WREXHAM COUNTY BOROUGH COUNCIL

RESIDENTIAL ROADS AND FOOTPATHS

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Appendix D
Minimum Construction Specification

Version 2 – September 2009

wrexham
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Introduction

This Appendix set's out the Council's specification for construction of carriageways and footways in residential areas.

The scope of the standard designs set out in the Appendix covers new roads in residential areas. For roads serving other than residential traffic, a detailed pavement design shall be prepared in accordance with the Design Manual for Roads and Bridges.

The Appendix only covers asphalt materials. Developers are free to select other pavement construction materials. However, detailed design calculations will be required for approval by the Council in accordance with the standards pertaining at the time. Furthermore, the Council reserves the right to seek payment of a commuted sum to cover the long-term maintenance of the pavement where non-standard materials are used.

Developers are encouraged to discuss the design of carriageway and pavements with the Council at an early stage if non-asphaltic pavements are to be incorporated into the development.

Reference in this Appendix to the **Specification** shall mean the Specification for Highway Works[1].

Pavement materials and construction shall be in accordance with the **Specification**.

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[1] Manual of Contract Documents for Highway Works: Volume 1: Specification for Highway Works: Highways Agency: March 1998 as amended.

CARRIAGEWAYS

Foundation Design

When preparing designs for road pavement foundations, the California Bearing Ratio (CBR) of the road formation must be established through testing.

Full access to the construction site is not always possible during the design phase so it can be difficult to carry out in-situ testing. Where a Geotechnical Investigation is carried out, representative samples should be taken of the subgrade materials likely to be encountered on site.

Estimation of the likely long-term, short-term and hence Design CBR should be derived using laboratory CBR tests in accordance with BS 1377 Pt 4[2]. The Design CBR is the lower of the long-term and short-term CBR.

Where it is not possible to collect material samples for assessment using the laboratory CBR tests, the Suction Index Method should be used, as described in Appendix C of LR1132[3]. Table A gives an extract from LR 1132 with estimated values for long-term CBR depending on soil type particularly for clay subgrades where moisture and plasticity index are significant issues. These CBR values assume a high water table and that the foundations may be wetted by ground water during their life.

SOIL	PLASTICITY INDEX (%)	ESTIMATED CBR (%)
Heavy Clay	70	2
	60	2
	50	2
	40	2.5
Silty Clay	30	3
Sandy Clay	20	4
	10	3
Silt	-	1
Sand (poorly graded)	-	20
Sand (well graded)	-	40
Sandy Gravel (well graded)	-	60

Table 1: Equilibrium Subgrade CBR Estimation

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[2] BS 1377-4: 1990: Methods of test for Soils for civil engineering purposes - Part 4: Compaction-related tests

[3] TRRL Laboratory Report LL1132: The structural design of bituminous roads: Powell, Potter, Mayhew and Nunn

Table 2 provides a very rough guide to CBR values for cohesive soils.

Soil Condition	CBR
Very soft, exudes between fingers when squeezed	Less than 1%
Can be moulded by light finger pressure	Between 1 and 2%
Can be moulded by strong finger pressure	Between 2 and 3%
Can be indented by a thumbnail but not by a thumb	More than 6%

Table 2: Rough Guide to CBR Estimation

Where a development is large enough that it may include several different soil types or moisture conditions, a more extensive survey will be necessary. The survey will consider the availability of materials and will ensure that all variations in subgrade are recorded and special emphasis can be made at transition zones and cut/fill interfaces.

In selecting the Design CBR value for the subgrade, consideration must be given to the likely moisture conditions applying during construction, assuming that appropriate precautions are taken against excessive disturbance, as demanded by the Specification.

For imported fill soils, the stiffness of the subgrade must be assured in the long term, which requires adequate compaction to ensure that it has a high density and low air voids content. The Moisture Condition Value is normally used to help ensure acceptable compaction and MCV testing is usually carried out at both the design stage, to evaluate the materials available, and at the construction stage, to ensure that soils are placed in an acceptable moisture condition. This process should ensure the long-term moisture equilibrium of the subgrade by minimising moisture ingress. In this manner, the subgrade should provide a stable platform for the pavement throughout its design life. The MCV can also be related to the ability of a subgrade to withstand construction traffic.

The minimum permitted design CBR is 2.5% CBR. Where a subgrade has a lower CBR it is considered unsuitable support for a pavement foundation. It must therefore be permanently improved.

The material at the surface can be removed and replaced by a more suitable material. If the depth of relatively soft material is small, it can be replaced in its entirety, although it may only be necessary to replace the top layer. The thickness removed will typically be between 0.5 and 1.0m.

Although the new material may be of better quality, the new Design CBR should be assumed to be equivalent to 2.5%, in order to allow for effects of any softer underlying material and the potential reduction in the strength of the replacement material to its long-term CBR value.

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If the soil is cohesive, a lime (or similar) treatment may be appropriate, subject to soil suitability being demonstrated. Details of various soil treatments are given in HA 44[4]. The new Design CBR should again be assumed to be equivalent to 2.5%. HA 74[5] contains further advice on stabilisation.

The pavement foundation design shall be based upon Interim Advice Note 73/06[6]. Only Foundation Class 2 Designs will be permitted. The designs may be capping and sub base or sub base only designs. Table 3 gives material thickness for the two options.

ESTIMATED CBR (%)	Foundation Option 1 Sub base only	Foundation Option 2 Sub base and capping	
	Sub Base Depth (mm)	Capping Depth (mm)	Sub Base Depth (mm)
2.5	450	250	350
3	410	240	320
4	360	230	270
5	320	210	240
6	300	200	220
7	280	200	210
8	260	190	200
9	250	180	190
10	240	170	180
11	230	170	170
12	220	160	160
13	210	160	160
14	210	150	150
>15	200	150	150

Table 3: Road Foundation Design Thicknesses

[4] Design Manual For Roads And Bridges: Volume 4 Geotechnics and Drainage: Section 1 Earthworks: Part 1 HA 44/91 Design and Preparation of Contract Documents: Highways Agency April 1995

[5] Design Manual For Roads And Bridges: Volume 4 Geotechnics and Drainage: Section 1 Earthworks: Part 6 HA 74/07 Treatment of Fill and Capping materials Using Either Lime Or Cement Or Both: Highways Agency May 2007

[6] Interim Advice Note 73/06 Revision 1 (2009) Design Guidance For Road Pavement Foundations (Draft HD25): Highways Agency: February 2009

Permitted Foundation Materials

Capping

Capping materials shall comply with Series 600 of the **Specification**. Capping material complying of the following types will be permitted.

- Class 6F1 Selected granular material (fine grading)
- Class 6F2 Selected granular material (coarse grading)
- Class 6F3 Selected granular material (Recycled bituminous planings and granulated asphalt, but excluding materials containing tar or tarbitumen
- binders. Recycled aggregate)
- Class 6F4 Selected granular material (fine grading) - imported on to the Site
- Class 6F5 Selected granular material (coarse grading) - imported on to the Site

Where the developer is proposing the use of stabilised materials for capping, full details shall be submitted for the Council's approval.

Sub base

Sub base materials shall comply with Series 800 of the **Specification**. Material complying with the following clauses will be permitted.

- Clause 803 Type 1 Unbound Mixtures
- Clause 804 Type 2 Unbound Mixtures
- Clause 805 Type 3 (open graded) Unbound Mixtures
- Clause 806 Category B (close graded) Unbound Mixtures

Asphaltic Material Thickness

The following pavement design will be required for roads in residential areas.

Surface Course	40mm Thin Surface Course System
Binder Course	60mm DBM50 Binder
Base	100mm DBM50
Total Thickness	200mm

Table 4: Asphaltic Material Thicknesses

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Permitted Asphaltic Materials

Asphaltic materials shall comply with the 700 and 900 Series of the **Specification**.

Surface Course

Thin Surface Course Systems shall comply with Clause 942 of the **Specification**.

Proprietary thin wearing course systems shall have a British Board of Agrément HAPAS Roads and Bridges Certificate appropriate for the site classification and the level of traffic in commercial vehicles/lane/day to be carried.

Details of BBA HAPAS Certification can be obtained from the British Board of Agrément web site.

A Thin Wearing Course system with a current BBA HAPAS Roads and Bridges Certificate shall only be laid by a Contractor approved by the System Proprietor. Installation and quality control procedures shall comply with the requirements of Clause 942 of the **Specification** and when issued, with the requirements of the BBA HAPAS Certificate.

Thin wearing course systems are proprietary products and as such their design, manufacture, transportation, laying and compaction are the responsibility of the Contractor.

The thinner the surfacing, the more important the role of the bond or tack coat in the performance of the system. The type and rate of spread of the bond or tack coat for each type of substrate on which each system can be laid should be specified in the BBA HAPAS Certificate or method statement for the system. Emulsion bond or tack coats sprayed as a separate operation ahead of the paver should be fully broken prior to surfacing.

Binder Course

Binder materials as set out in Table 4 shall be as follows:

DBM50 - Dense Binder Asphalt Concrete (Recipe Mixture) shall comply with Clause 906 of the **Specification**. The mixture designation shall be AC 20 dense bin 40/60 rec in accordance with BS EN 13108-1[7].

Base Course

Base materials as set out in Table 4 shall be as follows:

DBM50 - Dense Base Asphalt Concrete (Recipe Mixture) shall comply with Clause 906 of the **Specification**. The mixture designation shall be AC 32 dense base 40/60 rec in accordance with BS EN 13108-1.

[7] BS EN 13108-1 – Bituminous Mixtures – Material Specifications – Part 1: Asphalt Concrete: BSi 2006

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Skidding and Abrasion Resistance

The minimum Polished Stone Value (PSV) for aggregate in thin surface course systems shall be 50.

The maximum Aggregate Abrasion Value (AAV) for aggregate in thin surface course systems shall be 16.

Frost

All material within 450mm of the road surface, where the mean annual frost index (MAFI) of the site is ≥50 must be non frost susceptible in the long-term. Where the MAFI is < 50 the thickness of non-frost susceptible material may be 350 mm.

Advice on the frost index for any particular area may be obtained from the Met Office and further information from TRL Report RR45[8].

Testing

The supply of paving bitumen and the quality management of the production of asphalt mixes are the subject of National Highways Sector Schemes for Quality Management in Highway Works[9] [10].

Only materials conforming with such schemes shall be supplied. The Developer shall submit to the Council a copy of the certificate of conformity affirming compliance with the scheme.

The Developer shall provide the Council with a copy of the BBA HAPAS Certificate for the thin surface course system used.

All materials shall be sampled and tested by a UKAS accredited laboratory which holds accreditation for all relevant sampling and testing procedures. All sampling and testing shall be carried out to the appropriate British / European Standard or other relevant procedure. A copy of the laboratory's current UKAS sampling & testing schedule shall be supplied to the Highway Authority by the developer prior to the commencement of any works.

All costs for sampling & testing of construction materials shall be borne by the Developer. Any additional sampling & testing required by the Council shall be ordered by the developer who shall be responsible for the costs of any non-compliant tests.

All testing results including certificates of sampling shall be supplied to the Council.

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[8] TRRL research Report 45: Winter Air Temperatures in relation to Frost Damage in Roads: Sherwood and Roe: 1986

[9] National Highways Sector Schemes for Quality Management in Highway Works Scheme 14: For the quality management of the production of asphalt mixes. United Kingdom Accreditation Services January 2008

[10] National Highways Sector Schemes for Quality Management in Highway Works Scheme 15: For the supply of paving bitumens. United Kingdom Accreditation Services April 2009

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Subgrade

In situ CBR Testing / Plate Bearing Testing (equivalent CBR) shall be carried out on the subgrade in order to determine construction thicknesses.

The subgrade shall be tested at intervals of 50m (minimum) or where a change in soil type occurs.

Capping Layer

Plate Bearing Testing (equivalent CBR) shall be carried out on any proposed capping layer material and shall comply with the requirements of DMRB Volume 7 Section 2 Part 2 providing a minimum CBR value of 15%.

Capping Layer shall be tested at intervals of 50m (minimum).

Particle Size Distribution tests shall be carried out on capping layer material at a sampling rate of 1 per 500T or where there is a change in material supplier.

Sub base

Plate Bearing Testing (equivalent CBR) shall be carried out on granular sub-base material and shall comply with the requirements of DMRB Volume 7 Section 2 Part 2 providing a minimum CBR value of 30%.

The sub-base shall be tested at intervals of 50m (minimum).

Particle Size Distribution tests shall be carried out on sub-base material at a sampling rate of 1 per 500T or where there is a change in material supplier.

A plastic limit determination shall be carried out on each of the above samples. All sub-base material shall be non-plastic.

No bituminous surfacing shall commence until testing on the subgrade/ capping layer / sub-base has been carried out with test results submitted to and approved by the Highway Authority.

Bituminous Surfacing (including carriageway & footways)

Base

All materials shall be sampled at a rate of 1 sample per 100T.

A binder content & grading analysis shall be carried out on each test sample in accordance with the relevant standards and must comply with the relevant specification.

All areas of base shall have compaction determined by Percentage Refusal Density Testing in accordance with the relevant standards.

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A set of 6 no. cores shall be taken per 1000m^2 of surfacing.

Each set shall achieve a minimum PRD of 93%.

Binder course

All materials shall be sampled at a rate of 1 sample per 100T.

A binder content & grading analysis shall be carried out on each test sample in accordance with the relevant standards and must comply with the relevant specification.

Surface course

All materials shall be sampled at a rate of 1 sample per 100T.

A binder content & grading analysis shall be carried out on each test sample in accordance with the relevant standards and must comply with the relevant specification.

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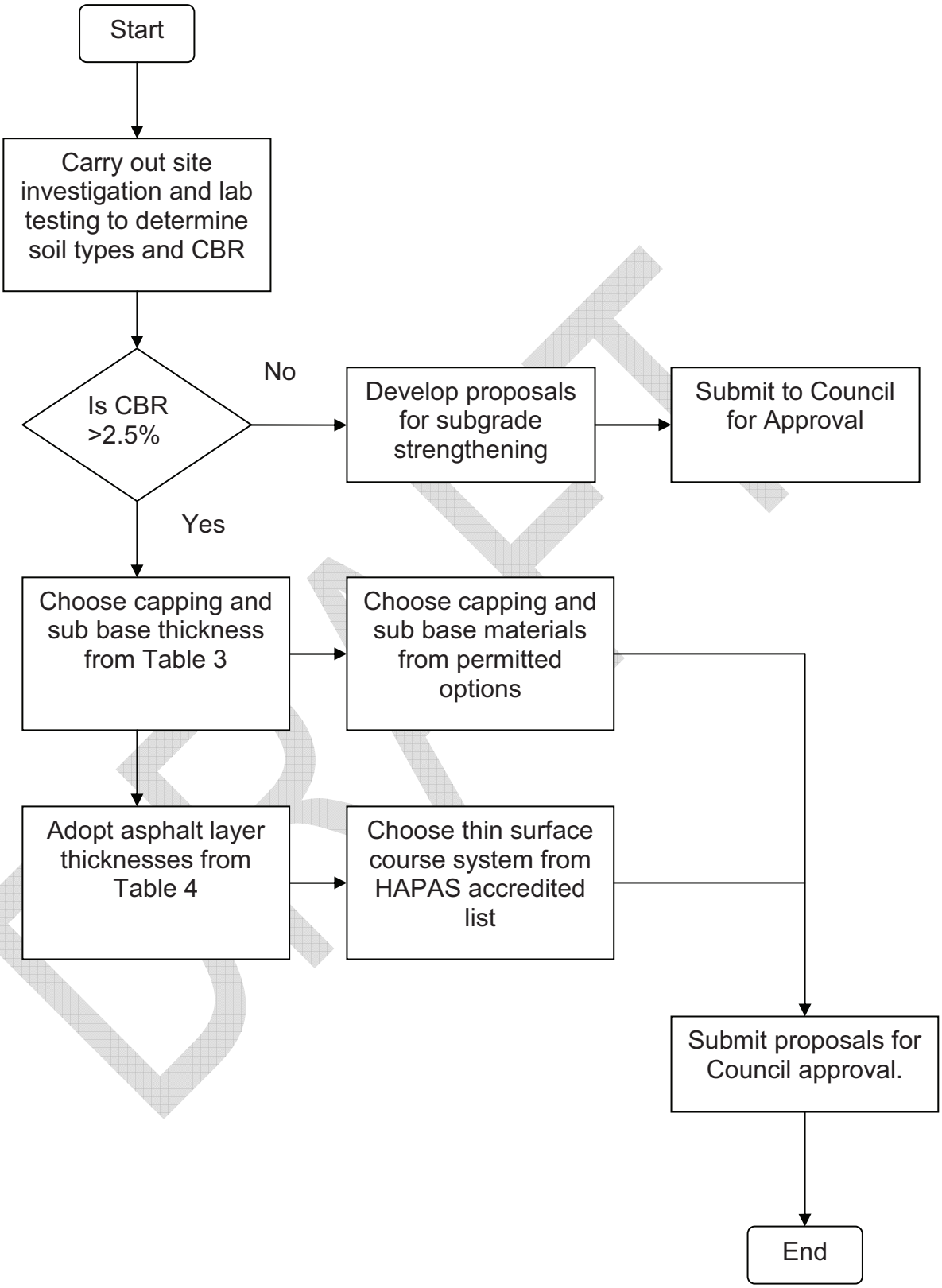
Pavement Design Flow Chart



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FOOTWAYS

Footway construction shall be as shown in Table 5:

Layer	Pedestrian only footways	Light vehicle footways
Surfacing	20mm dense graded surface course 40mm dense binder course	20mm dense graded surface course 40mm dense binder course
Sub base	100mm sub base	150mm sub base

Table 5: Footway Construction

The light vehicle footway design is used for cross-overs to private drives and wherever light vehicle overrun is likely.

Sub base materials shall comply with Series 800 of the **Specification**. Material shall comply with Clause 803 Type 1 Unbound Mixtures.

Dense Binder Asphalt Concrete (Recipe Mixture) shall be AC 20 dense bin 160/220 rec in accordance with BS EN 13108-1.

Dense graded surface course shall be AC 6 dense surf 160/220 rec in accordance with BS EN 13108-1.

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