

Appendix A2 – Key to materials



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and



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Introduction- SROH Appendix 2

This advisory document is designed to assist incoming and existing Inspectors as support and refresher material. It will be provided in simple language to aid in understanding and avoiding technical or descriptive explanation.

The current edition (Ed 4) of the Specification for Reinstatement of Openings in the Highway (SROH) has been updated to assist readers in understanding, and introduce new methods and developments within street-works.

Remember, the SROH applies to works undertaken on carriageway's, footway's and verge's maintained at public expense (not private roads or land).

You will now be taken through the key items within Appendix A2 which will enable you to have a better understanding of what to look for when monitoring the various types of materials applied in terms of reinstatement.



Please note:

This document is simply to aid in understanding of the Specification for the Reinstatement of Openings in the Highway (SROH) and should not be used for any other purpose. The simplicity of language is to assist in explanation, but may detract from certain technical or descriptive specification requirements and, therefore, the SROH should be consulted for clarity.

Appendix A2 – Key to materials

SROH what it says – A2 Introduction

A2.0.3 Materials in this appendix are predominantly for hand laying operations. Some asphalts incorporating highly modified polymer modified binders (PMBs) may not be suitable for hand-laying and should only be used by agreement. Clause 943 HRA incorporating PMB must not be hand-laid.

What it means



Street works usually involve smaller excavations that require reinstatements using hand lay methods for materials. However, where materials contain binders that have been polymer modified, it is not usual for them to be hand laid and they can only be used under agreement with the authority.



Hand laying 10mm ACSC

Roads – General

In small openings and narrow trenches, the preferred binder course mixture may be replaced by any surface course mixture that complies with this Code for the respective road type provided that the same mixture is used in the surface course, see S6.5.

In roads reinstatement, be aware that you can only apply full depth surface course in small openings and narrow trenches.

A small opening is an excavation with a reinstatement surface area, excluding the apparatus surface area, up to 2m² in road types 0, 1 and 2 and up to 4m² in road types 3 and 4. A narrow trench is an opening over 60 mm* up to 300 mm wide and over 1 m long.

**Below 60 mm wide is deemed as micro-trenching*

Footways, footpaths and cycle tracks – General

In all excavations, the preferred binder course mixture may be replaced by any surface course mixture that complies with this appendix and S8. This substitution is limited solely to the binder course layer. Void contents must meet the requirements of Table S10.1 for footpaths.

However, you can use full depth surface course in any footway, footpath and cycle track reinstatement.



Appendix A2 – Key to materials

SROH what it says – A2.1 Hot Rolled Asphalt Mixtures

A2.1.1 All HRA must conform to BS EN 13108-4. Conformity must be established in accordance with BS EN 13108-20 and BS EN 13108-21. Natural gravels are not permitted as coarse aggregate for use in Types 0, 1 and 2 roads.

For Types 0 and 1 roads the preferred surface course mixture is HRA 35/14 F surf PMB with the wheel tracking requirements meeting classification 2 for road Type 0 and classification 1 or 2 for road Type 1.

What do all the numbers and letters mean in a HRA material?

Well, in the one mentioned above it is 35% coarse aggregate of 14mm nominal size in the mixture, “F” means fine grading, “surf” means surface material and “PMB” is polymer modified binder. This is a strong and robust material for use in Type 0 and 1 roads

There are alternatives, such as HRA 35/14 F surf 40/60 des.

Yes, this is a similar mix. Again, it is 35% coarse aggregate of 14mm nominal size (35/14), with fine grading (F), surface material (surf), the penetration grade of the binder material (40/60), and it is a design mix (des).

Thanks, if I see “rec” at the end, what does it mean?

Simply, it's a recipe (rec) mix rather than a design mix (des).

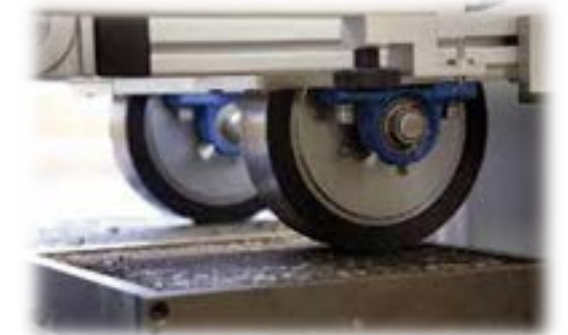
What it means

HRA materials have to be manufactured to exacting standards as shown on the left. All materials manufacturers and suppliers must abide by these standards and specifications in terms of street works reinstatements, as otherwise, they will not be suitable for use. We will outline what HRA terminology means when looking at specific products below.



The preferred surface course for road types 2, 3 and 4 is HRA 35/14 F surf 40/60 des. However, there are several permitted HRA alternatives as can be seen in the SROH.

Wheel tracking classification is simply based on the resistance of the material to deforming under traffic loading. It is based on a laboratory test carried out on a sample of the material mix.



Appendix A2 – Key to materials

HRA surface materials – a basic description

HRA 35/14 F surf PMB

35% = amount of coarse aggregate
14mm = nominal size of coarse aggregate
F = fine grading.
surf = surface course material
PMB = polymer modified binder
this is also known as a performance mix

The above material is the preferred HRA option for **Type 0 and 1 roads**. The polymer modified binder is usually applied where high durability and strength is required in high usage roads under significant loading.

Other permitted options are:

- a) HRA 30/14 F surf PMB des.
- b) HRA 35/14 F surf 40/60 des.
- c) HRA 30/14 C surf 40/60 des (*before use refer to SROH - A2.1.3*).



HRA 35/14 F surf 40/60 des.

35% = amount of coarse aggregate
14mm = nominal size of coarse aggregate
F = fine grading.
surf = surface course material
40/60 = penetration grade of binder material
des = design mix

The above material is the preferred HRA option for **Type 2, 3 and 4 roads**. The 60/40 is a Paving Grade Bitumen suitable for road construction and for the production of asphalt surfaces with superior properties.

Permitted options for Type 2 roads are:

- a) HRA 30/14 F surf 40/60 rec
- b) HRA 30/14 F surf 40/60 des
- c) HRA 30/14 C surf 40/60 des (*before use refer to A2.1.3*)
- d) HRA 35/14 surf 40/60 rec

Permitted options for Type 3 & 4 roads are:

- a) HRA 30/14 F surf 40/60 des
- b) HRA 30/14 C surf 40/60 des (*before use refer to A2.1.3*)
- c) HRA 30/10 or 30/14 F surf 40/60 rec
- d) HRA 55/14 F surf 40/60 or 100/150 des
- e) HRA 55/10 F surf 40/60 or 100/150 des

HRA 15/10F surf 100/150 rec.

15% = amount of coarse aggregate
10mm = nominal size of coarse aggregate
F = fine grading.
surf = surface course material
100/150 = penetration grade of binder
rec = recipe mix

The above material is the preferred HRA option for **footways, footpaths and cycle tracks**. The 100/150 is a Paving Grade Bitumen suitable for most applications other than heavily trafficked roads.

HRA 30/10F surf 70/100 or 100/150 or 40/60 rec is an alternative permitted mixture



Appendix A2 – Key to materials

HRA binder materials – a basic description

HRA 60/20 F bin 40/60 des

60% = amount of coarse aggregate
20mm = nominal size of coarse aggregate
F = fine grading.
bin = binder course material
40/60 = penetration grade of binder material
des = design mix

The above material is the preferred HRA binder course option for **Type 0 and 1 roads**. The 60/40 is a Paving Grade Bitumen suitable for road construction and for the production of asphalt binder layers with superior properties.

There are no permitted alternative options provided for in the SROH for HRA binder material.



HRA 50/20 F bin 40/60

50% = amount of coarse aggregate
20mm = nominal size of coarse aggregate
F = fine grading.
bin = binder course material
40/60 = penetration grade of binder material

The above material is the preferred HRA option for **Type 2, 3 and 4 roads**. The 60/40 is a Paving Grade Bitumen suitable for road construction and for the production of asphalt binder layers with superior properties.

Alternative HRA binder material options may only be used by agreement in circumstances as shown below:

- a) Openings up to 500 mm width – HRA 50/14 F bin 40/60
- b) Openings over 500 mm width – HRA 60/20 F bin 40/60.

In footways, footpaths and cycle tracks, areas not subject to vehicular trafficking, the preferred binder course mixture may also be replaced by any permitted carriageway surface course mixture.

HRA 50/20 F bin 100/150

HRA 50/20 F bin 70/100

HRA 50/20 F bin 40/60

50% = amount of coarse aggregate
20mm = nominal size of coarse aggregate
F = fine grading.
Bin = binder course material
100/150 = penetration grade of binder, or
70/100 = penetration grade of binder, or
40/60 = penetration grade of binder

You can see that you can use HRA binder materials with differing bitumen strengths.

The above materials are the preferred HRA binder option for **footways, footpaths and cycle tracks**. The figures at the end of each material above is describing Paving Grade Bitumen of differing penetration or strength values.

Alternative permitted mixtures (a) and (b) below may be used by agreement where satisfactory local experience has been gained in their use.

- a) Openings up to 500 mm width – HRA 50/14 F bin 100/150 or, HRA 50/14 F bin 70/100 or HRA 50/14 F bin 40/60.
- b) Openings over 500 mm width – HRA 60/20 F bin 100/150 or, HRA 60/20 F bin 70/100 or HRA 60/20 F bin 40/60.

Appendix A2 – Key to materials

SROH what it says

A2.2.1 SMA must conform to BS EN 13108-5 and PD 6691. Conformity must be established in accordance with BS EN 13108-20 and BS EN 13108-21. The following SMA mixtures are permitted by this Code, depending upon the detail requirements of the relevant section.

A2.2.2 Requirements for deformation resistance as assessed by wheel tracking performance (WTR) are in accordance with PD6691 appendix D, Table D.2 and the note to that table.

What it means

As with the HRA surfacing materials, conformity of SMA materials must be subject to a recognised industry standard in terms of aggregate size, grading and binder makeup and content. For these materials, the standards of conformity are named on the left. You may recall the wheel tracking test as mentioned when discussing HRA materials on previous pages, which is simply related to the materials resistance to deformation when subjected to laboratory testing. This is done by continuously running a weighted wheel over the surface of a sample for a set period, and measuring if any deformation occurs.



SMA mixtures must match the existing nominal size aggregates except for when hand-laying, where mixtures with 10 mm nominal aggregate size must be used to reinstate the existing SMA materials with 20 mm and 14 mm nominal aggregate size. SMA incorporating PMB may only be hand-laid by agreement.

In other words, you should only use SMA with a 10 mm nominal aggregate size for hand lay methods. This is even if the existing SMA is 14 mm or 20 mm aggregate size. If you are using machine lay methods, you must match the existing aggregate size. Do not hand lay SMA with polymer modified binder unless agreed with authority.



Appendix A2 – Key to materials

SMA surface materials – a basic description

Type 0 and 1 roads

Permitted SMA surface course options

- a) SMA 14 surf PMB
- b) SMA 14 surf 40/60
- c) SMA 10 surf PMB
- d) SMA 10 surf 40/60

The above SC materials are the preferred SMA options for **Type 0 and 1 roads**. They are all required to meet wheel tracking classification 2 when subjected to the laboratory test.

Options are allowed, but only under agreement :

- e) SMA 6 surf PMB
- f) SMA 6 surf 40/60

(must also achieve classification 2 for wheel tracking).



Types 2, 3 and 4 roads

Permitted SMA surface course options

- a) SMA 14 surf PMB or 40/60 or 100/150
- b) SMA 10 surf PMB or 40/60 or 100/150

The above SC materials are the preferred SMA options for **Type 2, 3 and 4 roads**. The 60/40 and the 100/150 are the Paving Grade Bitumens suitable for these types of road construction, along with polymer modified binders.

Options are allowed in types 2, 3 and for roads, but only under agreement :

- c) SMA 6 surf PMB or 40/60 or 100/150

(see S6.4.3 to S6.4.6)
(Remember, the general rule is 6 mm materials are not permitted in carriageways)

Footways, footpaths and cycle tracks

Permitted SMA surface course options

(unless advised otherwise by authority)

- a) SMA 6 surf 40/60
- b) SMA 6 surf 70/100
- c) SMA 6 surf 100/150

The above SC materials are the preferred SMA options for **footways, footpaths and cycle tracks**. The 40/60, 70/100 and 100/150 are the Paving Grade Bitumen's suitable for most applications.

There are no relevant alternative options within the SMA range of SC materials.



Appendix A2 – Key to materials

SMA binder materials – a basic description

Type 0 and 1 roads

Permitted SMA binder course options

The preferred binder course mixture is SMA 20 bin 40/60

The above material is the preferred SMA binder course option for **Type 0 and 1 roads**. The 60/40 is a Paving Grade Bitumen suitable for road construction and for the production of asphalt binder layers with superior properties.

There are no permitted alternative options provided for in the SROH for SMA binder material.

Type 2, 3 and 4 roads

Permitted SMA binder course options

a) SMA 20 bin 40/60 or SMA 20 bin 100/150.

The above materials are the preferred SMA binder option for **Type 2, 3 and 4 roads**. The 60/40 and 100/150 is the Paving Grade Bitumen suitable for road construction within the binder material, which is a superior grade for such purposes.

For small openings and narrow trenches, you can use the above material or, SMA 14 bin 40/60 or SMA 14 bin 100/150.

Footways, footpaths and cycle tracks

There are no requirements for SMA binder materials to be used in these locations.



Appendix A2 – Key to materials

SROH what it says

A2.3.1 Asphalt concrete must conform to BS EN 13108-1. Conformity must be established in accordance with BS EN 13108-20 and BS EN 13108-21. The following coated mixtures to BS EN 13108-1 and PD 6691 are permitted depending upon the detailed requirements of the relevant section.

A2.3.2 Where the existing mixture is HDM (heavy duty mixture to PD 6691) or HMB (high modulus base) and the authority requires the reinstatement to be completed using a similar mixture, the authority must notify the undertaker accordingly.

What it means

As with the HRA and SMA surfacing materials, conformity of asphalt concrete materials must be subject to a recognised industry standards in terms of aggregate size, grading binder makeup and content, and relevant testing. For these materials, the standards of conformity are named on the left.

Where the existing is a heavy duty mixture, the authority must inform the undertaker so he may source the material to be used within the new reinstatement.

Wheel tracking requirements still apply as with other surfacing materials and will be outlined below in relation to road types 0 and 1



Deformation resistance must comply with the limiting wheel tracking requirements for site classification in accordance with PD 6691 appendix B, Table B.4 and the note to that table.

This means the wheel tracking classification requirements for each mix of asphalt concrete can be verified with the table in the PD 6691 document.

For road Types 0 and 1, material must comply with the wheel tracking requirements for site classification 2.
There is no wheel tracking requirement for other road types.



Appendix A2 – Key to materials

Asphalt concrete surface materials – a basic description

All road types

The coated surface course mixtures to PD 6691 must be AC10 close surf 100/150.

The binder content may be increased above the PD 6691 allowances, and may be due to aid in workability purposes.
However, this has to be upon agreement with the local or relevant administrative authority.

Footways, footpaths & cycle tracks

The preferred coated surface course mixture is AC6 dense surf 100/150 complying with BS EN 13108-1.

The above material is the preferred option for **footways, footpaths and cycle tracks**. The 100/150 is a Paving Grade Bitumen suitable for most applications other than heavily trafficked roads.

Where AC10 close surf incorporating 100/150 bitumen complying with BS EN 13108-1 is used to reinstate a carriageway and it extends to the footway the same material can be used in the footway. However, this will be for a maximum total of 10 linear m or 4 m² in the footway, footpath or cycle track for a continuous reinstatement.

Remember, you can only apply this option where works in carriageway cross into footway or cycle path for a maximum 10m of trench or up to 4m² patch size. It cannot be applied to isolated patches or works not directly connected to the carriageway.





Appendix A2 – Key to materials

Asphalt concrete binder materials – a basic description

Type 0 and 1 roads

The preferred binder course mixture to PD 6691 is AC20 dense bin 40/60 with the wheel tracking requirements meeting classifications 2 for road Type 0 and 1 or 2 for road Type 1.



The above material is the preferred asphalt concrete binder material option for **Type 0 and 1 roads**. The 60/40 is a Paving Grade Bitumen suitable for road construction with asphalt binder layers having superior properties.



There are no permitted alternatives in the SROH for asphalt concrete binder material.



Type 2, 3 and 4 roads

The preferred binder course mixture to PD 6691 is AC20 dense bin 100/150.



The above materials are the preferred SMA binder option for **Type 2, 3 and 4 roads**. The 100/150 is the Paving Grade Bitumen suitable for road construction within the binder material, which is a suitable grade for such purposes.



There are no permitted alternatives in the SROH for asphalt concrete binder material.

Footways, footpaths and cycle tracks

The binder course mixture in footways, footpaths and cycle tracks must be either AC20 dense bin 100/150 or AC14 dense bin 100/150. For hand compaction (see S6.5) AC14 dense bin 100/150 is preferred.



Appendix A2 – Key to materials

Permanent cold lay surfacing materials

SROH what it says

A2.4.3 Approved PCSMs, laid and compacted in accordance with the Product Acceptance Scheme certificate may be used in substitution for any permitted equivalent bituminous material type, such as an SMA or AC, at the discretion of the undertaker, as follows:

- 1) Permanent cold-lay surfacing material (PCSM), at any position, in all reinstatements in footways, footpaths and cycle tracks.
- 2) Permanent cold-lay binder course (PCBC) in all reinstatements in Type 3 & 4 roads.
- 3) Permanent cold-lay surface course (PCSC) in all reinstatements in Types 3 & 4 roads.

If a new PCSM material has been put forward for certification, it must be treated as a deferred set material for use in interim situations.

This means the PCSM cannot be used as a permanent reinstatement until such time as it has achieved certification under the Product Acceptance Scheme.

The certificate will state the required thickness that the particular product should be laid at.

Do not confuse deferred set materials (DSMs) with Permanent Cold-lay Surfacing Materials (PCSMs). Only the PCSM materials may be used in a permanent reinstatement

What it means

Permanent Cold-lay Surfacing Materials (PCSMs) can be used instead of any allowed surface material such as SMA or AC. At the present time, there is no cold lay material available that will replace HRASC materials. All PCSM's must be approved, and be in accordance with the Product Acceptance Scheme certificate which may be awarded by the two approved bodies, being the British Board of Agrément (BBA) or, Paving Testing Services Ltd (PTS). You will see on the left that cold lay materials must only be applied in Types 3 and 4 roads along with footways, footpaths and cycle tracks.



Appendix A2 – Key to materials

Deferred set mixtures

SROH what it says – Deferred set mixtures

A2.4.6 Deferred set coated mixtures must be in accordance with PD 6691 and must be AC6 dense surf 160/220 DS (6 mm surface course) or AC10 close surf 160/220 DS (10 mm surface course) or AC20 dense bin 160/220 DS (20 mm dense binder course).

What it means

Deferred set mixtures (DSM's) must be approved and certificated as suitable for use in the highway. As you can see on the left, they mainly relate to asphalt concrete (AC) type mixes in terms of aggregate grading and distribution. They must be laid and compacted as recommended by manufacturer or SROH Table A2.5 for comparative materials.

Remember, deferred set materials will be applied for interim, or immediate works situations. They will not apply to permanent reinstatements.

If you decide to use deferred set materials, the binder grade and amount of flux oil may need to be amended to meet the performance requirements for surfacing mixtures for the duration of the interim reinstatement period. Advice on this is contained in PD 6691 appendix B.2.3.



You can see on the left that an AC10 mm equivalent deferred set mixture has been laid around a chamber in a HRA road surface, and this purely maintains a running surface course. It must comply with relevant SROH performance requirements until such time as the reinstatement is made permanent with the correct surface course material.



What does deferred set mean?

It means that the mixture does not fully set initially.

Why?

It is a cold lay material that relies on solvents or oils in the binder to keep it pliable. Until these dry out or evaporate the material will not fully set.

Appendix A2 – Key to materials

Polymer Modified Mastic Asphalt materials

SROH what it says – A2.5 Flowable materials

A2.5.1 PMMA must be CE Marked to BS EN 13108-6 or have a Product Acceptance Scheme Certificate.

Works using PMMA must meet the requirements of S2, unless otherwise agreed with authority (*edge depression, etc.*). PMMA material is a flowable asphalt and typically used around ironwork. No compaction is needed, so meeting compliance with S10 is not necessary (*compaction requirements*).

What are PMMA materials

PMMA materials are relatively new in terms of street works. They have been around for some time but are now accepted as a means of reinstatement in certain circumstances. They must be approved and certified through the schemes named on the left.

PMMA's must adhere to certain properties in terms of grading limits, binder limits, and indentation limits which are covered by a range of standards as outlined in SROH – A2.5.2. These are technical requirements not suited for general overview as part of this refresher material.



Appendix A2 – Key to materials

Foamed concretes for reinstatements (FCRs)

SROH what it says – A2.5 Flowable materials

A2.5.3 FCRs are cement-bound materials that have been prepared off-site or can be mixed on-site, generally as prescribed mixes, at an approved mixing plant and under appropriate quality control procedures. They are flowable and do not require compaction when placed. FCRs do not necessarily incorporate a coarse aggregate.

What it means

As you can see on the left, foamed concretes are flowable cementitious materials which can be used in various layers of a reinstatement. The particular road type may dictate what layers can be replaced with foamed concrete. Be aware, in what layers you can apply foamed concrete in each road type (See SROH Table A2.1). For example, you can only use foamed concrete at sub-base or below in a Type 0 road.



Foamed concrete is simply a liquid mix concrete with an added foaming agent to create a lightweight honeycomb effect.

FCRs must be cured for the period specified by the manufacturer. During this period, the reinstatements must be protected.

To avoid FCRs flowing into damaged drains or ducts in or adjacent to the excavation, plastic sheeting or other protective measures must be used during pouring and curing.

FCRs must not be tamped or compacted unless otherwise specified by the manufacturer.



Sub-base or base material must not be reinstated over FCR until it has reached sufficient strength to allow proper compaction.

SROH A2.5.4 - FCRs must not encase cables or be used within 300 mm of a gas pipe.

Table A2.1 FCRs minimum layer thickness and compressive strength requirements

Layer	Road type					Footways, Footpaths and Cycle tracks
	0	1	2	3	4	
Combined Binder Course & Sub-base	NP	NP	NP	NP	NP	150 mm C1.5/2
Base	NP	NP	NP	300 mm C1.5/2	200 mm C1.5/2	---
Base & Sub-base	NP	450 mm C3/4	450 mm C3/4	450 mm C1.5/2	350 mm C1.5/2	---
Sub-base or below	150 mm C1.5/2	150 mm C1.5/2	150 mm C1.5/2	150 mm C1.5/2	150 mm C1.5/2	100 mm C1.5/2

Notes:

NP = Not permitted

Minimum asphalt overlay thickness as per A3 to A7.

FCR is not permitted as CBGM base replacement.

Layer thickness and compressive strength at 7 days requirements must be in accordance with Table A2.1 of the SROH (above).

Appendix A2 – Key to materials

Micro-trenches reinstatement

SROH what it says – A2.6 Reinstatement for Micro-trenches

A2.6.1 The granular bedding material must comply with the requirements of Table A2.2.

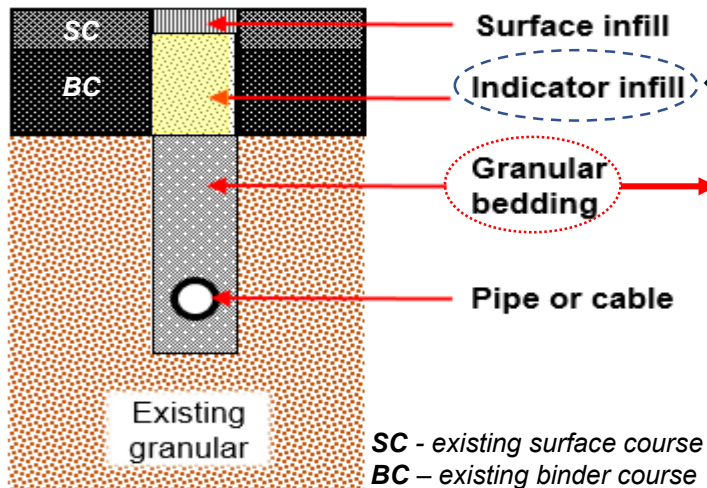
A2.6.2 The size fraction of the aggregate passing the 0.425 mm size test sieve must be non-plastic as defined by and tested in accordance with BS EN 17892-12.

What it means

We are now dealing with micro-trenches which require different reinstatement procedures when compared to other conventional trench or patch methods. The granular bedding materials used in micro trenching will meet the requirements of SROH Table A2.2 as shown below. Also the finer materials must be non-plastic (*do not bind like a clay*) and they must conform to the standard named on the left in terms of testing.

Table A2.2 BS EN 13242 Fine aggregates for micro trenching

Category for general grading requirements	Category Gr80
Category for tolerances on manufacturer's declared typical grading	GT _{NR} (no requirement)
Category for maximum values of fines content	Gravel – f_0 Crushed rock recycled aggregate – f_{11}
Aggregate size, mm	0/4 or 0/6



SC - existing surface course
BC - existing binder course

The indicator infill material will be resin based product which is laid within the bound layers of the pavement structure. It is usually a high contrast colour to warn subsequent works of micro-trench presence.

Table A2.3 Performance criteria for indicator infill material

Performance criteria	Procedure	Requirement
Material type	Not Applicable	Thermoset resin
Permanent deformation resistance	Wheel tracking to BS EN 12697-22 (Small device, Procedure A at 60°C)	WTR _{MR15,0} and RD _{MR7,0}
Tensile bond strength	Tensile bond tested in accordance with appendix J in TRL report 176	≥ 0.75 MPa
Elongation	BS EN ISO 527-1 & 3 – Plastics – determination of tensile properties	≥ 30%



The performance requirements of the surface infill material will comply with the requirements of SROH Table A2.4 (*skid resistance, texture depth, etc.*)

Appendix A2 – Key to materials

Structural layer thickness tolerances

SROH what it says – A2.7 Structural layer thickness tolerances

A2.7.1 Several individual layers of material, commonly termed lifts, may be required to reinstate a structural layer.

A2.7.2 The thickness of each complete structural layer is specified as a nominal value.

The lower tolerance for the thickness of a structural layer must be as follows:

- 1) -5 mm for the surface course
- 2) -10 mm for any other structural layer comprising bound material
- 3) -20 mm for any other structural layer comprising unbound material

Although we can apply these tolerances, there are other minimum values we have to consider as the combination of the above tolerances cannot pass minimum overall layer values. For example, there can never be less than 100mm of bound materials in a road, or less than 60mm of bound materials in a footway.

Ok, so I can take -5mm off the surface course, but in a Type 2 road, can I take -10mm off both the binder layer and the base layer to make a -25mm reduction overall?

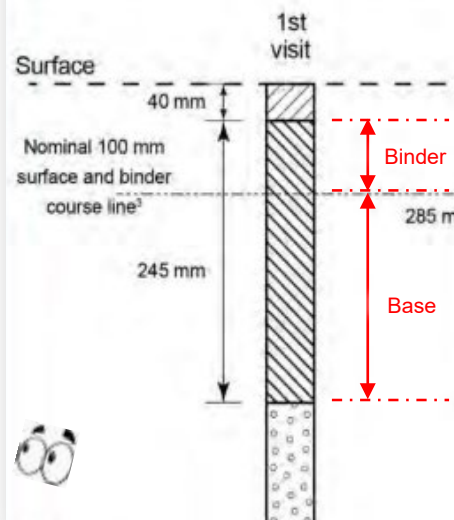
Unfortunately not. SROH A2.7.5 shows you cannot have a reduction in the “overall” bound layers of more than 15mm. A type 2 flexible road will have 285mm overall of bound materials, so the minimum it can ever be is 270mm to comply with the SROH.

What it means

You should already know that you may have several compacted lifts within a structural layer. The thickness of each of the compacted lift will be dependent the overall structural layer thickness and materials you are using as per SROH Tables A2.5 and A2.6. See below for further description of layer tolerances and compacted lifts.

Figure A3.3 Flexible roads type 2

Method: **A**
All permanent



What if I have a Type 4 road with 35mm of surface course and 50mm of binder course which is the -5 and the -10 applied.

Unfortunately, this is an uncompliant reinstatement as the absolute minimum of 100mm bound material is not achieved (A2.7.5)

Ok, what about 110mm overall with 80mm binder course?

Also uncompliant, as that would leave only 30mm for the surface course which cannot be less than 35mm.

Thank you, now could you please help describe what compacted lifts are?

Sure, a compacted lift is a layer of compacted material within a structural layer. In a type 2 road with a combined binder/base of 245mm when using an AC20 DBC material you will have at least three compacted lifts. Please see next page.

Appendix A2 – Key to materials

A2.8 Compacted lift thickness

Table A2.5 Compacted lift thickness (mm) – Bituminous mixtures				
Material type	PD 6691 reference	Compacted lift thickness (mm)		
		Minimum at any point	Nominal lift thickness	Maximum at any point
6 mm DSC	AC6 dense surf	15	20 – 30	40
10 mm CGSC	AC10 close surf	25	30 – 40	50
15/10 HRA	HRA 15/10 F surf	25	30	50
30/10 HRA	HRA 30/10 F surf	30	35	45
30/14 HRA	HRA 30/14 F surf HRA 30/14 C surf	35	40	50
35/14 HRA	HRA 35/14 F surf HRA 35/14 C surf	40	45 – 50	60
55/14 HRA	HRA 55/14 F surf	40	45	55
55/10 HRA	HRA 55/10 F surf	35	40	50
6 mm SMA	SMA 6 surf	15	20 – 40	45
10 mm SMA	SMA 10 surf	20	25 – 50	55
14 mm SMA	SMA 14 surf	30	35 – 50	55
10 mm PA	PA 10*	25*	30 – 35*	40*
20 mm PA	PA 20*	40*	45 – 60*	65*
50/14 HRA	HRA 50/14 F bin	30	35 – 65	85
50/20 HRA BC	HRA 50/20 bin	40	45 – 80	100
60/20 HRA BC	HRA 60/20 bin	40	45 – 80	100
14 mm SMA BC	SMA 14 bin	25	30 – 60	65
20 mm SMA BC	SMA 20 bin	40	50 – 100	110
14 mm DBC	-	35	40 – 70	80
20 mm DBC	AC20 dense bin	40	50 – 100	110

Notes:
The binder course thickness must be adjusted accordingly to the thickness of the surface course to comply with the requirements in appendices A3 to A7.
* The use of Porous Asphalt (PA) is limited in the UK except for specialist uses such as sustainable drainage systems. Where porous asphalt surfaces are encountered refer to S6.4.13 (BS EN 13108-7 contains specifications for this group of asphalts and guidance on the appropriate material should be obtained from the authority).
** 14 mm DBC is not currently included in PD 6691. It should be referenced as AC14 dense bin.



Now I see what you meant on the previous page for compacted lift thickness.

Yes, the area outlined in red is your target compacted lift thickness.



I also see there is a maximum and minimum layer thickness at any point.

Too thick means compaction is not effective and too thin will possibly distress the material.



What happens if I don't apply compacted lift thickness requirements?

You are at risk of excessive air voids within the material.



Do compacted lift thickness requirements apply to unbound materials?

Yes they do, as you can see in Table A2.6 above.

Table A2.6 Compacted lift thickness – Non-bituminous materials			
Material	Compacted lift thickness (mm)		
	Minimum at any point	Nominal lift thickness	Maximum at any point
CBGM base	100	120 to 150	200
C25/30 concrete	100	As required	As existing
C32/40 concrete	100	As required	As existing
GSB1	75	100 to 150	200
Classes A & B	75	100 to 150	200
Classes C & D	75	100 to 150	200
SMF-A & SMF-B	75	100 to 150	200
SMF-C & SMF-D	75	100 to 150	200



Appendix A2 – Key to materials

A2.9 – Bituminous laying temperatures

Table A2.7 Laying temperatures– Bituminous materials				
Material	Binder grade	Maximum temperature at any stage (°C)	Minimum temperatures (°C)	
			Arrival *	Minimum rolling #
CGSC DSC	100/150	170	120	95
	160/220	170	110	85
DBC	40/60	190	130	100
	70/100	180	125	95
	100/150	170	120	90
	160/220	170	110	80
HRA SC#	40/60	190	140	110
	70/100	180	125	90
	100/150	170	120	85
HRA BC	40/60	190	130	105
	70/100	180	125	90
	100/150	170	120	85
SMA SC SMA BC	40/60	200	130	100
	70/100	180	125	90
	100/150	170	120	85
Porous Asphalt	125	135	110	85
	190	145		

Notes:

1 * = In the lorry within 30 minutes after arrival on site.

2 For coated slag mixtures temperatures may be 10°C lower than the recommended values.

3 # = See Table A2.8 for the final rolling temperatures when chippings are applied to HRA surface courses.

4 To achieve acceptable air voids, most materials will require greater compactive effort as the temperature approaches the lower limit. Additives are available which can be used to assist compaction at lower temperatures

SROH A2.9.1 - The laying temperatures for bituminous mixtures must be in accordance with Table A2.7.

It is important to ensure the temperature of the material is never below the required value. If it is not, you risk the failure of the material due to air voids content, or lack of bonding. HRA Final rolling temperatures are also shown in Table A2.8 below.

Table A2.8 Final rolling temperatures - HRA

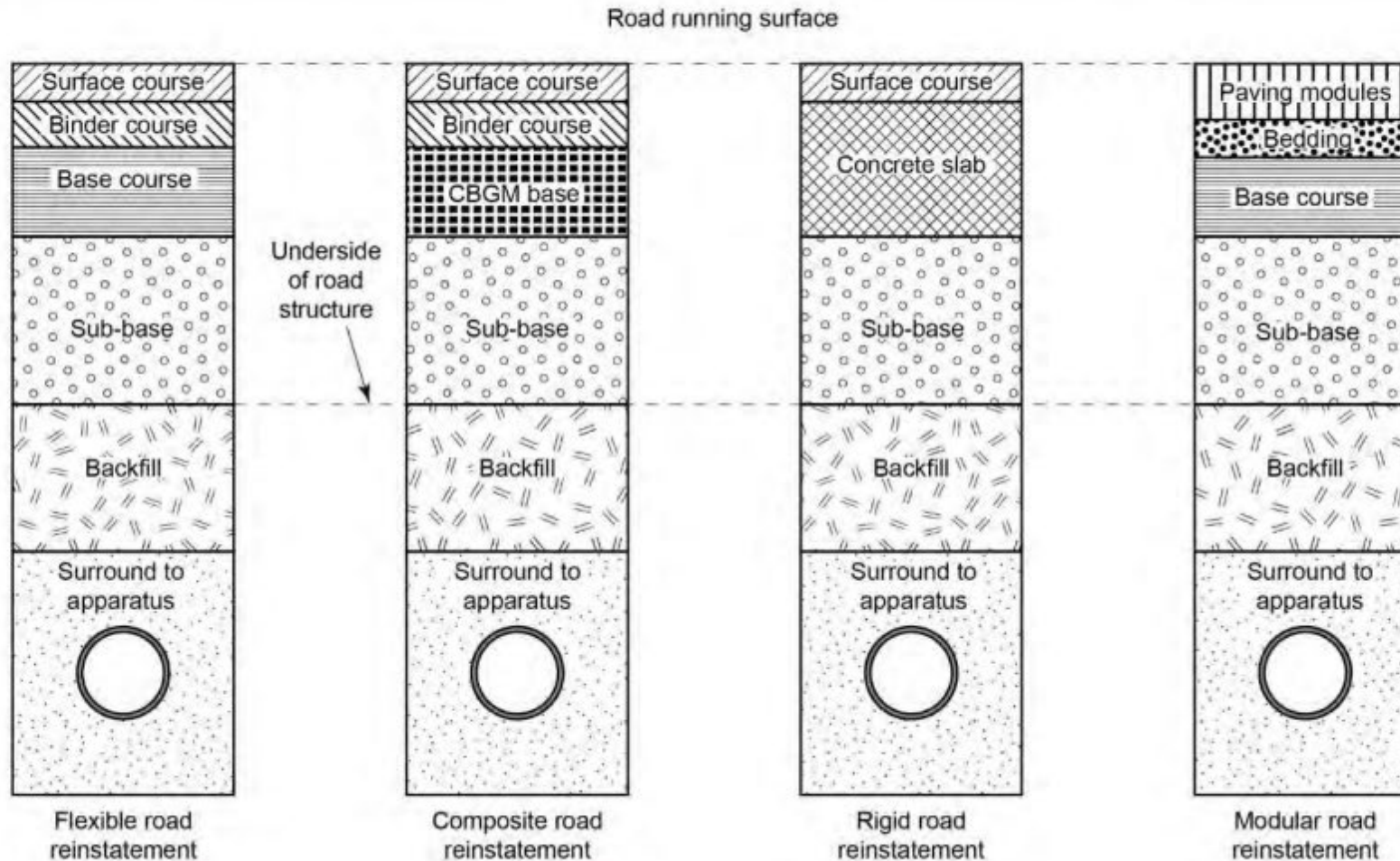
Binder grade	Minimum temperature (°C) at completion of rolling
40/60	85
70/100	80
100/150	75
Note: When using modified bitumen or additives, different temperatures might be applicable.	



Appendix A2 – Key to materials

A2.10 – Identification of structural layers roads

Figure A2.1 Typical reinstatement structure within recognised road designs



You will see from Figure A2.1 how to identify the design of a road in terms of construction. This will also identify the individual structural layers within each type of road.

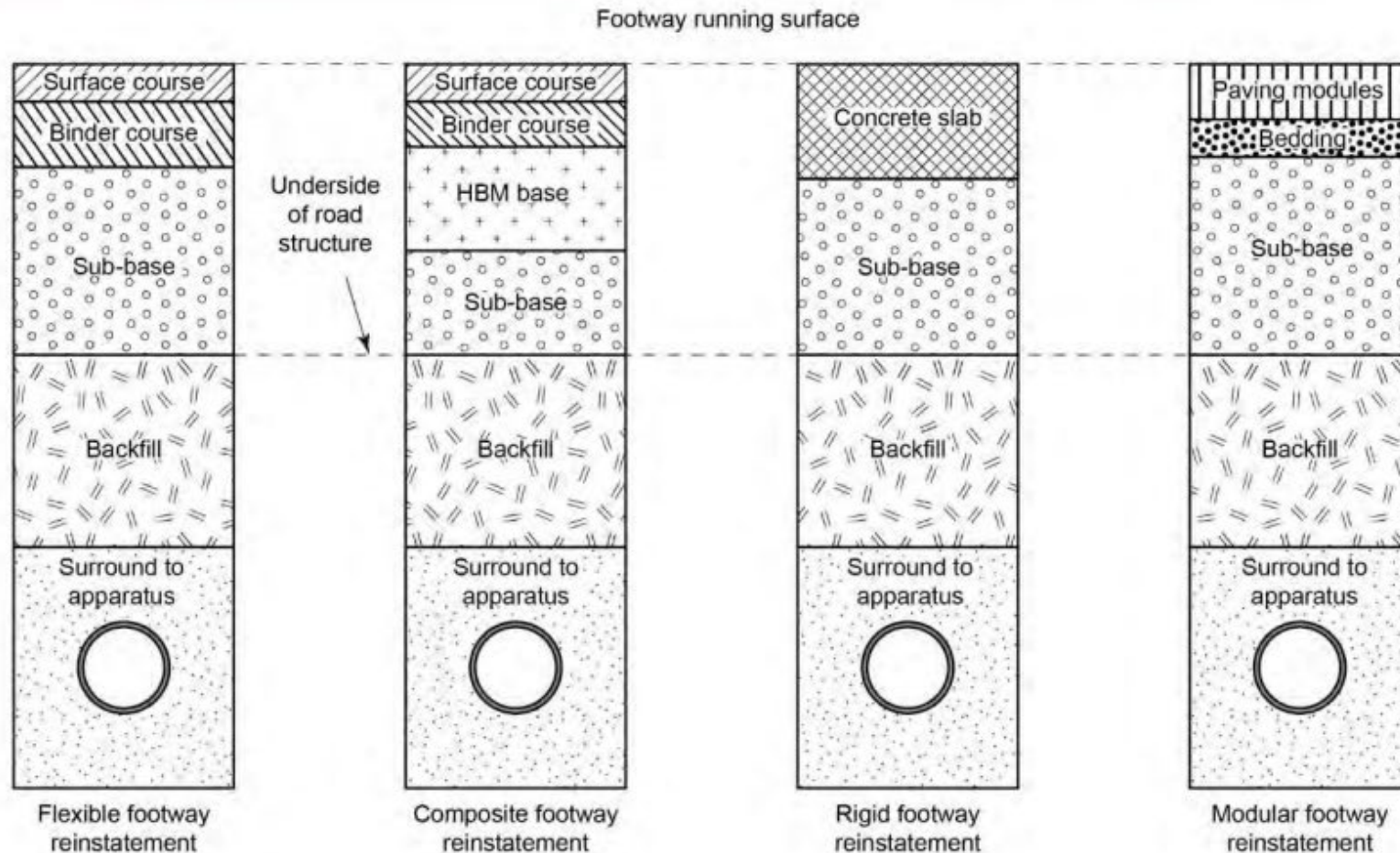
It is important to recognise items such as backfill layer in the context of road make-up. It is a common mistake to believe that all unbound materials are known as backfill, but it must be highlighted the base layer and sub-base layer located above the backfill layer may also be unbound.

Be aware of things like class of backfill material being used, as it is likely to determine the thickness of the sub-base layer immediately above it. Also know there are minimum values for each structural layer, based on each type of carriageway

Appendix A2 – Key to materials

A2.10 – Identification of structural layers footways

Figure A2.2 Typical reinstatement structure within recognised footway designs



You will see from Figure A2.2 how to identify the design of a footway in terms of construction. This will also identify the individual structural layers within each type of footway.



Appendix A2 – Key to materials

Material keys and Methods of reinstatement

If you have already seen refresher aids for S6, S7, S8 along with some of the SROH appendices, you will already be aware of the reinstatement methods available as seen in Table A2.10 below. This will show what methods are available to you for each type of construction in carriageways, footways, footpaths and cycle tracks. On the left, is a key to identify bound and unbound materials which you will see being used in the appendices for all construction types. Also, each appendix will use these for each construction.

Table A2.9 Key to reinstatement materials














	HRASC ACCSC SMASC	HRASC - Hot Rolled Asphalt Surface Course See A2.1.1 ACCSC - Asphalt Concrete Close Surface Course See A2.3.1 ACDSC - Asphalt Concrete Dense Surface Course See A2.3.1 SMASC - Stone Mastic Asphalt Surface Course See A2.2.1 PCSC - Permanent Cold-lay Surface Course See A2.4.1
	HRASC ACCSC ACDSC SMASC PCSC	
	HRABC ACBC SMABC	HRABC - Hot Rolled Asphalt Binder Course See A2.1.2 ACBC - Asphalt Concrete Binder Course See A2.3.2 SMABC - Stone Mastic Asphalt Binder Course See A2.2.2 PCBC - Permanent Cold-lay Binder Course See A2.4.1
	HRABC ACBC SMABC PCBC	
	DSM PCSM	DSM - Deferred Set Mixtures See A2.4.2 PCSM - Permanent Cold-lay Surfacing Material See A2.4.1
	Concrete	Concrete - Pavement Quality Concrete To SHW Clause 1001
	CBGM base	CBGM base - Cement Bound Granular Mixture See S6.3.3
	HBM	HBM - Hydraulically Bound Materials See A10.2
	GSB 1	GSB 1 - Type 1 unbound mixture or modified type 1 unbound mixture See A10.1
	Class A	Class A - Graded granular backfill material See A1.1
	Class B	Class B - Granular backfill material See A1.1
	Class C	Class C - Cohesive granular backfill material See A1.1
	Class D	Class D - Cohesive backfill material See A1.1

Table A2.10 Key to reinstatement methods

Reinstatement method (at first visit)	Flexible & composite roads		Rigid & modular roads				Footways, footpaths & cycle tracks		
	S6		S7				S8		
	Flexible (A3.0 - A3.4 incl.)	Composite (A4.0 - A4.3 incl.)	Rigid (A5.0 - A5.2 incl.)	Modular			Flexible and composite (A7.1 and A7.2)	Rigid (A7.3)	Modular (A7.4)
	Bituminous base (roadbase) (A6.1)	Composite base (roadbase) (A6.2)	Granular base (roadbase) (A6.3)						
All permanent	Method A (Types 0-4 incl.)	Method A (Types 0-4 incl.)	Method A (Types 0-4 incl.)	Method A (Types 3, 4 only)	Method A (Types 3, 4 only)	Method A (Types 3, 4 only)	Method A	Method A	Method A
Interim with permanent binder course	Method B (Types 0-4 incl.)	Method B (Types 0-4 incl.)	N/A	N/A	N/A	N/A	Method B	N/A	N/A
Interim with permanent base	Method C (Types 3, 4 incl.)	Method C (Types 0-4 incl.)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Interim with permanent sub-base	Method D (Types 0-4 incl.)	Method D (Types 0-4 incl.)	Method D (Types 0-4 incl.)	Method D (Types 3, 4 only)	Method D (Types 3, 4 only)	Method D (Types 3, 4 only)	Method D	Method D	Method D
Permanent incorporating interim surface overlay	N/A	N/A	Method E (Types 0-4 incl.)	N/A	N/A	N/A	N/A	N/A	N/A



A2 - Summary

What is the absolute minimum bound layer in a road and a footway?

You can never have less than 100mm in a road and 60mm in a footway.

Why is overall bound layer tolerance limited to -15mm?

Each bound layer, other than surface course (-5mm), is allowed a -10mm tolerance. However, you may have a binder, base, and sub-base which are all bound, therefore, allowing -35mm overall reduction. This is restricted by imposing a maximum -15mm

Where can you use AC10 material in the footway?

Only where the works cross from carriageway into footway. The length of trench in FW must not be longer than 10m or greater than 4m²

Can you outline what a compacted lift thickness is?

A compacted layer is a layer of material that has been compacted. There may be several compacted layers within a structural layer such as binder/base in Type 2 road.

What structural layers can you use foamed concrete in a flexible road?

You have to know the road type, and where you can use foamed concrete within it. For example, you cannot use foamed concrete in a Type 0 road in any layer above the sub-base. You cannot use foamed concrete to replace binder in any road construction. However, you can use it in a combined base/sub-base in road types 1, 2, 3 and 4. NOTE: Only in footways, can you use foamed concrete as a combined binder/sub-base layer.

