

Appendix A9 – Alternative Reinstatement Materials & Technologies



Researched, compiled and produced by



and



With support through TFL lane rental funding scheme

Introduction- SROH Appendix 9

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 A9 which will enable you to have a better understanding of what to look for when monitoring alternative reinstatement materials and technologies.



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 A9 – SMR's, TMF's, and other ARM's



What is the purpose of alternative materials or methods for reinstatement when we already appear to have sufficient options?

As you say, we already have a huge amount of materials at our disposal to carry out compliant reinstatements in Street Works. SROH Appendix 9 allows us to investigate other additional potential materials and/or methods which may become available to us as technology progresses.



Ok, so why do we have to carry out such extensive trials?

Well, you must understand that when you introduce something new to the materials or methods applied in the SROH, they have to be trialled and tested to ensure they are suitable for purpose. Trials cannot be done in a simple or short manner, so therefore have to be properly applied as per the suggested procedure as shown in SROH A9.5



Ahh!, so unless I introduce something new, I don't necessarily need to apply SROH A9?

Exactly, SROH A9 only applies where you want to introduce new materials or methods. Otherwise follow the SROH for standard practices.



Appendix A9 – SMR's, TMF's, and other ARM's

What it says in the SROH

A9.1.1 New or alternative reinstatement materials (ARMs) and alternative technologies (ATs) may be developed for use in street works. ARMs and ATs might be used to improve safety or reduce disruption, cost, noise or other environmental impacts.

Essentially, there are three groups of ARM's:

1. **Structural Materials for Reinstatements (SMR's)**
2. **Treated Materials for Fills (TMF's)**
3. **Other types of ARM's** (items such as certain modified asphalts that are not already covered in the SROH, but still have to achieve minimum performance requirements as specified within it).

There are two types of SMR materials.

Flowable SMR's.



Non-flowable SMR's.



TMF material.



Other ARM material.



What it means

The SROH allows for innovation in materials and technologies that are developed for use in street works. They may only be allowed for use where it has been proven that they are trialled, tested, and found suitable for intended purpose. This will be discussed further as we work through this document.

So, if I develop a new material or method for use in reinstatement, I can use it because its innovative or environmentally friendly?

Absolutely not, it will have to be trialled and tested under an approved scheme as outlined in SROH A9.5, which could potentially take between 2 and 5 years to gain approval.



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Remember, these materials and methods can only be used with permission.

A9.2.1 ARMs and ATs may only be used with the agreement of the authority obtained in accordance with the approval process described in A9.5.

The same requirements apply to Alternative Technologies (not just materials) ATs must be used in accordance with the procedures established by prior development and testing.

Where the authority is aware of areas with drainage or groundwater problems, it should notify the undertaker. Following such notification, the undertaker must provide ARMs that are permeable to a degree not less than the surrounding ground at backfill and sub-base levels within trench reinstatement.

A9.2.6 Surfacing materials must not be reinstated until the ARM has attained sufficient strength or has an immediate bearing index sufficient to allow adequate compaction of overlaying materials and sustain adequate traffic loading.

🐼 This simply means no surfacing until the material is set and strong enough. 🐼



Water in trench

The producer must maintain a Quality System that includes policy and procedures for production control. ARMs must be produced, handled, transported and used in accordance with the approved and tested mix formulations and procedures.

The authority must be notified of any alterations to the proven mix formulations, mix proportions, aggregate type, admixtures, procedures, etc. Confirmation of their suitability must be agreed, and further development and testing may be needed.

A backfill layer of pea gravel of 100 mm minimum thickness and surrounded by a geotextile filter fabric (where appropriate) may be considered to offer equivalent drainage potential.

A9.2.7

FSMRs can flow into any damaged drains or ducts nearby. Where required, plastic sheeting may be needed to provide protection during pouring.

🐼 This is common sense when you think about it. You wouldn't want it to flow into a pipe or drain and set causing a serious blockage. 🐼



Blocked pipe

Appendix A9 – Structural Materials for Reinstatement (SMR's)

What it says in the SROH

A9.1.3 SMRs include proprietary or alternative bound reinstatement materials that have a bituminous, cementitious, chemical or hydraulic binder or are inherently self-cementing.

We already have shown there are both flowable and non-flowable SMR materials. However, what we must know is that they are structural, and have to achieve a minimum compressive strength value depending on where they are used, as can be seen from SROH Table A9.1

Table A9.1 SMR minimum layer thickness and strength requirements

Layer	Road type					Footway, footpath or cycle track
	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
Strength class at 28 days	C3/4 minimum to C9/12 maximum C1.5/2 minimum to C9/12 maximum					

NP = Not Permitted (see A9.3.1)

What it means

Structural Materials for Reinstatement (SMR's) are usually made up from a mixture of different types of materials which are bonded together by some form of binder material such as cement, lime, other chemical, and/or water.

Can I use either a flowable or non-flowable SMR material in place of a Type 1 or granular graded material?

Not really, as these materials are excluded from some structural layers within a reinstatement depending on road category, as seen in SROH Table A9.1 shown opposite.



Core sample taken from Non-flowable SMR material

Do not confuse the term SMR (*Structural Material for Reinstatement*) with any additive or product using the same or similar name. Such additives may be the required binding agent to create a structural material when properly mixed or manufactured, but they are not a structural material for reinstatement on their own.

If cube samples for testing have not been taken at time of manufacture or laying, another method is by performance testing in-situ by core samples extracted from site after 28 days curing has passed. If a sample cannot be successfully extracted, it is likely the material is not performing as an SMR according to Table A9.1 and therefore may be non-compliant.

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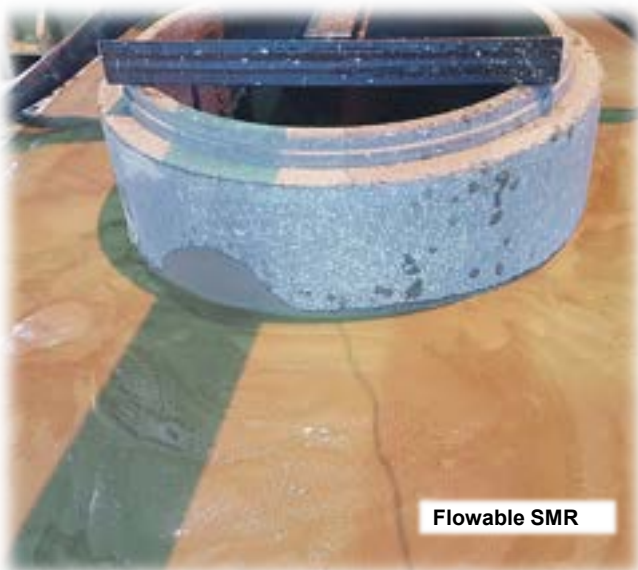
Flowable & Non-Flowable SMR materials

Flowable SMR's (FSMRs)

- PMMA (Polymer Modified Mastic Asphalt) and FCR (Foamed Concrete for Reinstatement) complying with A2.5 are not FSMRs and are not required to comply with A9.
- With the above exceptions, FSMRs comprise any type or combination of aggregates and binders that are flowable and do not normally require compaction.
- FSMRs may be used by agreement with the authority following the procedure detailed in A9.5.
- Layer thickness and compressive strength requirements must be in accordance with Table A9.1.

Non-Flowable SMR's (NFSMRs)

- HBM's (Hydraulically Bound Materials) complying with A10.2 are not NFSMRs and are not required to comply with A9.
- With the above exceptions, NFSMRs comprise any type or combination of aggregates, soils and binders that are non-flowable mixes, and they normally require compaction on site. These materials may be used by agreement with the authority following the procedure detailed in A9.5.
 - Layer thickness and compressive strength requirements must be in accordance with Table A9.1.



So, do I need to seek approval from the local authority to use flowable or non-flowable SMR materials?

Yes, you may use these materials upon agreement with the local authority as stated under SROH A9.1 as long as they have been fully trialled under the procedure in A9.5

If I can demonstrate the material has passed the trial process outlined in A9.5, can the local authority still refuse permission?

The local authority cannot unreasonably withhold permission to apply these materials or methods, and can only deny such permission if it relates to a specific engineering reason.



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Treated Materials for Fill's

What it says in the SROH

A9.1.4 TMFs comprise any type or combination of aggregates, soils and binders that are non-flowable mixes and they normally require compaction on site. These materials may be used by agreement with the authority following the procedure detailed in A9.5.

What it means

Treated Materials for Fills (TMF's) are made up in a similar way to NFSMR materials but with one important difference. They are not structural in nature, and should not be applied in the structural layers within any reinstatement. In other words, they are modified fill materials for backfill layer only, and must be subject to A9.5 test procedure.

If a TMF material is manufactured in a similar way to a non-flowable SMR, can I use it in a sub-base layer?

No you cannot. These materials are only for use in backfill layer as they are not structural, and can also be similarly classed as equivalent to A, B, C and D backfills.

Thanks, so if I have one of these classes of TMF, I can then use within the backfill layer?

Only once they have passed the trial and test process as outlined in SROH A.9.5, and agreed with the local authority. If they are agreed, they should be applied as usual backfill materials.

What do you mean, usual backfill?

That structural Sub-Base layer thickness adjustments are made based on the class of backfill (A,B,C,D - SROH A3.6, A4.5 & A4.6).

CBR

(California Bearing Ratio)
Is a value which measures how resistant any type of ground is to pressure from above. This is why it also measures compaction.

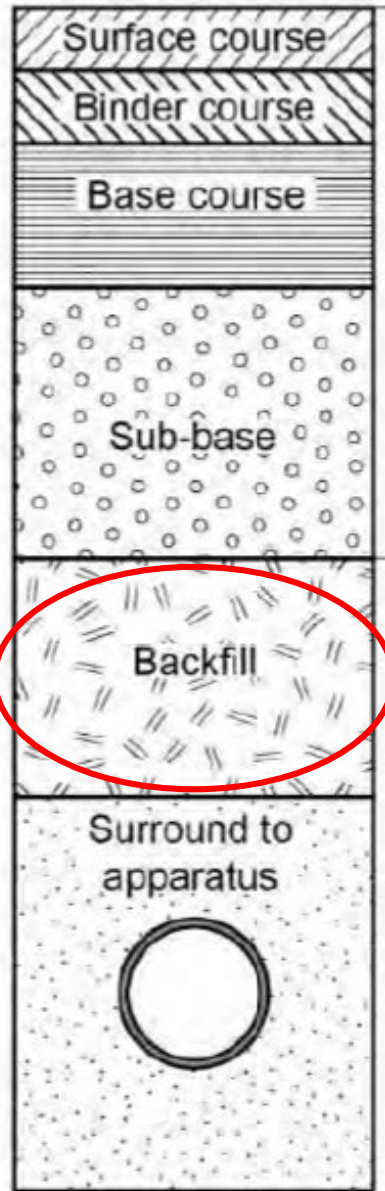
CBR requirements must be in accordance with Table A9.2.

Table A9.2 TMF CBR requirements

SMF class	% CBR
A	>15
B	7 to 15
C	4 to 7
D	2 to 4

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Treated Materials for Fill's

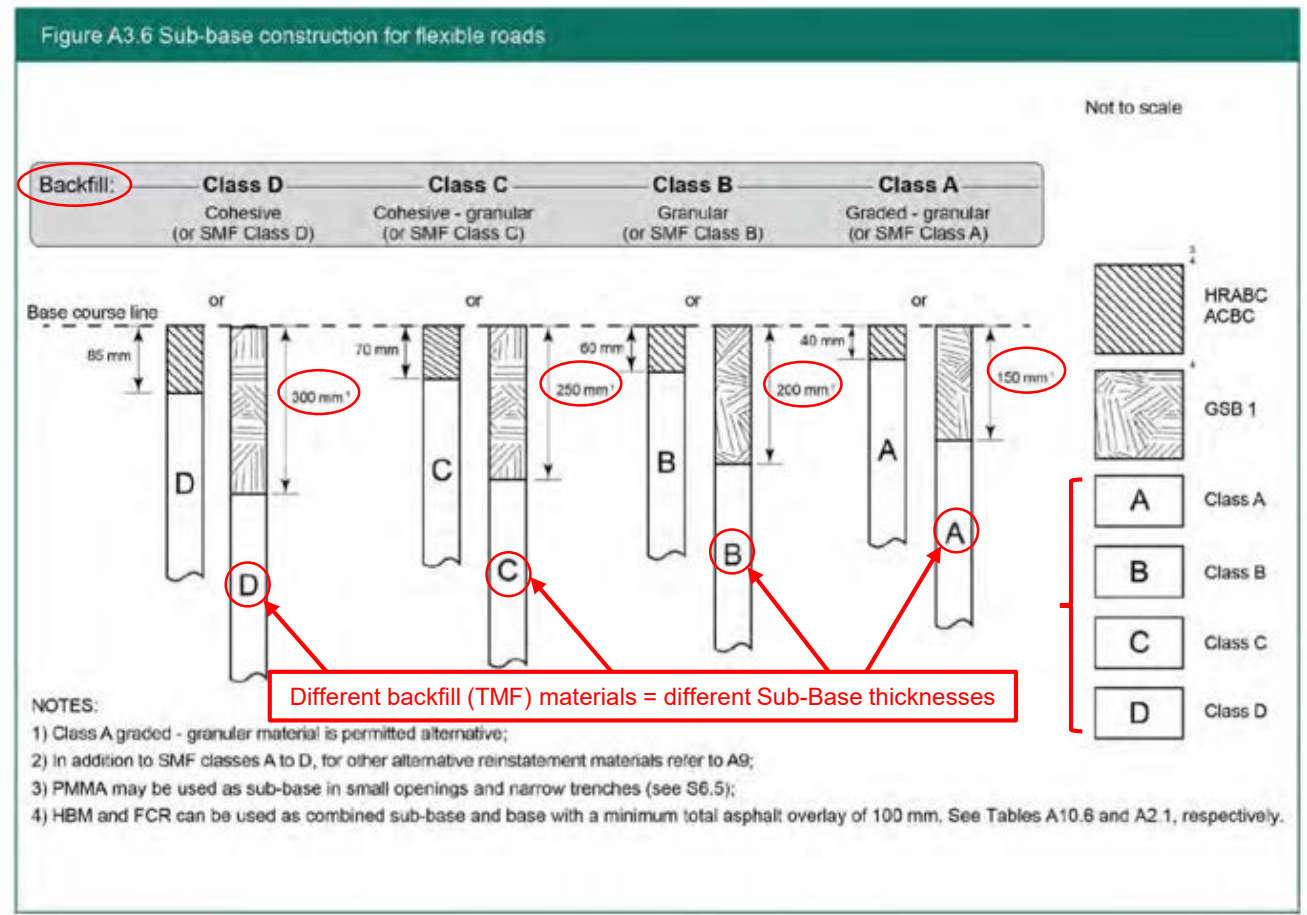


Flexible road reinstatement

Remember, the application of TMF's are exactly as standard backfill materials. Do not mistake the backfill layer with any other layer. The Base and Sub-Base layer's sit above the Backfill layer and are structural through using the correct materials and methods to maintain strength and integrity and TMF's do not apply to these layers.

The materials we find 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)

NOTE
For each drop in backfill (TMF) material class, the Sub-Base increases by 50mm



Appendix A9

Remember, all the materials and methods (ARM's & AT's) outlined or proposed which fall under the requirements of SROH appendix A9 can only be applied after being successfully trialled and upon agreement with the local authority.

However, as mentioned previously within this document, if a material or method has already been successfully trialled and has been granted permission for use within England and Wales, it should only be refused based on engineering reasons.

Where such materials are applied, regular manufacturing and performance checks will ensure that the quality of the materials or methods are maintained in line with the original trial and test criteria in terms of suitability for purpose.

Regular testing of manufacturing process (factory testing) will show that the material is being produced using the correct and proper materials and methods. Performance testing will verify if a material has been correctly laid and compacted.

Factory testing of either FSMR or NFSMR materials can include items such as cube or cylinder sample testing where a sample of newly mixed material is placed in a mould and cured by a method equating to 28 days hardening.

Performance testing of FSMR or NFSMR materials can include the extraction of a core sample from the material at sometime after the initial hardening of 28 days where it has been either poured (FSMR), or placed and compacted in-situ (NFSMR).

Testing of SMR materials will usually relate to compressive strength (similar to concrete method). The curing process is accelerated for samples taken at time of manufacture or laying by immersing in a water filled curing tank. Core samples should not be taken within 28 days as the material needs to cure naturally before extraction.



Testing of TMF materials will usually relate to CBR% values (California Bearing Ratio). This essentially measures the bearing or weight capacity the material will have once properly laid. Weaker materials will have a lower CBR% value. This value can be achieved through several differing laboratory test methods.

All tests must be carried out by a UKAS (or equivalent) accredited laboratory holding current UKAS accreditation for the specified test methods unless agreed otherwise.


Appendix A9.5

Outline scheme for approved trials


What it says in the SROH

A9.5.1 Trials of ARMs or ATs may be carried under an approval trial agreement between the undertaker and the authority.

Essentially, this is what A9 is all about. The way you should approach the trial and testing of potentially introducing a new material or technology.




SROH A9.5 provides the procedure on how to create and carry out the trial and testing of a new material or technology. This will involve agreement between the undertaker promoting the product, and the relevant local authority.



When an ARM or AT has been approved by an authority following a successful trial, the undertaker can provide another authority with the trial data and ask permission to use the ARM or AT in its area.

An ARM or AT trialled and approved by one authority must be accepted in different authority areas unless there is a reasonable engineering concern that requires local validation. Authorities can, within reason, request additional information if they have valid engineering concerns.



ARMs and ATs can be used without trials if an authority agrees. However, where no trials have taken place, there is no requirement for another authority to accept the use of those ARMs or ATs.



Appendix A9.5

Outline scheme for approved trials

The approved trial process is quite involved and includes many elements, but we will provide a **basic** outline here to assist in description.

General requirements for approved trials

- 1 Trials may be undertaken in any road category with the approval of the authority. Trials cannot be undertaken in a high amenity or high duty footway, footpath or cycle track. Off-site trials may be undertaken if appropriate.
- 2 Approval trials in carriageways must be conducted on a minimum of three separate sites selected to represent a range of traffic conditions. A number of positions in the carriageway should be selected (*in or out of wheel track, on trenches, etc*)
- 3 The duration of all approval trials must be agreed between the undertaker and the authority. The duration will depend on evidence of performance, timescale to demonstrate performance and type of ARM or AT.
- 4 A record of all test sites must be kept to enable effective monitoring and management of the asset. Specific details must be agreed as part of the **Memorandum of Understanding** for the approval process.
- 5 The final inspection must be completed within one month following the end of trial period. The undertaker must notify the authority of the inspection date at least seven working days in advance.
- 6 Core sampling and interim inspections of any type may be carried out on approval trial reinstatements at any time. The undertaker must notify the authority at least five working days in advance of such works.
- 7 Reinstatements may be accidentally damaged during the trial and rendered unsuitable for accurate assessment. It is therefore recommended that trials should include duplicate sites of the same type and category.
- 8 Where an approval trial reinstatement requires remedial action, then regardless of the reason, the undertaker must provide the authority with details of the remedial measures within one month of completion.
- 9 With the approval of the authority, further use of the ARMs or ATs under trial may be permitted before completion of the trial. Such approval will only apply to works carried out within the boundary of the authority that has given approval.
- 10 On successful completion of the approval trial, the results, audit trail and Factory Production Control or Quality System documentation should be shared with other authorities from whom permission for further use is to be sought.
- 11 After successful completion of an approval trial, permission for further use of the ARM or ATs must not be unreasonably withheld by any other authority and must only be denied for engineering reasons. Otherwise, an additional assessment may apply.
- 12 It is recognised that the scope, extent and duration of ARM and AT approval trials may vary widely. ***This essentially means the trial may take longer, or may need further monitoring, testing or locations to provide a confident result.***

Appendix A9.5.6

Special considerations for approved trials



For small-scale approval trials intended to take place on a small number of sites and over a fixed period of time (e.g. for specially prepared approval trial excavations), the undertaker must notify the authority at least one month in advance of each trial.

Specially prepared excavations should be of similar depth and plan dimensions to the undertaker's routine excavations, and generally not less than 500 mm by 500 mm in plan, or not less than 200 mm wide for trench excavations (*minimum of 2m² overall combined size*).

The location and position of the approval trial reinstatements should represent as wide a range as possible (*see item 2 on previous page*). If specially prepared sites are to be used, the site locations may be jointly selected between the parties.

Large-scale trials, such as those where the material or technique is used during works, may take place over a longer time period. The undertaker must notify the authority of such trials at least one month before they start. *This essentially relates to trials in real works situations*

The agreed trial period starts on the date of installation. Dates for submission of an interim report on the trial should be agreed, with the report being submitted in the agreed period. The final review or reporting must be carried out when the trial sites have reached the agreed age.

Any restrictions on size, location and position, number of approval trial sites or the period during which the approval trial reinstatements may be carried out, should also be included in the approval trial agreement. *In other words, changes from recommended sizes or locations.*



Appendix A9.5.7

Duties of parties to approved trials

What it says in the SROH

A9.5.7.1 The initiator (usually the undertaker) would be expected to have carried out documented development work to ensure a high level of confidence in the proposed ARM or AT before starting the approval process. The results of such development work should not be unreasonably withheld from the authority.



This simply means that the undertaker proposing the new material or technology will have already have access to significant research and testing of the material, and would be able to demonstrate this to the local authority. If such information is unreasonably withheld, it may cause concern for the local authority who may require a deeper trial and verification process.

The undertaker must provide as much notice of the approval trial reinstatement operation(s) (e.g. location, date/time, excavation, mixing, reinstatement, sampling, post-construction activities etc.)



This is a requirement that the undertaker proposing the new material or process will give sufficient notice to the local authority along with providing all relevant information of means and methods required for the trial scheme to commence.

The undertaker must not unreasonably withhold information relating to any aspect of the approval trial from the authority.



Withholding relevant information from the local authority will not benefit the trial process, and must be provided if material or technology is to be trialled and adopted.

The authority must not unreasonably obstruct approval trials or cause their termination provided they are carried out in accordance with the terms of the approval trial agreement.



The local authority cannot interfere with the trial process in a subjective or unreasonable manner. This will support the process in being properly executed in terms of trialling the new material or technology.

Either party has the right to request confidentiality on any matter relating to the approval trial.



For understandable reasons, either party may require confidentiality in terms of the material or technology used. Commercial sensitivity may be one reasons for this.





Appendix A9.5.8

Suggested information for inclusion in approval trial agreement

General Information

- 1) Parties to trial** – names of undertaker and authority agreeing to approval trial
- 2) Confidentiality** – parties (if any) to whom trial information may be divulged
- 3) Geographical extent of trial** – county or district border, utility region or area boundary
- 4) Scope of trial** – total number of trial reinstatements or maximum number of sites
- 5) Time limit for trial** – start/end dates
- 6) Termination criteria** – conditions under which agreement may be ended and notice of termination
- 7) Signatories/witnesses** – approved officers of appropriate seniority who are permitted to commit their organisation to the execution of the approval trial and who can approve the terms and conditions of the trial
- 8) Record of sites where the ARM or AT has been used and dates of installation.**

Procedural

- 1) Contemporary records**
– details of records required, responsibility for record-keeping
- 2) Notification details**
– notice periods, arrangements for contacting relevant parties to an approval trial
- 3) Attendance at trials**
– parties who may attend an approval trial
- 4) Review periods/meetings**
– dates, participants, procedures for calling ad hoc meetings
- 5) Post-construction assessment**
– test methods to be employed and arrangements for periodic surveying, sampling, etc



Technical

- 1) Type of trial site** – routine utility excavations or specially excavated approval trial
- 2) Location of trial site** – non-high-amenity or non-high-duty footway, cycle track, (including road classification Type 2 to 4) etc
- 3) Positioning of trial site** – “as excavated”, within wheel track, etc
- 4) ARMs or ATs to be trialled** – generic SMR or SMF materials
- 5) ARM or AT details** – Mix design, binder details, additives, dependencies on site conditions or excavated/base material type and condition, details of prior development work
- 6) ARM or AT preparation** – batching, mixing and placement procedures.
- 7) Quality control on site** – any tests to be applied to ensure that an ARM has been prepared to the required design
- 8) Compaction regime** – NFSMRs and SMRs only
- 9) Sampling requirements** – types of samples and sampling frequency
- 10) Testing laboratories** – contact details of accredited laboratories or otherwise
- 11) Remedial measures for “failed” sites** – replacement with an alternative SMR or SMF material or other approved material or remove from the approval trial agreement
- 12) Future of trial sites** – remove after trial completion or leave in place, future monitoring or testing
- 13) Any specific assessment management or maintenance requirements.**
- 14) Confirmation of compliance** - with all SROH performance requirements; linked to inspection and defects



A9 - Summary



What does ARM stand for?

ARM stands for an Alternative Reinstatement Material.

How about an AT?

This simply means Alternative Technology, and will relate to a new method or means of completing a reinstatement.

Where can an ARM be used?

Generally, they can be used as any part of the reinstatement, but you have to ensure of at what layer or level they can apply. For instance, you cannot use a TMF (Treated Material for Fill) in any structural layer above the backfill.

What does an Approved Trial involve?

An approved trial will be agreed between the promoting undertaker and the local authority. It will determine the scope, time and testing required to gain approval to a specific material or technology.

How long does an approved trial take?

Generally, the approved trial will be agreed by the parties but the usual period is in the region of two years so ample time can pass to ensure that the alternative material or technology will prove compliant and suitable in a real world application.

