

Figure 1 Stairway Minimum Requirements



## 9.19 Deterrent Tactile Paving

Anti-pedestrian paving is to be provided to areas of verge between footpath and carriageway kerb line at locations to discourage access to carriageways by pedestrians in the vicinity of major distributor roads and approaches to pedestrian crossings.

## 9.20 Barriers

Pedestrian barriers are to be provided where required to each side of pedestrian crossings and at the junction with footpaths parallel to the carriageway.

### **9.21 Bollards**

Where bollards are required, their location should be carefully selected taking due consideration for access to the loading ramp of rear-loading mobility vehicles.

### **9.22 Signs and Markings - Cycleway**

Signs and markings are to be provided where required at junctions and regular intervals as required.

# 10 Reinstatement

## Contents

10.1 General

### 10.1 General

The extents and construction requirements of reinstatements shall be carried out as agreed with *the Engineer*.

Reinstatements are to be carried out in accordance with the procedures outlined in the NRWSA 1991.

# 11 Appendices

**APPENDIX A**

**SAMPLING AND TEST METHODS IN ACCORDANCE WITH UKAS**

TYPES OF SITE LOCATION	MATERIALS/PRODUCTS TESTED TYPES OF TESTS / PROPERTIES MEASURED RANGE OF MEASUREMENT	STANDARD SPECIFICATION EQUIPMENT/TECHNIQUES USED
CIVIL ENGINEERING CONSTRUCTION SITES	AGGREGATES  <b>Physical Tests</b>  In situ density	Documented In-House Method No. CCC TP 97 Nuclear Density Meter
	BITUMINOUS MIXTURES for roads and other paved areas  <b>Sampling</b>  Sampling from - around the augers of the paver  Sampling coated chippings from stockpiles	BS 598-100: 2004  BS 598-100: 2004
	CONCRETE - Fresh  <b>Physical Tests</b>  Slump  Air content - method A  <b>Sampling</b>  Sampling fresh concrete on site  Sampling from initial discharge (slump test)  Making test cubes	BS EN 12350-2 (2009) BS EN 12350-7 (2009)  BS EN 12350-1 (2009) BS EN 12350-2 (2009)  BS EN 12390-1 (2012)
	IN SITU FLOORINGS – polymer modified cementitious surfaces course  <b>Physical Tests</b>  Slip resistance value (SRV)	BS 8204-3: 2004
	IN SITU FLOORINGS - terrazzo wearing surfaces  <b>Physical Tests</b>  Slip resistance value (SRV)	BS 8204-3: 2004

TYPES OF SITE LOCATION	MATERIALS/PRODUCTS TESTED TYPES OF TESTS / PROPERTIES MEASURED RANGE OF MEASUREMENT	STANDARD SPECIFICATION EQUIPMENT/TECHNIQUES USED
CIVIL ENGINEERING CONSTRUCTION SITES	PAVED SURFACES  <b>Physical Tests</b> Skid resistance value	TRRL Road Note 27/69
	ROAD PAVEMENT MATERIALS  Physical Tests In situ density	BS EN 594987
	BITUMINOUS ROAD SURFACING  <b>Physical Tests</b> Texture depth by sand-patch method	BS 598:105 (withdrawn)
	ROAD PAVEMENT SURFACES  <b>Physical Tests</b> Texture depth - by the sand-patch method  Surface regularly using a rolling straight edge	Volumetric patch method BS EN 13036-1 Specification for Highway Works, HMSO May 2001 Clause 702
	SOILS for civil engineering purposes  <b>Physical Tests</b> MCV - natural moisture content In situ density - core cutter method	BS 1377-4: 1990 BS 1377-9: 1990
AGGREGATES	<b>Physical Tests</b>  Particle size distribution – washing and sieving  Particle size distribution – dry sieving  <b>Flakiness index</b>  Moisture content - oven drying method	BS EN 933-1:2012  BS EN 933-1:2012  BS EN 933-3:2012  BS 812-109: 1990



TYPES OF SITE LOCATION	MATERIALS/PRODUCTS TESTED TYPES OF TESTS / PROPERTIES MEASURED RANGE OF MEASUREMENT	STANDARD SPECIFICATION EQUIPMENT/TECHNIQUES USED
BITUMINOUS MATERIALS	Physical Tests Needle penetration - 25°C  Softening point - ring and ball method	BS EN 1426:2015, BS 2000-49:2015  BS EN 1427:2015, BS 2000-58:2015
BITUMINOUS MIXTURES for roads and other paved areas	Mechanical Tests Determination of the composition of design surface course rolled asphalt (loads from 1 to 25kN)  Physical Tests Binder content and grading of mineral aggregate – extraction bottle method: binder directly determined, filler by difference  Rate of spread of coated chippings - clause 4.2	BS 594987:2015 Annex H  BS 598-102: 1996  BS 598-1:2011
CONCRETE - Fresh	Physical Tests Slump Air content - method Sampling Making test cubes in the laboratory	BS EN 12350-2 (2009) BS EN 12350-7 (2009)  BS EN 12390-1 (2012)
CONCRETE - Hardened	Mechanical Tests Compressive strength of cubes - including curing (loads from 40 to 2500 kN) Compressive strength of cores (loads from 40 to 2500 kN)  Physical Tests Density Measurement and examination of cores	BS EN 12390-3:2009 BS EN 12390-2:2009  BS EN 12504-1:2009  BS EN 12390-7:2009 BS EN 12504-1:2009
IN SITU FLOORINGS - polymer modified cementitious wearing surfaces	Physical Tests Slip resistance value (SRV)	BS 8204-3:2004+A2:2011

TYPES OF SITE LOCATION	MATERIALS/PRODUCTS TESTED TYPES OF TESTS / PROPERTIES MEASURED RANGE OF MEASUREMENT	STANDARD SPECIFICATION EQUIPMENT/TECHNIQUES USED
IN SITU FLOORINGS - terrazzo wearing surfaces	<b>Physical Tests</b> Slip resistance value (SRV)	BS 8204-3:2004+A2:2011
PAVED SURFACES	<b>Physical Tests</b> Measurement and examination of cores	BS EN 12504-1:2009
PRECAST CONCRETE FLAGS, KERBS, CHANNELS, EDGINGS and QUADRANTS	<b>Mechanical Tests</b> Transverse strength (loads from 5 to 100 kN)	BS EN 1339:2003
SOILS for civil engineering purposes	<p><b>Mechanical Tests</b></p> <p>California Bearing Ratio (CBR) (loads from 0.2 to 2.0 kN)</p> <p>Undrained shear strength – triaxial compression without measurement of pore pressure (loads from 0.2 to 20 kN)</p> <p><b>Physical Tests</b></p> <p>Moisture content - over drying method</p> <p>Liquid limit - cone penetrometer</p> <p>Physical Tests</p> <p>Plastic limit</p> <p>Plasticity index and liquidity index</p> <p>Linear shrinkage</p> <p>Particle density - gas jar</p> <p>Particle density - small pyknometer</p> <p>Particle size distribution - wet sieving</p> <p>Particle size distribution - dry sieving</p> <p>Particle size distribution - sedimentation - pipette method</p> <p>Dry density/moisture content relationship (2.5 kg rammer)</p> <p><i>Continued...</i></p>	<p>BS 1377-4 1990</p> <p>BS 1377-7 1990</p> <p>BS 1377-2 1990</p> <p>BS 1377-2 1990</p> <p>BS 1377-2 1990</p> <p>BS 1377-2 1990</p> <p>BS 1377-2 1990</p> <p>BS 1377-2 1990</p> <p>BS 1377-2 1990</p> <p>BS 1377-2 1990</p> <p>BS 1377-2 1990</p> <p>BS 1377-4 1990</p>

	Dry density/moisture content relationship (4.5 kg rammer)	BS 1377-4 1990
	MCV - nature moisture content	BS 1377-4 1990
	MCV/moisture content relation	BS 1377-4 1990
	One-dimensional consolidation properties	BS 1377-4 1990

# 12 List of Standards Used

The following is a list of current standards that are referenced in this specification at the time of publication. When referring to this specification, the latest version of the standards listed should be used

Standard Number	Year of Publication	Standard Title
BS 8500-1	2015+A1:2016	Concrete - Complementary British Standard to BS EN 206-1. Method of specifying and guidance for the specifier
BRE SD1	2005	BRE Special Digest 1 Concrete in Aggressive Ground 2005, 3rd edition
BRE Digest 363	1991	Sulphate and acid resistance of concrete in the ground
BS 5930	2015	Code of practice for ground investigations
BS 1377-2	1990	Methods of test for soils for civil engineering purposes. Classification tests
BS 1377-4	1990	Methods of test for soils for civil engineering purposes. Compaction-related tests
BS 1377-9	1990	Methods for test for soils for civil engineering purposes. In-situ tests
BS 5837	2012	Trees in relation to design, demolition and construction. Recommendations
BS EN 12620	2002+A1:2008	Aggregates for concrete
BS EN 1097-2	2010	Tests for mechanical and physical properties of aggregates. Part 2. Methods for the determination of resistance to fragmentation
BS 812-124	2009	Testing aggregates. Method for determination of frost heave
BS EN 933-1	2012	Tests for geometrical properties of aggregates. Determination of particle size distribution. Sieving method
BS EN 1744-1	2009+A1:2012	Tests for chemical properties of aggregates. Chemical analysis
BS EN 1340	2003	Concrete kerb units. Requirements and test methods
BS EN 1342	2012	Setts of natural stone for external paving. Requirements and test methods
BS EN 1343	2012	Kerbs of natural stone for external paving. Requirements and test methods
BS EN 206	2013+A1:2016	Concrete. Specification, performance, production and conformity
BS 8500-2	2015+A1:2016	Concrete. Complementary BS to BS EN 206. Part 2. Specification for constituent materials and concrete
BS EN 13055	2016	Lightweight aggregates
BS EN 480-1	2014	Admixtures for concrete, mortar and grout. Test methods. Reference concrete and reference mortar for testing
BS 1881		Testing concrete (Relevant Parts)
BS 4483	2005	Steel fabric for the reinforcement of concrete. Specification
BS EN 772-3	1998	Methods of test for masonry units. Determination of net volume and percentage of voids of clay masonry units by hydrostatic weighing
BS EN 771-1	2011+A1:2015	Specification for masonry units. Clay masonry units

BS 1722		Fences (Relevant Parts)
BS 4978	2007+A2:2017	Visual strength grading of softwood. Specification
BS 8417	2011+A1:2014	Preservation of wood. Code of practice
BS 771-5	2011+A1:2015	Specification for masonry units. Manufactured stone masonry units
BS EN 594987	2015+A1:2017	Asphalt for roads and other paved areas - Specification for transport, laying and compaction and type testing protocols
BS EN 13108	2016	Bituminous mixtures. Material specifications
PD6691	2015+A1:2016	Guidance on the use of BS EN 13108, Bituminous mixtures. Material specifications
BS 598-107	2004	Sampling and examination of bituminous mixtures for roads and other paved areas. Method of test for the determination of the composition of design surface course rolled asphalt
BS EN 13108-4	2016	Bituminous mixtures. Material specifications. Hot Rolled Asphalt
BS 812-121	1989	Testing aggregates. Method for determination of soundness
BS EN 1097-3	1998	Tests for mechanical and physical properties of aggregates. Determination of loose bulk density and voids
BS 7533		
BS EN 1338	2003	Concrete paving blocks. Requirements and test methods
BS EN 1344	2013	Clay pavers. Requirements and test methods
BS 7533-7	2010	Pavements constructed with clay, natural stone or concrete pavers. Code of practice for the construction of pavements of natural stone paving units and cobbles, and rigid construction with concrete block paving
BS 7533-3	2005+A1:2009	Pavements constructed with clay, natural stone or concrete pavers. Code of practice for laying precast concrete paving blocks and clay pavers for flexible pavements
BS 7533-4	2006	Pavements constructed with clay, natural stone or concrete pavers. Code of practice for the construction of pavements of precast concrete flags or natural stone slabs
MCHW Vol.1 Series 600	2016	Road Pavements - Earthworks
MCHW Vol.1 Series 700	2016	Road Pavements - General
MCHW Vol.1 Series 800	2016	Road Pavements - Unbound, Cement and Other Hydraulically Bound Mixtures
MCHW Vol.1 Series 900	2018	Road Pavements - Bituminous Bound Materials
MCHW Vol.1 Series 1000	2018	Road Pavements - Concrete Materials
MCHW Vol.1 Series 2400	2008	Brickwork, Blockwork and Stonework
MCHW Vol.3	2005	Highway Construction Details
BS EN 1339	2003	Concrete paving flags. Requirements and test methods.
DD CEN/TS 15209	2008	Tactile paving surface indicators produced from concrete, clay and stone

# 13 Glossary

Below is a list of abbreviations and acronyms used within this document.

Abbreviation/Acronym	Description
AAV	Aggregate Abrasion Value
ASR	Alkali - Silica Reaction
AWCCT	Asphalt Waste Containing Coal Tar
BS (or BS EN)	British Standard
CBR	California Bearing Ratio
cvd	Commercial Vehicles per Day
DMRB	Design Manual for Roads and Bridges
HDM	Heavy Duty Macadam
MCHW	Manual of Documents for Contract Highway Works
NJUG	National Joint Utilities Group
NRSWA	New Roads and Street Works Act (1990)
PCC	Precast Concrete Flags
PRD	Percentage Refusal Density
PSV	Polished Stone Value
SHW	Specification for Highway Works
SRV	Skidding Resistance Value
TFV	Ten percent Fines Value
TRL	Transport Research Laboratory
TSCS	Thin Surface Course System

# 14 Index

<b>1</b>	<b>Introduction .....</b>	<b>3</b>			
1.1	Foreword .....	4			
1.2	Safety .....	5			
1.2.1	Use of Explosives .....	5			
1.2.2	Children and Construction Sites .....	5			
1.3	Nuisance and Noise .....	6			
1.4	Notice for Inspection .....	6			
1.5	Standards of Materials and Samples .....	6			
1.6	Developer's Responsibilities .....	7			
1.6.1	Damage to Highways .....	7			
1.6.2	Mud, Materials or Equipment on Highway .....	7			
1.6.3	Clear up on Completion .....	7			
1.6.4	Maintenance Period .....	7			
1.6.5	Hazardous Waste .....	7			
1.6.6	Works near Structures .....	7			
<b>2</b>	<b>General .....</b>	<b>8</b>			
2.1	Terms and Definitions .....	9			
2.2	Ground Site Investigation Report .....	9			
2.2.1	Ground Investigation - General .....	9			
2.2.2	Contaminated Land .....	9			
2.2.3	Sulphates .....	9			
2.2.4	Embankments/Cuttings .....	9			
2.2.5	Carriageway Construction .....	10			
2.2.6	Soil Classification .....	11			
2.2.7	Laboratory testing of soil samples .....	11			
2.3	Construction Thickness .....	12			
2.4	Quality of Materials and Workmanship .....	12			
2.5	Testing of Materials .....	12			
2.6	Acceptable Materials .....	12			
2.7	Notification of Start of Works .....	13			
2.8	Quality of Work .....	13			
2.9	Statutory Undertakers Apparatus .....	13			
2.10	Temporary Signs/Signals .....	13			
2.11	Protection of Carriageways .....	13			
2.12	Work on Public Highways .....	14			
2.13	Order of Work .....	14			
2.14	Traffic Calming Features .....	14			
<b>3</b>	<b>Earthworks .....</b>	<b>15</b>			
			3.1	Site Clearance .....	16
			3.1.1	Trees .....	16
			3.1.2	Obstructions .....	16
			3.1.3	Topsoil .....	16
			3.2	Excavation .....	16
			3.3	Unsound Ground and Fill Materials Below Formation .....	16
			3.4	General Fill Material .....	17
			3.4.1	Classification and Use of Earthwork Materials .....	17
			3.4.2	Embankments .....	17
			3.4.3	Contaminated Land .....	17
			3.4.4	Fill to Structures .....	19
			3.5	Compaction of Embankments and Fill .....	19
			3.6	Standing Water .....	22
			3.7	Road and Footpath Formation .....	22
			3.8	Groundwater Levels .....	22
<b>4</b>	<b>Carriageway Capping and Sub-Base Layers .....</b>	<b>23</b>			
			4.1	Capping Layers .....	24
			4.2	Sub-Base Material and Grading (Type 1) .....	24
			4.3	Compaction .....	27
			4.4	Frozen Materials .....	27
			4.5	Frost Susceptible Material .....	27
			4.6	Use of Surfaces by Traffic and Construction Plant 27	
			4.7	Use of Geogrids and Geotextiles .....	28
<b>5</b>	<b>Kerbs, Channels and Edgings .....</b>	<b>29</b>			
			5.1	Pre-Cast Concrete Products .....	30
			5.2	Natural Stone Kerbs .....	30
			5.3	Edgings .....	30
			5.4	Foundations .....	30
			5.5	Installation .....	30
			5.6	Mortar Bedding .....	31
<b>6</b>	<b>Concrete, Reinforcement, Brickwork, Stone and Timber .....</b>	<b>32</b>			
			6.1	Mixes and Quality .....	33
			6.2	Structural Concrete .....	33
			6.3	Concrete Grades .....	33
			6.4	Constituent Materials of Concrete .....	35

6.4.1	Cement.....	35	7.7	Shared Surfaces and Cycleways.....	43
6.4.2	Aggregates.....	35	7.8	Adjustment of Manhole Covers.....	44
6.4.3	Water.....	35	7.9	Tying into Existing Work.....	44
6.4.4	Admixtures.....	35	7.10	Surface Level Tolerances.....	44
6.4.5	Chloride Content.....	35	7.11	Transporting.....	44
6.4.6	Alkali - Silica Reaction (ASR).....	35	7.12	Laying.....	45
6.5	Properties of Fresh Concrete.....	35	7.12.1	Adverse Weather.....	45
6.5.1	Workability.....	35	7.13	Compaction Requirements.....	45
6.5.2	Additional Water.....	35	7.14	Surface Regularity.....	46
6.5.3	Air Content.....	35	7.15	Rectification Due to Non-Compliance.....	46
6.6	Ready Mixed Concrete.....	36	7.15.1	Binder Course and Base Materials.....	46
6.6.1	Manufacture.....	36	7.15.2	Surface Course Materials.....	47
6.6.2	Changes in Materials and/or mix composition.....	36	7.16	Surface Dressing (Sealing Grit).....	47
6.6.3	Transport Delivery.....	36	7.17	Construction Traffic.....	47
6.7	Formwork.....	36	<b>8</b>	<b>Block Paving.....</b>	<b>48</b>
6.8	Placement.....	36	8.1	General.....	49
6.9	Cold Weather Working.....	36	8.1.1	Block Paving Units.....	49
6.10	Compaction.....	37	8.1.2	Block Thickness.....	49
6.11	Sampling and Testing.....	37	8.2	Laying Requirements.....	49
6.12	Defects in Concrete.....	37	8.2.1	Bedding Course Sand.....	49
6.13	Reinforcement.....	37	8.2.2	Moisture Content.....	49
6.14	Cover Blocks.....	37	8.2.3	Preparation of Laying Course.....	50
6.15	Reinforcement for Lay-bys.....	37	8.3	Edge Restraints.....	50
6.16	Air-Entrained Concrete.....	38	8.4	Laying Block Paving.....	50
6.17	Rigid Pavement Construction.....	38	8.5	Compaction of Block Paving.....	51
6.18	Curing of Concrete.....	38	8.6	Surface Regularity.....	51
6.19	Thermal Gradients.....	39	8.7	Sealing.....	51
6.20	Joint Filler and Sealant.....	39	8.8	Adverse Weather Conditions.....	52
6.21	Brickwork.....	39	8.9	Recessed Covers.....	52
6.22	Timber.....	39	8.10	Colour of Blocks.....	52
6.23	Reconstituted Stone.....	39	8.11	Drainage of Bedding Sand.....	52
<b>7</b>	<b>Bituminous Materials.....</b>	<b>40</b>	8.12	Stone Setts.....	52
7.1	Preferred Materials.....	41	<b>9</b>	<b>Footpaths, Footways and Cycleways.....</b>	<b>53</b>
7.2	Alternative Materials.....	42	9.1	General.....	54
7.3	Aggregates.....	42	9.2	Formation - Inspection and Approval.....	54
7.3.1	Hardness.....	42	9.3	Typical Flexible Construction.....	54
7.3.2	Durability.....	42	9.4	Typical Modular Paving Construction.....	54
7.3.3	Cleanliness.....	42	9.5	Edge Restraint.....	55
7.4	Bituminous Binders.....	42	9.6	Drainage.....	55
7.4.1	Hot Rolled Asphalt Mixtures.....	42	9.7	Sub-Base Materials.....	55
7.4.2	Dense and Heavy Duty Asphalt Concrete (Macadam) Mixtures.....	42	9.8	Flexible (Bituminous) Construction.....	55
7.5	Bituminous Sprays.....	43	9.8.1	Binder Course.....	55
7.6	Coated Chippings.....	43	9.8.2	Surface Course.....	55



9.8.3	<i>Alternative Surface Course for Cycleway</i> .....	56
9.9	Adhesion Between Layers .....	56
9.10	Footpath Vehicular Crossing .....	56
9.11	Surface Level Tolerances .....	56
9.12	Storage of Bituminous Materials.....	56
9.13	Laying of Bituminous Materials.....	56
9.14	Surface Regularity .....	57
9.15	Modular Construction .....	57
9.15.1	<i>Precast Concrete Flags (PCC) Including Tactile Crossing Flags</i> .....	57
9.15.2	<i>Laying of Precast Concrete Slabs</i> .....	57
9.15.3	<i>Concrete or Clay Paving Blocks</i> .....	57
9.15.4	<i>Laying of Blocks</i> .....	57
9.15.5	<i>Sealing</i> .....	57
9.16	Drainage and Services .....	57
9.17	Tying into Existing Work.....	57
9.17.1	<i>Bituminous</i> .....	57
9.17.2	<i>Modular</i> .....	58
9.17.3	<i>Concrete</i> .....	58
9.18	Steps and Ramps .....	58
9.18.1	<i>Access Ramps</i> .....	58
9.18.2	<i>Steps</i> .....	58
9.19	Deterrent Tactile Paving.....	58
9.20	Barriers .....	58
9.21	Bollards.....	59
9.22	Signs and Markings - Cycleway.....	59
<b>10</b>	<b>Reinstatement</b> .....	<b>60</b>
10.1	General .....	60
<b>11</b>	<b>Appendices</b> .....	<b>61</b>
<b>12</b>	<b>List of Standards Used</b> .....	<b>67</b>
<b>13</b>	<b>Glossary</b> .....	<b>69</b>
<b>14</b>	<b>Index</b> .....	<b>70</b>