









Introduction- SROH S6

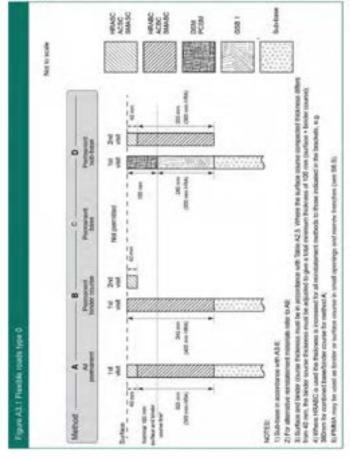
This advisory document is designed to assist incoming and existing Inspectors as support and refresher material. It will be provided in simple language to aid in understanding and avoiding technical or descriptive explanation.

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 S6 which will enable you to have a better understanding of what to look for when monitoring the reinstatement of Flexible and Composite roads.

Appendix A3 Flexible roads



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.





What exactly is a flexible construction?

Generally, a flexible construction is where bituminous materials are laid over unbound materials



But why is it called flexible?



There is no specific definition, but there is a certain amount of "flexibility" within the road structure.



What do you mean?



Flexible constructions are areas that can "bend" or "deflect" due to traffic loads, hopefully making them less susceptible to damage and requiring fewer repairs over time.

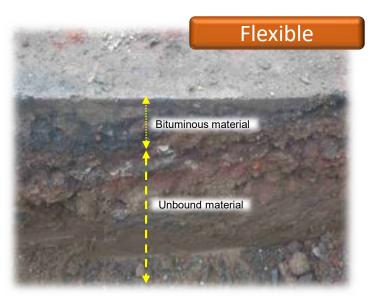


So what is a composite construction?



A combination of bituminous over cement bound materials used in base and sub-base layers. Bituminous layers need to be in excess of 100mm to be a composite construction. IT IS SO IMPORTANT THAT YOU IDENTIFY THE EXISTING ROAD CONSTRUCTION CORRECTLY.







The image on the left will show an excavation in a flexible road. This consists of bituminous layers over unbound materials of granular and cohesive materials. To reinstate this, you would need to apply the correct materials and structural layers for a flexible reinstatement as per the requirements of the SROH based on the road category.

This image will show what is an existing composite construction. This is demonstrated by meeting two criteria that confirms this. Firstly, there is a concrete or cement bound granular material identified within the structure. Secondly, there is over 100mm of bituminous materials laid immediately above the concrete or cement bound layer.





What it says in the SROH

S6.1.1 The undertaker must carry out reinstatement in accordance with one of the following methods and should endeavour to achieve the greatest degree of immediate permanent reinstatement.

Reinstatement methods are listed in Table A2.10.



What it means

As you can see, there are several methods of completing a reinstatement. However, you should always aim to complete the reinstatement as all permanent at the first visit. If you choose one of the other methods, you will usually be going back to site to complete the reinstatement, which is not ideal or well organised.

Table A2.10 will show you what road constructions you can apply these methods. You will see that road types, footways, footpaths and cycle tracks allow Method A as a first time permanent reinstatement.

Be careful, as Method A only applies to Modular Types 3 & 4, and also Method D if you are using the permanent subbase option (both outlined in blue)

Example: If you apply Method B, (interim with permanent binder) you will see that it only applies on flexible and composite roads along with flexible and composite footways, footpaths and cycle tracks. All other options are not applicable (N/A) as highlighted in Table A2.10 on the right.

Table A2.10 Key to reinstatement methods

Reinstatement method (at first visit)	roads S6		roads S7				cycle tracks		
	Flexible	Composite	Rigid (A5.0 - A5.2 incl.)	Modular			Flexible and	Rigid	Modular
	(A3.0 - A3.4 incl.)	(A4.0 - A4.3 incl.)		Bituminous base (roadbase) (A6.1)	Composite base (roadbase) (A5.2)	Granular base (roadbase) (A6.3)	(A7.1 and A7.2)	(A7.3)	(A7.4)
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

NOTE

Method B is where the binder course layer and below is permanently reinstated.

Method C is where the base course layer and below is permanently reinstated.

Therefore, You will have to re-visit the site to complete the other required layers

This is why Method A – All permanent is the preferred option, as only one site visit is required

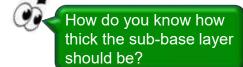
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What it says in the SROH - S6.2 Sub-base reinstatement

S6.2.1 Permitted options are shown in Figures A3.6, A4.5 and A4.6, subject to the following exceptions:

- 1) Sub-base equivalence: thickness of granular sub-bases may be reduced provided that the thickness of the bituminous binder course is increased proportionately, in accordance with S6.3.7.
- 2) Small openings and narrow trenches: in composite roads with a CBGM base, this material may also be used as a sub-base regardless of whether the existing sub-base is cement bound.



What about a Class B or Class C backfill?



It will always depend on what class of backfill material you use. If your backfill is class A, then your sub-base layer of Type 1 will be 150mm thick (*Fig A3.6*)

The sub-base layer increases by 50mm for each class. So Class B is 200mm and Class C would be 250mm of Type 1 granular sub-base material

Simply, for every 10mm you add to the binder layer, you can subtract 35mm from the granular base layers as one is equal to the other. The granular base and sub-base layers can decrease to absolute minimum of 150mm thickness overall (You can never have less than this in a road).



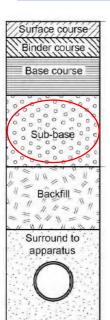


What it means

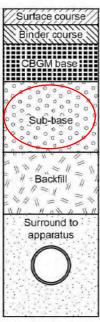
Sub-base layer is a very important part of the road construction. It is located below the base and above the backfill layer and you should ensure you have selected the correct material and the required layer thickness. You can reduce the thickness of granular base or sub-base layers, but if you do this, you must increase the binder course layer. For every 10mm added to the binder material you can decrease the granular material by 35mm, subject to absolute minimum granular layer thickness of 150mm..

In **composite roads** with a cement bound granular material (CBGM) base layer, <u>only small openings and narrow trenches</u> can use this material as subbase, even where the existing road does not have a cement bound sub-base.





Flexible road reinstatement In Types 3 and 4 flexible roads, the base course layer is granular Type 1 material laid over a subbase layer, also of granular materials. In Types 0, 1 and 2 flexible roads, the base layer will be bituminous material. The thickness of the sub-base is still determined by class of backfill material. (SROH Figure A3.6)



Composite road reinstatement In composite roads the base layer will be made up of a CBGM material which will still have the granular sub-base immediately below it. The thickness of the sub-base is still determined by the class of backfill material.



What it says in the SROH – S6.3 Base reinstatement

S6.3.1 Permitted options are shown in A3 and A4, subject to the following exceptions: (There are ten exceptions listed within the SROH)



The base layer is a structural layer located immediately below the binder course layer. Depending on the road category, it can be constructed from bound or unbound materials in flexible roads. The ten exceptions mentioned above relate to road construction, material types and equivalence rule already mentioned in the previous slide. Ensure you refer to the SROH for a full understanding of these as they are too detailed to fully describe here, but we will summarise for ease of understanding.



Image shows CBGM material being fed into trench ready for compaction.

All composite roads constructed with a base of CBGM, lean-mix concrete or equivalent must be reinstated with a CBGM base.

CBGM base must either be C16/20* (to Table A14 - BS 8500-1) or it must comply with requirements of SROH S6.3.3 Where CBGM base is used, it must be able to receive immediate overlay and meet a compressive strength of C3/4

If CBGM base is used in Type 0 and 1 roads it must receive seven days curing before trafficking regardless of overlay or not.

In Types 2, 3 and 4 roads, the CBGM base may either be surfaced on the same day or allowed 3 days curing before surfacing.

In Types 2, 3 and 4 roads, if the CBGM base is immediately overlaid, it can be opened to traffic on the following day

In composite roads, the reinstated CBGM base must be laid flush with the top of the existing CBGM, lean-mix concrete or equivalent.

Continuously reinforced concrete bases that have been connected with dowel bars are not covered in the SROH (base layer).

Therefore, special conditions will apply and the reinstatement method must be agreed with the authority.

In flexible type 3 & 4 roads, granular base and sub-base can reduce in thickness by increments of 35mm where binder course increases by 10mm

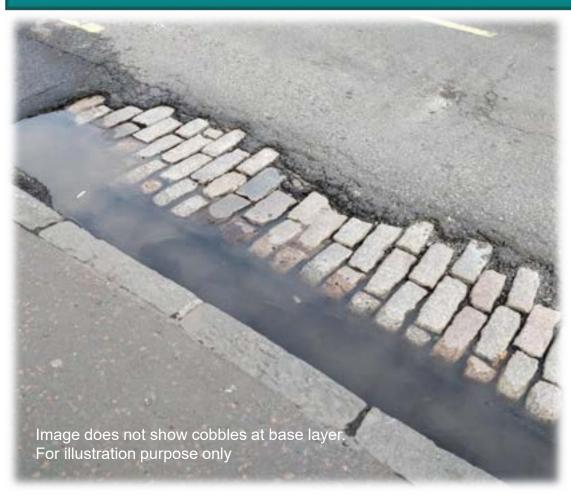
Where this is applied, the remaining granular material layer must never be less than 150mm thick for structural integrity

* C16/20 relates to compressive strength of cementitious materials. A crush test is applied to determine this value



What it says in the SROH – S6.3.8 Modular materials within base excavation





Remember
This only
applies to
cobbles or
setts found
at base
layer.

Where cobbles or setts are found during base excavation, they may be recovered and reused for reinstatement of the relevant layer.

Or the layer may be reinstated using CBGM base laid to a thickness of 100 mm, or to match the original thickness, whichever is greater.

If the cobbles or setts are laid interlocking, if they are not relayed, GBGM material of 100mm or matching existing thickness is allowed.

Advise authority of surplus cobbles or setts if not used. If no response after 10 days they can be removed for disposal.





What it says in the SROH – S6.4 Surface reinstatement

S6.4.1 Permitted options are shown in A2 to A4 inclusive, subject to the exceptions set out in S6.4.



What it means

As stated, all the permitted options for surface course reinstatement are found in the SROH Appendices A2 to A4. However, some of the exceptions listed in the SROH 6.4 are important to be aware of such as:

S6.4.2 Will show that HRA must be used in a HRA road in accordance with one of the HRA surface course options in A2.1,

S6.4.3 Shows that Stone Mastic Asphalt (**SMA**) materials must be used in **SMA** roads and that the aggregate size is matched, unless laid by hand, where 10mm aggregate size must be used. This also applies to Thin Surface Course Systems (**TSCS**) materials. The combined surface course and binder course should always be minimum 100mm. HRA may be used <u>only upon agreement</u> with the local authority.

The above is two exceptions, there are another seventeen, some of which we will note over the nest few pages, check the SROH for full information.



Stone Mastic Asphalt (SMA)



Asphalt Concrete (AC)



Other materials



Reinstatement edges should be sawcut to 40mm depth. A bond coat must be applied in all instances. Edge sealant must be applied to top 100mm.

Composite Roads - The thickness of the binder course and surface course must match the existing bituminous thickness. The <u>required surface course</u> thickness should be maintained by adjustment of the binder course thickness.





Hot Rolled Asphalt (HRA)



Remember: Only use HRA reinstatement in an existing HRA road.

Where pre-coated chippings are to be embedded into a road surface, they must be spread to give a chipping density as per BS 594987 or, reasonably matching that of the existing surface.

HRA can be used for reinstatement where the existing road is Asphalt Concrete.



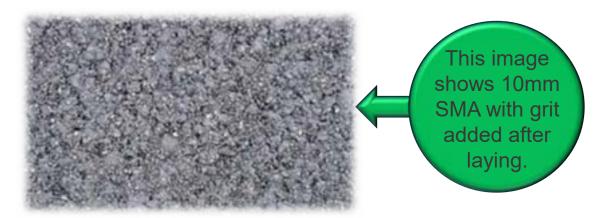
Stone Mastic Asphalt (SMA)



Stone Mastic Asphalt can be used for reinstatement where the existing road surface is Asphalt Concrete.

If the existing surface is a Thin Surface Course System (TSCS) and the authority do not want an SMA reinstatement, they must contact the undertaker to agree this in advance of completion.

If the authority has a policy to grit or treat newly laid SMA, they must advise the undertaker, who must comply with the policy.





Asphalt Concrete (AC)



Where the existing surface course is Asphalt Concrete it may be reinstated with any of the surface course options in A2. (HRA, SMA, or any other approved material).

Where used, Asphalt Concrete surface course materials must be AC10 close surface, laid 40 mm thick.

Where AC binder course is to be used as the running surface for over 6 months, the usual target binder content must be increased by 0.5%.

NOTE

Where AC binder is used as a running surface you may need to monitor skid resistance.

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Other bituminous materials





IMPORTANT - Before applying any permanent or interim friction surfacing, warning signs must be displayed indicating a potentially slippery road surface.



SROH – S6.4.10 deals with other bituminous materials. These cover a selection of items such as high-friction surfacing, coloured surfaces and porous asphalt.

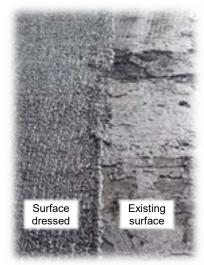
The above materials should be treated as part of permanent reinstatement. High friction materials should be reinstated within 15 working days of completion of reinstatement unless weather prevents this.

Where a coloured surface (eg. painted on) has been laid, a matching coloured material must be laid to the same thickness.

Where a coloured surfacing material has been laid, it must be laid to the same thickness. If this is not possible, an agreed alternative with authority is required.

In Types 0, 1 & 2 roads, where surface treatment exists, the undertaker must reinstate surface course with HRA unless otherwise requested by the authority.

The undertaker must apply an equivalent surface treatment if practicable and requested by the authority. Works must be agreed to required specification.



Unless the authority calls for it it, surface dressing or treatment is not required in Types 3 & 4 roads when any binder course and surface course option permitted by S6.4 is laid.

This should be verified prior to reinstatement.





What it says in the SROH - S6.5

\$6.5.1 A permanent surface course material in accordance with A2 may be laid in place of a permanent binder course material at base and/or binder course level.

- 1) in narrow trenches and small openings (as defined in S1.5.3 and S1.5.4): and
- 2) within 350 mm of access chamber covers.



What it means

You can use surface course materials to replace binder course materials in a narrow trench (less than 300mm wide) or a small opening (see S1). This can also be applied within 350mm around chamber covers. Do not use this method in any other flexible or composite road reinstatement, as usual binder materials are required in trenches over 300mm wide and openings over 4m2 in size as this may result in a non-conformance.

Max 350mm surface course 0 0

Full depth

Unbound materials

Compaction should be done using correct equipment and lift thickness' for the selected materials as shown in S10. Also pay particular attention to temperatures if using hot lay materials.

If it is too difficult to use the compaction equipment due to being in a restricted or awkward space, you can use hand compaction tools if suitable.

Otherwise PMMA materials can be used.



What are PMMA materials?

Polymer Modified Mastic Asphalt (PMMA) materials. Now included as suitable for bituminous reinstatement



PMMA's must be finished with a suitable treatment to provide the necessary skid resistance. This may be bitumen coated chips or calcined bauxite to the specified PSV. You can see from the images where pre-coated chippings have been applied.

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 it says in the SROH - S6.6 Micro Trenching

S6.6.1 This section applies to micro trenching in flexible roads, footways, footpaths and cycle tracks (as per S8). It does not apply to micro trenching in verges (S9). Micro trenching in rigid or composite roads, footways, footpaths and cycle tracks <u>requires approval via A9</u> (materials and technology).



What it means

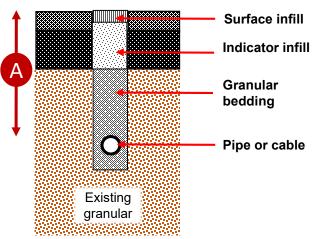
Micro trenching is a cutting technique where narrow, trenches are cut through the road structure up to 60mm wide. Once the particular process has had required approvals, the authority should not unreasonably stop it from being used, unless it's in high duty/amenity areas for relevant engineering reasons.













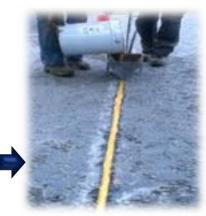
= Depth to apparatus

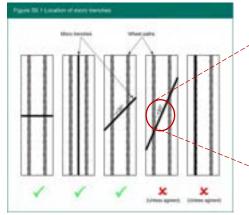
Absolute minimum of 175mm in carriageway and 100mm in footway.

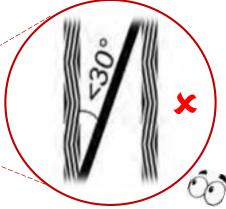
If pipe or cable is laid in bituminous material layers, only indicator infill and surface infill should be used. Granular bedding material can only be used where existing material is unbound.

Surface and indicator infill materials will usually be resin based, and must be compatible with each other.

Indicator infill must be coloured to help stop future works damaging the pipe or cable if found.







SROH - Figure S6.1 will show where micro trenches are used. Avoid wheel track areas and when crossing the road, never have an angle less than 30° to the running line or wheel-track.



What it says in the SROH – S6.6 Large Diameter Cores

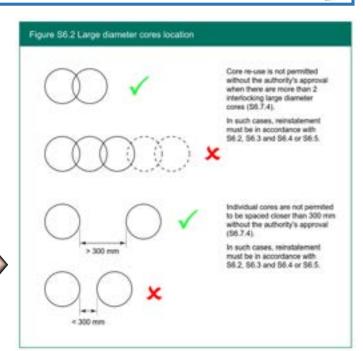
S6.7.1 Large diameter coring is a technique whereby a core greater than 150 mm diameter is cut out of the bound layers of the road surface in one piece and stored for re-use when reinstating the road. Excavation of the underlying unbound material is typically accomplished by vacuum extraction.



New and innovative methods of excavation and reinstatement have been developed such as large diameter coring. Even though vacuum extraction is mentioned as a means of excavation, it may be possible to apply other methods such as hand-digging as they are not specifically excluded.

Reinstatement by core is only permitted for single cores, two overlapping cores, or multiple cores with a minimum clear separation between core perimeters of 300 mm

Where there are three or more overlapping cores or where the separation between multiple cores is less than 300 mm, core reuse is not permitted unless agreed to by the authority





Regardless of the method of excavation, care must be taken to avoid undermining the adjoining structure.

If undermining does occur, re-using the core is not permitted and reinstatement must be carried out to the available options under SROH S6 for the relevant construction and road surface materials.

If the depth of the existing bound layers/concrete slab is less than 100 mm, reinstatement by core re-use is not permitted.

When the core is removed, it must be checked that the bound layers are at least 100 mm around the total circumference. If less than 100 mm at any point, re-using the core for reinstatement is also not permitted.



The core must be reinstated with a tolerance of

plus or minus 5mm and this remains for the two

year guarantee period. Intervention is required if

this tolerance is exceeded. You will notice this is

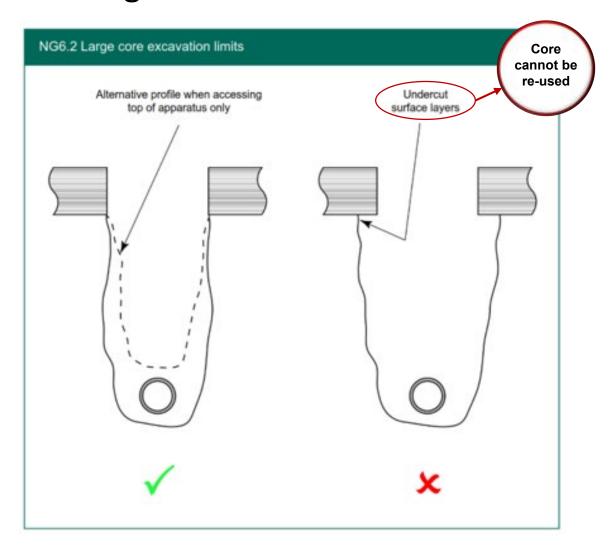
not the usual intervention requirement for edge

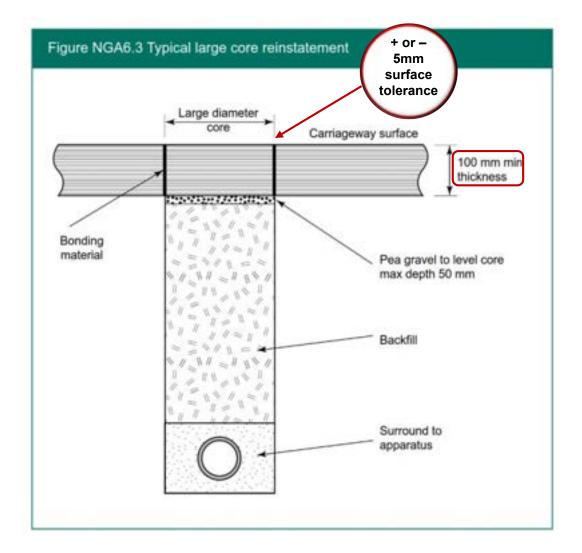
depression (10mm) under SROH S2.2.2

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Large diameter cores – Excavation limits and reinstatement







What it says in the SROH – S6.8 Base & Edge preparation

S6.8.1 All surfaces must be free of contamination before applying the bond coat. This is especially important after the removal of any sand separation layer.

S6.8.2 A bond coat must be applied to the surface of all bound layers before overlaying in all circumstances.

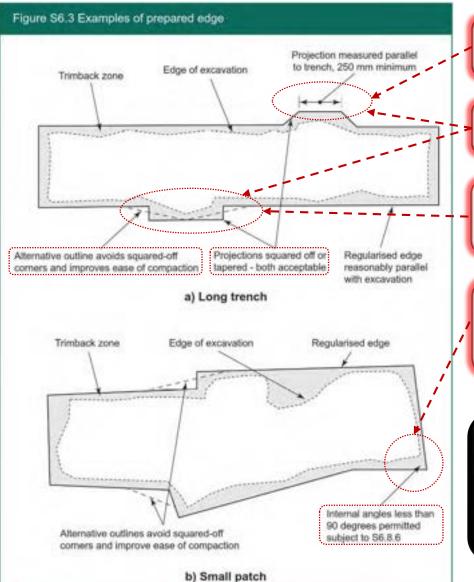
What it means

This material is used to bond a bituminous layer to another material. This is a requirement of the specification as it states it must be done in all circumstances. If a bond coat is not applied and correctly placed, it could be deemed as evidence of non-compliance with the SROH code of practice. This will not apply to compacted lift thickness' as per SROH – S10

Bond coat may also be generally referred to as tack coat. It must not be confused with edge sealant products which are designed to seal vertical joints. Bond coat cannot be used for edge sealant replacement. However, edge sealant can be used for bond coat in small openings and narrow trenches.

All interim or permanent openings (except micro trenches), require the top 100 mm of all bound vertical edges at surface and binder course, along with kerbs other fixed features, must be painted with an edge sealant.





Cut-outs cannot be less than 250mm long.

Can be squared or tapered.

Can avoid square off by applying a different outline to assist compaction

Internal angles less than 90° are allowed where compaction tools can access.

Saw cuts at corners should not overlap and leave an overcut. If this occurs, the cut should be sealed with flexible bituminous sealant.



What it says in the SROH – S6.8 Base & Edge preparation

S6.8.8 1) Overbanding may be used in reinstatements, including remedial works (see S12.3.3) to improve durability. If overbanding is used, it must comply with the reinstatement guarantee period.

2) Overbanding must be at least 3 mm wide, no wider than 40 mm, and be no more than 3 mm thick at the surface.



What it means

Overbanding can be used on all bituminous reinstatements and should not exceed the dimensions specified in S6.8.8.1). It is not an edge sealant, and must not be used as one. Different products have to be certified as suitable for use, and may use a hot or cold laying process. The product must have a skid resistance value (SRV) of 55 or greater, after being placed.

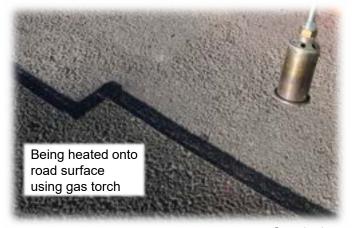


Overbanding being applied as a hot material poured into a shoe to provide the correct width un road surface.



Overbanding must be black in colour unless the local authority requests otherwise. Where it is used, it is expected to last the duration of the two year guarantee as stated above under S6.8.8 Remember, overbanding is not an edge sealant product which is only used between the vertical faces of the surface and binder courses.







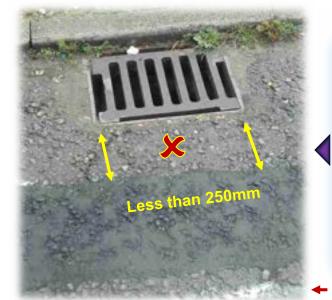
What it says in the SROH - S6.8 Base & Edge preparation

\$6.8.9 1) Where the trimmed edge of any excavation is within 250 mm of the road edge, kerbing, other fixed features or another reinstatement, the trim-line must be extended to the interface with the road edge, kerbing etc. See Figure S6.4.

What it means

As you will see from Figure S6.4 on the right, anything closer than 250mm from the new reinstatement will require the existing surface to be replaced. This will include street furniture, other reinstatements, kerbs and channels. This is to avoid introducing weakness in the layer where anything less that 250mm in the existing surface course may cause a failure.





If the reinstatement comes within 250mm of any street furniture, other reinstatement, kerb or channel, it should be cut out and included in the new reinstatement

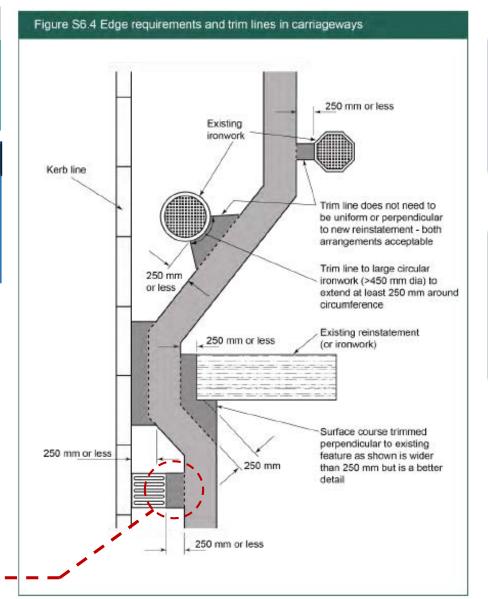


Figure S6.4 of the SROH will demonstrate where trim lines should be extended to in terms of the 250mm rule

This may only apply to the surface course layer as long as lower layers have not been damaged. If they have, they must be replaced.

NOTE

The 250mm rule only applies to bituminous and composite roads. Not rigid roads, footways and cycle tracks



What it says in the SROH – S6.8 Base & Edge preparation

S6.8.10 1) All bound edges must be fairly smooth and vertical with no significant undercutting, see Figure S6.5.



What it means

The edges of the surface course, binder course, and (if bound material) base course should be essentially vertical. Undercutting of these layers is not permitted as can be seen from Figure S6.5

Figure S6.5 Example of need for trimback due to undercutting Existing flexible structure Final trimmed excavated edge Surface and binder courses Surface course normally saw cut Binder course Bound courses trimmed back for permanent reinstatement Base (if bound) (carriageways) Bound base course may peel away during trench excavation undercutting original saw cut line Sub-base Existing sub-base may not hold up during trench excavation, undercutting bound courses



If undercutting occurs, and bound materials are not cut back as shown in Figure S6.5 it is likely to cause existing surface to fail at a later stage, as seen in the above image.

This is why it is so important to ensure undercutting or undermining has not occurred. This should be monitored through duration of the works, from excavation to reinstatement.



What it says in the SROH – S6.8 Base & Edge preparation

S6.8.11 1) On Type 0 and 1 roads where it is the custom and practice of the authority to cut-back the surface or binder course to provide a stepped profile, this must be notified to the undertaker. Subject to the agreement of the authority, the stepped joint may be applied to reinstatements in Type 0 and 1 roads.



What it means

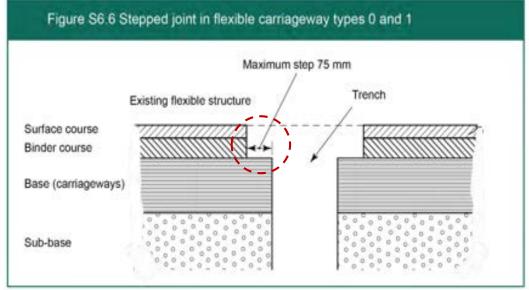
If the local authority require stepped reinstatement in Type 0 & 1 roads it must be notified to the undertaker. This is important, as the undertaker can carry out conventional reinstatement with straight vertical edges on the surface and binder course layers. If the undertaker decides to apply the stepped profile where not notified, he should first seek agreement from the authority to do so.

What is a stepped profile.

It means where the surface and binder layers are stepped back to offset from line with trench wall below (Figure S6.6).



The undertaker is not obliged to reinstate using the stepped profile unless they have been advised by the authority to do so. The authority can advise the extent of the step to a maximum of 75mm



The idea is, stepping back of the surface and binder course layers reduces the risk of movement or separation of the vertical wall of the bound materials. Therefore, the surface reinstatement is less likely to fail where the joints are offset. It also reduces risk of water ingress from surface if upper layers fail.

What it says in the SROH – S6.9 Tolerances

S6.9.1 Tolerances for bituminous materials permitted in A2 for the reinstatement of flexible and composite roads must be in accordance with the requirements of A2.

As it states above, the tolerances can be found in A2 and SROH - A2.7.3 will show:

- 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

However, you must note, the tolerances to not add to each other for each layer, as there is an overall reduction tolerance of 15mm for bound layers in a road subject to an absolute minimum of 100mm. The same applies to footway as overall reduction of 10mm for bound layers and absolute minimum of 60mm (SROH - A2.7.5)

S6 - Summary





What are flexible and composite constructions?

Flexible construction is where bituminous materials are laid over unbound materials

Composite road is cementitious materials more than 100mm depth under bituminous

What method of reinstatement would you recommend?

Method A – Permanent reinstatement at first visit, therefore works complete.

Where can I use a HRA in a road

You have to use HRA in an existing HRA road. However, you can also use HRA in an asphalt concrete road as it is a stronger material.

What is undercutting?

Undercutting or undermining is where the unbound or loose materials fall into the trench from below the bound layers. Therefore undermining their integrity.

What happens if I do not meet minimum layer tolerances?

Effectively, you have not complied with the specification and the reinstatement is compromised. This will require remedial action to bring into compliance. Failure to comply could be deemed as evidence of an offence under the New Roads and Street Works Act 1991.



