Appendix A3 – Flexible Roads

Researched, compiled and produced by corehard hardcore integrity and ENFIELD Council with support through TFL lane rental funding scheme

Introduction- SROH Appendix 3

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 A3 which will enable you to have a better understanding of what to look for when monitoring reinstatement in 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.

Appendix A3 – Flexible Roads

A reminder of reinstatement methods

The reinstatement methods you can employ for flexible roads is shown in Table A2.10 of the SROH.
As you can see outlined in red, methods A, B and D apply to all types of flexible roads, but method C *(outlined in blue)* will only apply to road types 3 and 4.

This is mainly because types 3 and 4 roads will have a granular base layer which can be permanent.
However, types 0,1 and 2 will have a bituminous base layer which will be combined with the binder layer.
Therefore, it is better that these are laid at the same time, forming a combined base/binder layer to ensure structural integrity. Which then negates method C in these types of road

Now you can see why method C, interim with permanent base, will not apply to types 0, 1 and 2 roads as it introduces an unnecessary joint in the combined binder/base layer. The following pages will confirm this application in Type 0, 1 and 2 roads only.

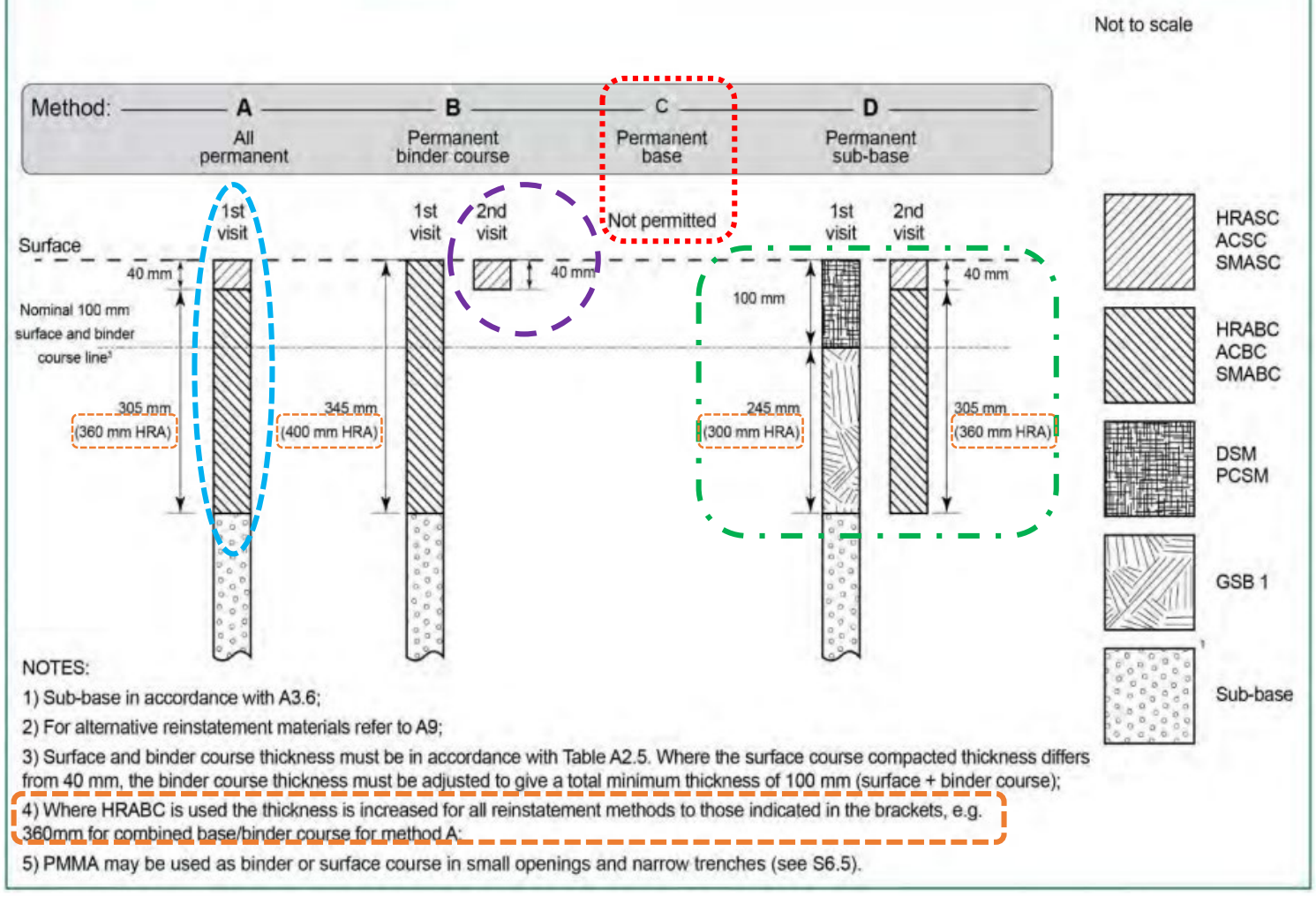
Table A2.10 Key to reinstatement methods

Reinstatement method (at first visit)	Flexible & composite roads S6		Rigid & modular roads S7				Footways, footpaths & cycle tracks S8		
	Flexible (A3.0 - A3.4 incl.)	Composite (A4.0 - A4.3 incl.)	Rigid (A5.0 - A5.2 incl.)	Modular: Bituminous base (roadbase) (A6.1)	Modular: Composite base (roadbase) (A6.2)	Modular: Granular base (roadbase) (A6.3)	Flexible and composite (A7.1 and A7.2)	Rigid (A7.3)	Modular (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

Appendix A3 – Flexible Roads

Figure A3.1 – Flexible Roads Type 0

Figure A3.1 Flexible roads type 0



NOTES:

1) Sub-base in accordance with A3.6;

2) For alternative reinstatement materials refer to A9;

3) Surface and binder course thickness must be in accordance with Table A2.5. Where the surface course compacted thickness differs from 40 mm, the binder course thickness must be adjusted to give a total minimum thickness of 100 mm (surface + binder course);

4) Where HRABC is used the thickness is increased for all reinstatement methods to those indicated in the brackets, e.g. 360mm for combined base/binder course for method A;

5) PMMA may be used as binder or surface course in small openings and narrow trenches (see S6.5).

You can see why **Method A** is the preferred option as the reinstatement works are completed in one visit.

Method B will mean you will have the binder course and all layers below it completed as permanent reinstatement. This will require a re-visit the site to complete the surface course at a later time.
This is obviously not as efficient as method A, due to the fact you have to apply for relevant permits or permissions, set up traffic management and finally lay permanent surface course.

This is a Type 0 flexible road and, therefore, **Method C** will not apply as it would introduce an unnecessary joint into the combined binder/base layer *(as discussed on the previous page).*

Method D would be highly unusual to apply where you have chosen to permanently reinstate sub-base layer and below. However, if you did select this method, you are required to lay approved materials to the prescribed thickness's.

Please note: If you use HRABC material, you will have to increase the combined binder/base layer as shown in Figure A3.1 *(usually an extra 55 mm overall).*

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Figure A3.2 – Flexible Roads Type 1

Again, you can see **Method A** is the preferred option as the reinstatement works are completed in one visit.

As described on previous page dealing with Type 0 roads, you can see **Method B** will mean you will have the binder course, and all layers below it completed as permanent reinstatement.

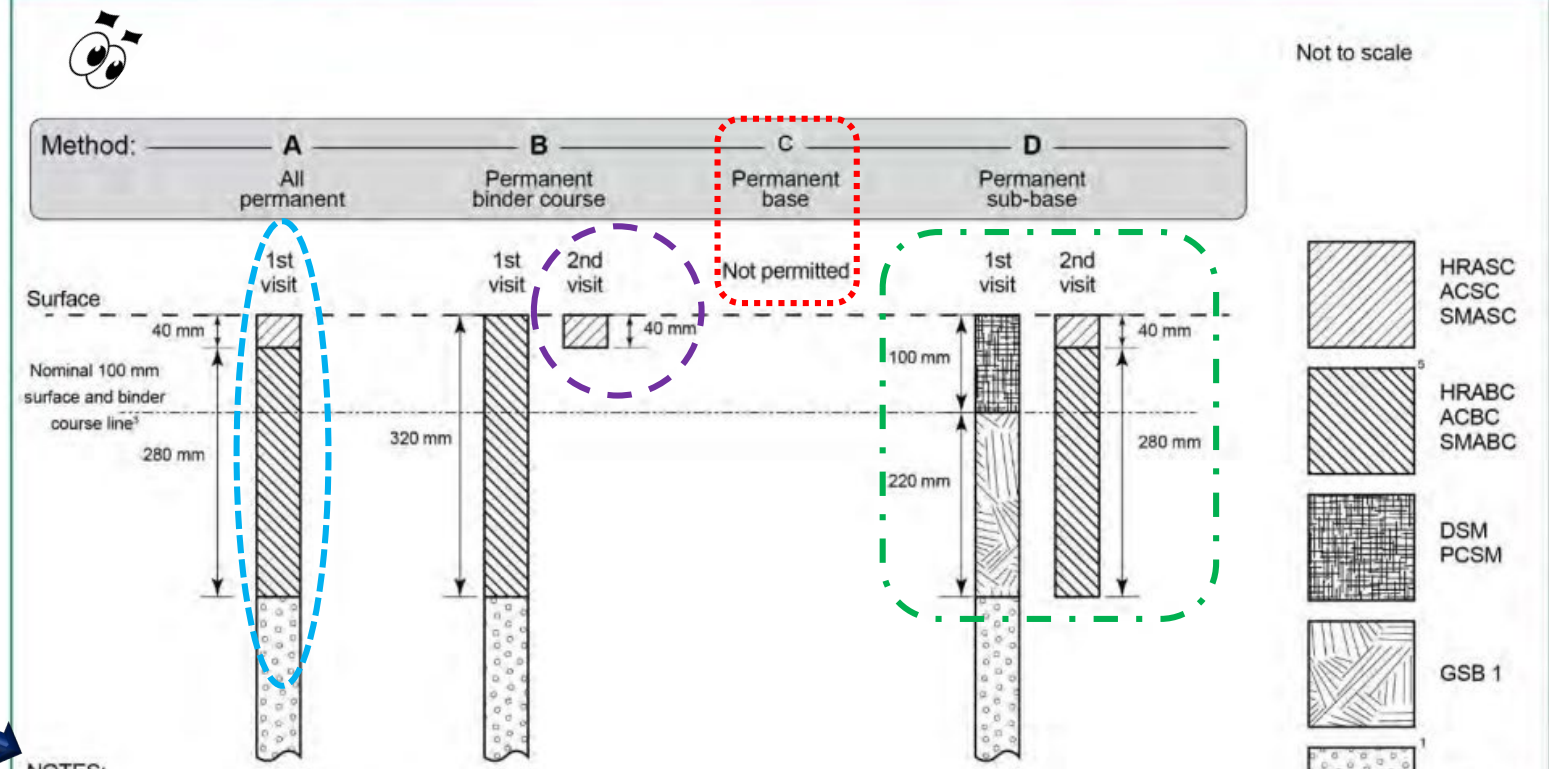
This is a Type 1 Flexible road and, therefore, **Method C** will not apply for the reasons provided on previous pages.

As with the Type 0 road, **Method D** would be highly unusual to apply where you have chosen to permanently reinstate sub-base layer and below.

Always pay attention to the "NOTES" as they provide additional information such as alternative materials and methods allowed for each road type.

For example: You can see from Note 5, that you can use a hydraulically bound material (HBM), or a foamed concrete for reinstatement (FCR), as a combined sub-base and base layer in a type 1 flexible road, as long as you have a minimum 170 mm of asphalt as an overlay.

Figure A3.2 Flexible roads type 1



NOTES:

1) Sub-base in accordance with A3.6;
2) For alternative reinstatement materials refer to A9;
3) Surface and binder course thickness must be in accordance with Table A2.5. Where the surface course compacted thickness differs from 40 mm, the binder course thickness must be adjusted to give a total minimum thickness of 100 mm (surface + binder course);
4) PMMA may be used as binder or surface course in small openings and narrow trenches (see S6.5);
5) HBM and FCR can be used as combined sub-base and base with a minimum total asphalt overlay of 170 mm. See Tables A10.6 and A2.1, respectively.

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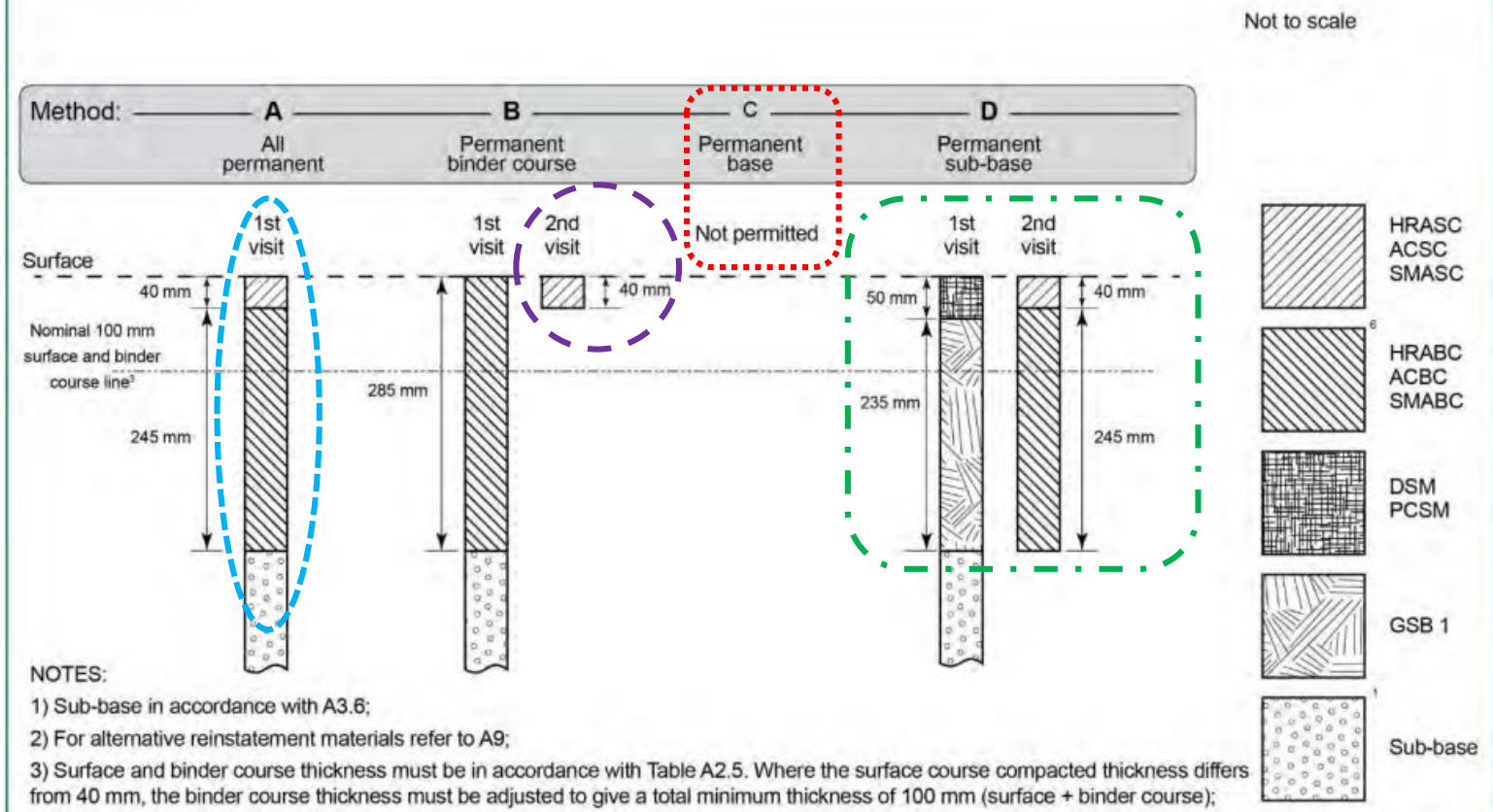
Figure A3.3 – Flexible Roads Type 2

Figure A3.3 Flexible roads type 2



NOTES:

1) Sub-base in accordance with A3.6;

2) For alternative reinstatement materials refer to A9;

3) Surface and binder course thickness must be in accordance with Table A2.5. Where the surface course compacted thickness differs from 40 mm, the binder course thickness must be adjusted to give a total minimum thickness of 100 mm (surface + binder course);

4) Where a road has been constructed, by the authority, to HD 26 design standards, and informs the undertaker accordingly, the total asphalt thickness shall be increased to 320 mm (assuming 100/150 pen) by the use of additional binder course material;

5) PMMA may be used as binder or surface course in small openings and narrow trenches (see S6.5);

6) HBM and FCR can be used as combined sub-base and base with a minimum total asphalt overlay of 100 mm. See Tables A10.6 and A2.1, respectively.

Again, **Method A** is the preferred option as the and the only thing that changes for each road type is the thickness of some of the layers such as base or sub-base.

As already mentioned, **Method B** will mean you will have the binder course, and all layers below it completed as permanent reinstatement.

Method C will not apply for the reasons provided on previous pages.

If you had to use **Method D**, you are required to lay approved materials to the prescribed thickness's.

As previously mentioned, pay attention to the "NOTES" as they provide information in relation to each road type. Make sure you do not confuse the notes from differing road types.

For example: Note 4 relates to where the authority has constructed the road to HD 26 design standards that they inform the undertaker *(possibly through gazetteer)* and the overall asphalt thickness is increased to 320 mm.
Note 6 relates to the use of HBM's and FCR's as combined base/sub-base and the minimum layer of asphalt overlay is 100 mm .

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Figure A3.4 – Flexible Roads Type 3

As already seen, **Method A** is the preferred option as the reinstatement works are completed in one visit.

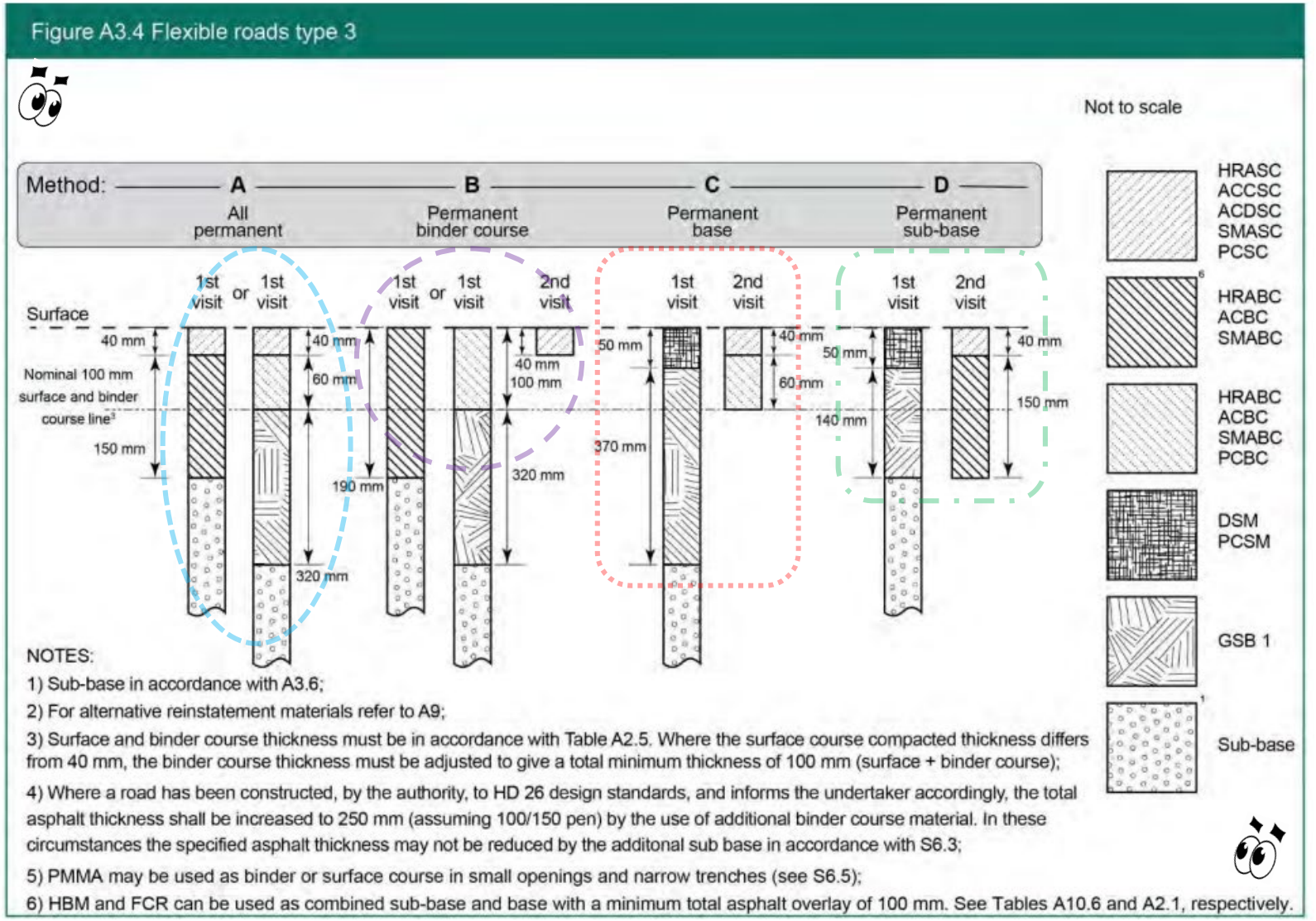
Method B will again mean you have the binder course, and all layers below it completed as permanent reinstatement.

This is a Type 3 Flexible road and, therefore, **Method C** will now apply as a permanent base course scenario.

Again, **Method D** would be highly unusual to apply where you have chosen to permanently reinstate sub-base layer and below.

You will notice that **Method C** is an option due to the fact that the base layer will now be an unbound GSB Type 1 material rather than a combined binder/base asphalt material as found in Type 0, 1 and 2 roads.

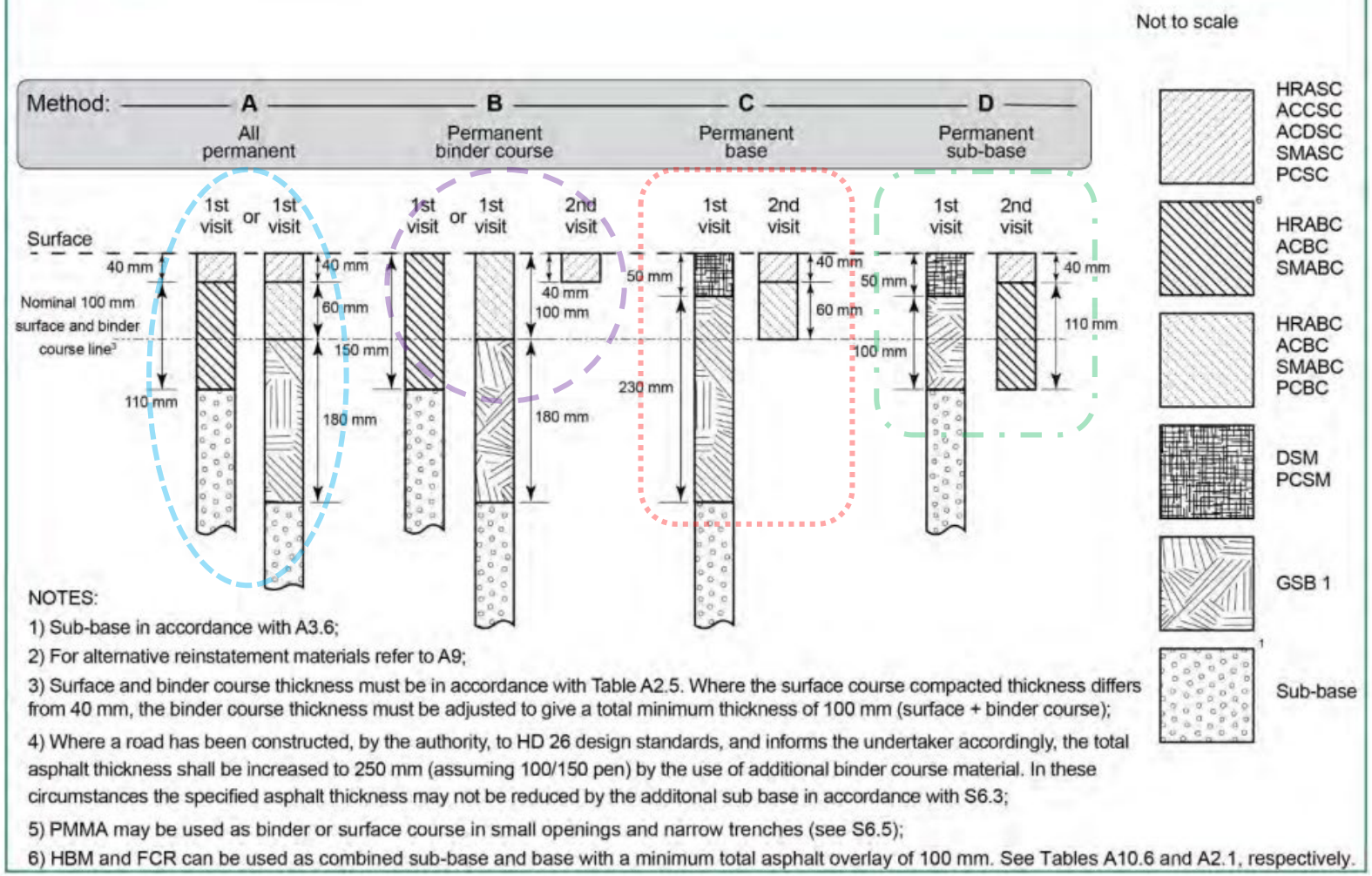
For a Type 3 road you will also notice you have a choice of reinstatement options for Method A and Method B.
If you replace the granular base layer *(320mm)* with asphalt material *(90mm)* and add it to the binder layer *(60mm)* which provides a combined binder/base layer of 150mm. This can be laid directly above the sub-base layer.



Appendix A3 – Flexible Roads

Figure A3.5 – Flexible Roads Type 4

Figure A3.5 Flexible roads type 4



NOTES:

1) Sub-base in accordance with A3.6;

2) For alternative reinstatement materials refer to A9;

3) Surface and binder course thickness must be in accordance with Table A2.5. Where the surface course compacted thickness differs from 40 mm, the binder course thickness must be adjusted to give a total minimum thickness of 100 mm (surface + binder course);

4) Where a road has been constructed, by the authority, to HD 26 design standards, and informs the undertaker accordingly, the total asphalt thickness shall be increased to 250 mm (assuming 100/150 pen) by the use of additional binder course material. In these circumstances the specified asphalt thickness may not be reduced by the additonal sub base in accordance with S6.3;

5) PMMA may be used as binder or surface course in small openings and narrow trenches (see S6.5);

6) HBM and FCR can be used as combined sub-base and base with a minimum total asphalt overlay of 100 mm. See Tables A10.6 and A2.1, respectively.

As already seen, **Method A** is the preferred option as the reinstatement works are completed in one visit.

Method B will again mean you have the binder course, and all layers below it completed as permanent reinstatement.

This is a Type 4 Flexible road and, therefore, **Method C** will now apply as a permanent base course scenario.

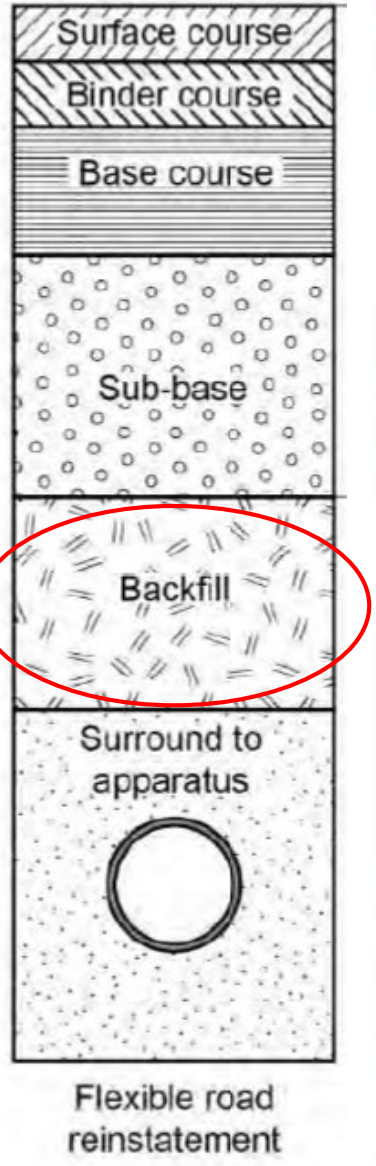
Again, **Method D** would be highly unusual to apply where you have chosen to permanently reinstate sub-base layer and below. Unless it's a full re-excavation.

Again, you will notice that **Method C** is an option due to the fact that the base layer is unbound GSB Type 1 material rather than a combined binder/base asphalt material as found in Type 0, 1 and 2 roads.

For a Type 4 flexible road you will see you again have a choice of options for Method A and Method B.
If you replace the granular base layer *(180mm)* with asphalt material *(50mm)* and add it to the binder layer *(60mm)* which provides a combined binder/base layer of 110mm. This combined binder/base layer can be laid directly above the sub-base layer.

Appendix A3 – Flexible Roads

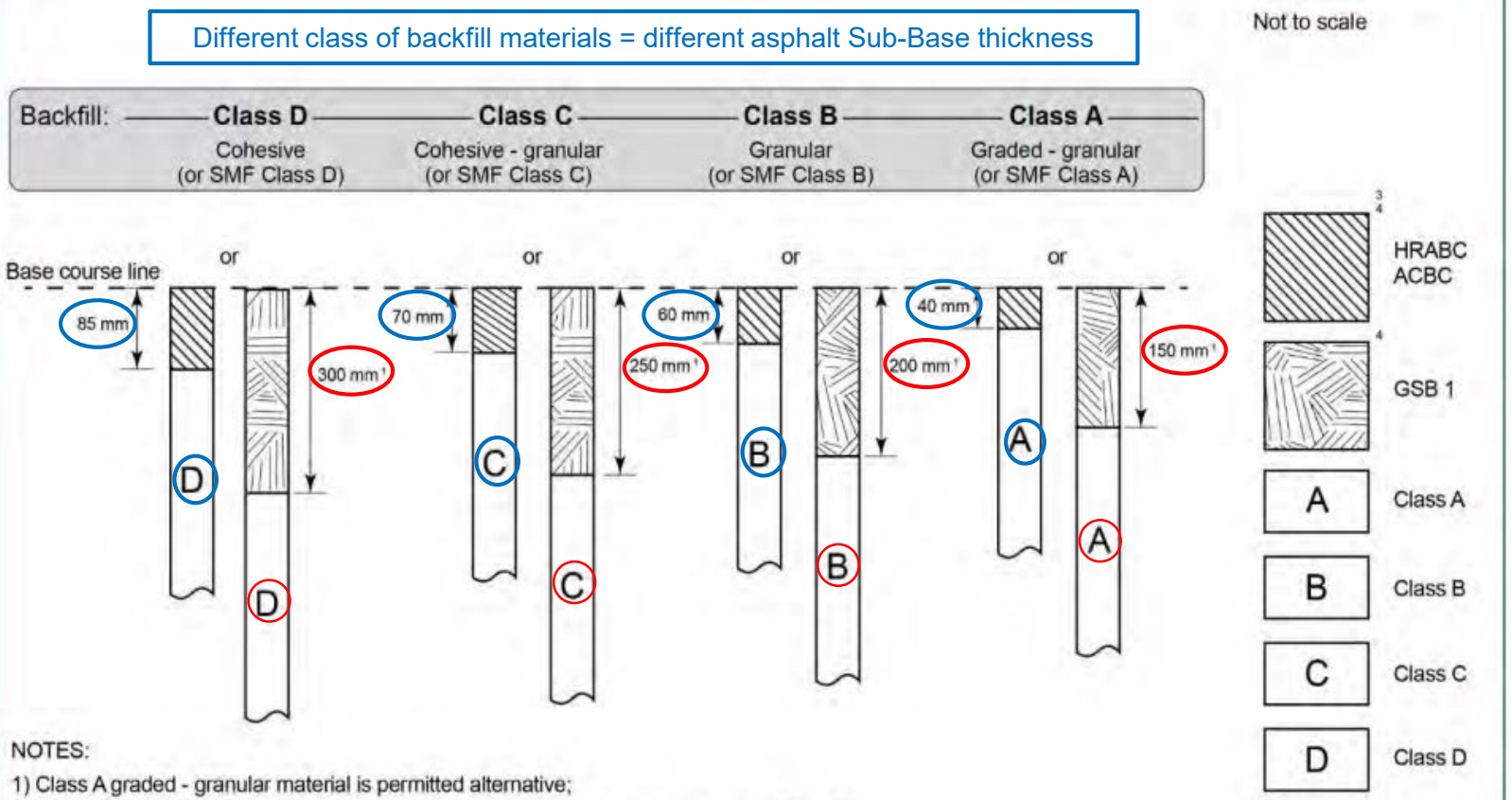
Sub-Base construction in flexible roads



Flexible road reinstatement

Figure A3.6 Sub-base construction for flexible roads

Different class of backfill materials = different asphalt Sub-Base thickness



NOTES:

1) Class A graded - granular material is permitted alternative;
2) In addition to SMF classes A to D, for other alternative reinstatement materials refer to A9;
3) PMMA may be used as sub-base in small openings and narrow trenches (see S6.5);
4) HBM and FCR can be used as combined sub-base and base with a minimum total asphalt overlay of 100 mm. See Tables A10.6 and A2.1, respectively.

Different class of backfill materials = different GSB 1 or class A granular Sub-Base thickness

If you have an asphalt combined binder/base layer, you can substitute granular sub-base with asphalt materials as seen from Figure A3.6 on the left. The thickness will also be determined by the class of backfill materials immediately below it.

The materials classified under SROH - S5 show how and where backfill materials are to be used. What we have to be aware of is that if you use a poorer backfill material, you are required to increase the Sub-Base layer to compensate for this (SROH – Figure A3.6)

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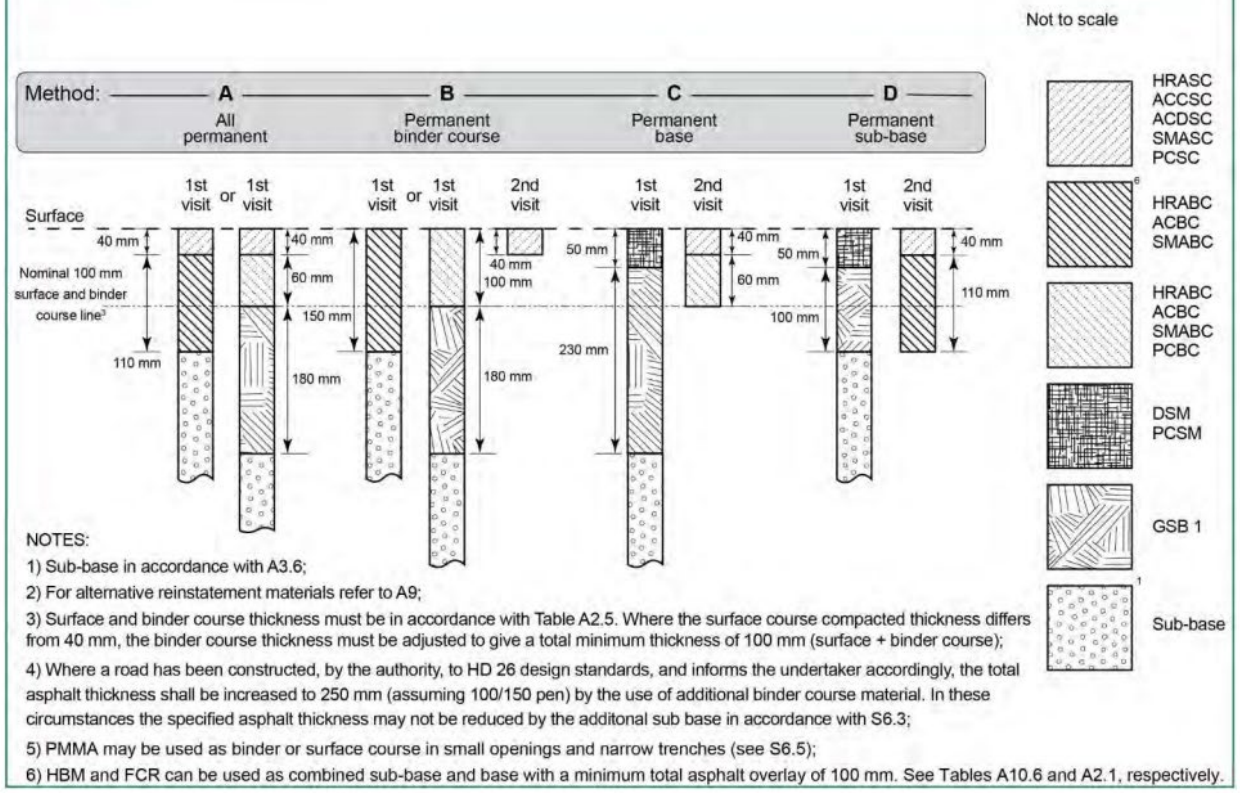
Flexible Roads and Sub-Base thickness

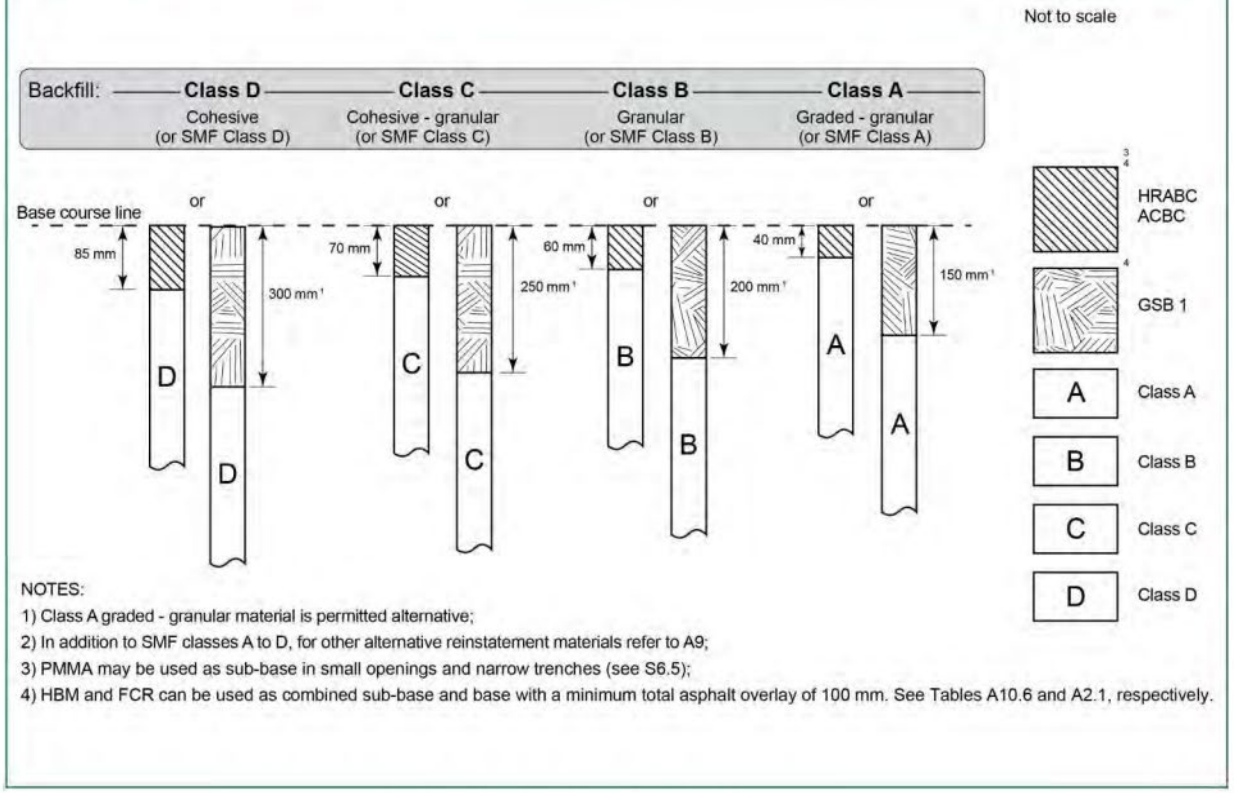
Figure A3.5 Flexible roads type 4



NOTES:

1) Sub-base in accordance with A3.6;
2) For alternative reinstatement materials refer to A9;
3) Surface and binder course thickness must be in accordance with Table A2.5. Where the surface course compacted thickness differs from 40 mm, the binder course thickness must be adjusted to give a total minimum thickness of 100 mm (surface + binder course);
4) Where a road has been constructed, by the authority, to HD 26 design standards, and informs the undertaker accordingly, the total asphalt thickness shall be increased to 250 mm (assuming 100/150 pen) by the use of additional binder course material. In these circumstances the specified asphalt thickness may not be reduced by the additonal sub base in accordance with S6.3;
5) PMMA may be used as binder or surface course in small openings and narrow trenches (see S6.5);
6) HBM and FCR can be used as combined sub-base and base with a minimum total asphalt overlay of 100 mm. See Tables A10.6 and A2.1, respectively.

Figure A3.6 Sub-base construction for flexible roads



NOTES:

1) Class A graded - granular material is permitted alternative;
2) In addition to SMF classes A to D, for other alternative reinstatement materials refer to A9;
3) PMMA may be used as sub-base in small openings and narrow trenches (see S6.5);
4) HBM and FCR can be used as combined sub-base and base with a minimum total asphalt overlay of 100 mm. See Tables A10.6 and A2.1, respectively.

Figure A3.5 above only shows the methods you apply in a Type 4 road reinstatement. Don't ever confuse the methods of reinstatement named "A" to "D" with the classes of materials allowed in the backfill layer which are named "A" to "E".

Figure A3.6 purely relates to how thick the sub-base layer should be after compaction in a flexible road. This is purely based on the quality of the backfill material immediately below the sub-base layer.

So you will see from Figure A3.6 that the 150mm thickness of the granular sub-base layer increases by a factor of 50 mm for each time the quality of material drops from a Class A. Therefore, a Class B backfill has a granular sub-base of 200 mm, and so on.

A3 - Summary

What are backfill materials?

They are materials found within the backfill layer immediately below the sub-base layer.

What is meant by flexible roads?

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

Does the class of backfill material make any difference to the reinstatement?

Definitely, the poorer the class of backfill material will determine the road construction as the sub-base thickness has to increase to compensate *(SROH – Figure A3.6).*

Can I use bituminous materials in the base and sub-base layers instead of granular?

Simply, yes! The base layer in types 0,1 and 2 roads is already an asphalt material and in types 3 and 4 you can replace granular base layer with asphalt. Therefore, as long as the layers above it are also asphalt, you can substitute granular sub-base with asphalt sub-base subject to layer thickness requirements of SROH - Figure A3.6

Why is it best to apply Method A when reinstating a flexible road?

Essentially, it is because you will be undertaking a first time reinstatement which does not need to be re-visited to complete the works. It is better for environmental, cost, and works timetable reasons to finish the works at first visit.