Recycled materials in trench reinstatement

This guidance document is written for anyone involved in procurement, specification or overseeing installation of trench reinstatement materials.
WRAP helps individuals, businesses and local authorities to reduce waste and recycle more, making better use of resources and helping to tackle climate change.
Introduction

The function of this guide is to provide the Street Works Community [Utility Companies, their Contractors, Local Authority Inspectors and Materials Suppliers] and other interested parties with an overview of the use of recycled materials in street works and the techniques associated with waste avoidance. It is complimentary to existing specifications, which detail methods and permissible material options for the reinstatement of openings in highways.

The ‘Specification for the reinstatement of openings in highways, second edition’ (2002), herein referred to as the Specification, is the statutory document for street works in England, under the New Roads and Street Works Act (1991). In Wales, an equivalent code of practice was published under the Street works (Reinstatement) (Amendment) (Wales) Regulations 2006. A third edition of the Specification has been drafted by the national Highways Authorities & Utilities Committee, HAUC (UK), and is under consultation in England and Wales.

A similar second edition code of practice was drafted for Scotland by the Roads Authorities and Utilities Committee (Scotland) [RAUC(S)] under the Road Works (Reinstatement) [Scotland] (Amendment) Regulations 2003. The ‘Specification for the reinstatement of openings in roads, second edition’ (2006) is the statutory document for street works in Northern Ireland under, the separate but parallel legislation, the Street Works [Northern Ireland] Order 1995. This code of practice is based on the Specification and has been adapted, where necessary, for use in Northern Ireland by the Department for Regional Development and the Northern Ireland Road Authority and Utilities Committee [NIRAUC].

HAUC [UK] have also produced supporting guidance including a practical guide to street works and an advice note on the use of alternative reinstatement materials; (Figure 1).

Background information

In November 2005, WRAP (Waste & Resources Action Programme) commissioned research to investigate the use of trench arisings and other recycled materials in gas and water company trenches. The research estimated that arisings from companies’ asset renewal throughout Great Britain was 4.8 million tonnes per annum, with about 2.5 million tonnes being landfilled.

Further research commissioned by WRAP examined the technical aspects of using recycled reinstatement materials and performance testing.

WRAP have developed a suite of voluntary agreements for the utility industry and a database of street works recycling to help improve the materials resource efficiency of the sector.

Standards and specifications

The Specification draws upon specifications in the Highways Agency’s, Manual of Contract Documents for Highway Works (MCHW), and associated guidance and material and mixture standards, such as the harmonised British and European Standards (BS ENs) – see the Table of Standards at the end of this guide. All of which fully incorporate and support the use of recycled aggregates.

The Specification and associated guidance allow the use of a wide range of materials, including mixtures complying with BS ENs and proprietary products. Furthermore, specific provision is given for the use of recycled aggregates, hydraulically bound mixtures and trench arisings within the Specification.

The relevant standards, specifications and regulations regarding resource recovery, mixture design, material production and application minimise and mitigate risk to the asset owner, the supply chain and the environment. Therefore, perception of risk should not be a barrier to the use of trench reinstatement materials produced and used in accordance with the Specification, whether these are primary or recycled materials within bound or unbound mixtures.
Sustainable material usage

Materials resource efficiency
Not generating waste and recycling waste arisings can deliver savings by avoiding costs associated with new materials, waste disposal and haulage.

The waste hierarchy (Figure 2) is a well known and understood concept that should be considered for all trenching activities. The principle objective is to use materials more efficiently and to reduce the amount of waste requiring final disposal. This means that it is preferable to:

- reduce the quantities of waste generated (for example, by using trenchless technologies);
- reuse materials as they arise (for example, on site segregation and reuse of granular materials for backfill);
- recycle trench arisings (for example transfer arisings to a local hub for processing into a reinstatement material – closed loop recycling);
- procure recycled content (for example, use a recycled aggregate subbase in preference to a primary aggregate subbase);
- send excess materials for recycling rather than for landfill disposal; and
- only send materials unsuitable for recycling for landfill disposal.

Sustainable construction
The Strategy for Sustainable Construction\(^{17}\) sets out specific actions by Government and by industry in England which will contribute to the achievement of overarching targets within each of the main areas covered by the sustainability agenda.

It represents a commitment from industry to work towards reducing its CO\(_2\) emissions and its consumption of natural resources. The industry wide target for waste is:

- By 2012, a 50% reduction of construction, demolition and excavation waste sent to landfill, compared to 2008.

This target for England is complemented by targets to:

- Reuse or recycle 75% of construction, demolition and excavation wastes by 2020\(^{18}\) (Northern Ireland);
- Reduce business waste, including construction and demolition waste, by 200,000 tonnes a year\(^{19}\) (Scotland); and
- Move towards becoming a zero waste nation (Wales)\(^{20}\).

The strategy\(^{17}\) also recommends that improving logistics can help towards achieving the vision. Improved logistics:

- Reduce the number of vehicle movements, which reduces the associated carbon emissions; and
- Avoid unnecessary loading and unloading of materials, minimising congestion and easing traffic flow.
Materials flow
Where waste reduction or reuse is not feasible, then recycling of trench arisings to improve materials resource efficiency should be considered. The WRAP guidance document – Recycled and stabilised materials in trench reinstatement – highlights good practice in recycling trench excavation wastes. A simplified materials flow for trench reinstatement works is shown in Figure 3.

How the materials are used
The waste hierarchy for materials resource efficiency in street works includes reducing volumes of waste and increasing the reuse of materials as they arise. The Net Waste Tool developed by WRAP calculates the waste arising on a construction project, to quantify the overall Net Waste for the project, and shows how recycled content can be improved. Recycling options include procurement of recycled materials or sending excess materials for recycling, rather than landfill disposal. Responsible sourcing of any material includes efficient logistics to minimise haulage and empty vehicle movements and ensuring that the materials are fit for purpose.

The overarching targets from the Strategy for Sustainable Construction include:
- “to achieve improved whole life value through the promotion of best practice construction procurement and supply side integration”; and
- “that the materials used in construction have the least environmental and social impact as is feasible both socially and economically”.

Durability
Few untried and truly new materials are being used; the majority of ‘new’ materials relate to a material or product group with an existing track record. For example, soil stabilisation has a UK track record longer than that of bituminous bound mixtures (asphalt). However, the situation can appear confusing in the street works sector as there have been a series of products developed which specifically target reinstatements and have proprietary names. There can be a perception that these materials fall outside the Highways Agency’s Specifications and material and mixture standards, but they may well be compliant with them. The durability and performance requirements for proprietary materials that are not covered by such standards and specifications are dictated by the Specification.

Durability and performance of materials is ensured through a combination of the Specification requirements, and ensuring that feedback and research on materials, mixtures and products are incorporated into supplementary guidance and revisions to the Specification. Material suppliers may also be able to provide additional information about specific products.

Figure 3: Simplified materials flow highlighting good practice
Recycled materials in trench reinstatement

**CO₂ emissions assessment**
Several tools are available for CO₂ emissions assessment of materials, based upon general assumptions of production technique and associated processes. The WRAP CO₂ emissions estimator tool\(^1\) assesses the CO₂ output resulting from four types of construction material:

- bitumen bound mixtures;
- concrete mixtures;
- hydraulically bound mixtures; and
- unbound mixtures.

Haulage distance is an important factor when assessing the CO₂ emissions of material options, as a reduction in haulage can significantly reduce emissions. This may be achieved by identifying a locally available source or reducing empty vehicle movements by delivering and collecting material at the same location.

**Right material**
Selection of permissible material depends on the following factors:

- suitability;
- availability;
- economics;
- vicinity / haulage;
- recycled content;
- installation considerations; and
- nature and extent of works.

**Right first time**
Quality control is an important aspect of sustainable construction. Right first time reinstatement will result in a reduction in defects and a reduction in materials being wasted. It ultimately reduces the costs associated with the reinstatement process. In addition, right first time reinstatement leads to increased confidence and subsequent up take of materials and mixtures.

Material specifications for the relevant reinstatement application are covered by the Specification\(^1\), and quality control of material production is addressed by the suite of BS ENs related to concrete, bituminous bound, hydraulically bound and unbound mixtures – see the Table of Standards. Quality production of recycled aggregate is addressed by the WRAP Quality Protocol for the production of aggregates from inert waste\(^2\). In addition the AggRegain specifier tool can help users choose the right aggregate for the right application.

**Recovery of waste**
The recovery of aggregate from a waste stream must be clearly demonstrated for the aggregate to be used as a product.

The Quality Protocol\(^2\) provides a uniform control process for producers, from which they can state and demonstrate that their product has been fully recovered and is no longer a waste. The framework in the protocol provides a clear audit trail for those responsible for ensuring compliance with Waste Management Legislation.

Information on purchaser’s, specifier’s and producer’s roles and responsibilities for ensuring full recovery can be found on the AggRegain website, www.aggregain.org.uk
Process for reinstatement

The Specification details where materials are permitted for use, both for the class of road and the level within the reinstatement, and the technical and performance requirements associated with that use. Therefore, the Specification should be referred to in the first instance when selecting material for reinstatement. Site specific conditions may require further consideration and early liaison with the highway/road authority is recommended to address potential engineering or technical issues. For example, soft ground, a high water table or a network of utilities at different levels in the reinstatement may negate the suitability of compacting a material, in such cases a flowable reinstatement material may be considered as a preferred option.

Key elements of good practice for materials use in trench reinstatement are set out in the framework shown below (Figure 4) and described thereafter. This framework for assessing the wide range of permitted material options and the over-riding principles it embodies hold true for all material use in reinstatement works, whether primary or recycled materials within bound or unbound mixtures.

Material acceptance
Recycled or primary materials, or any combination thereof, are permitted by the Specification provided they meet the performance requirements and any compositional requirements detailed in the Specification for the relevant road type and level in the reinstatement.

Series 800 of the Highways Agency’s Specifications states the content of foreign materials (including wood, plastic and metal) shall not exceed 1% by mass for aggregate used in unbound mixtures. The maximum limits for impurities within HBMs ranges from 3 to 5% by mass, and the maximum limits for wood within an HBM is 1 to 2% by mass, depending on the binder used for the HBM.
Material options for use in reinstatement

There is a variety of material options for trench reinstatements, which can be broadly grouped into concrete, foamed concrete, hydraulically bound mixtures (HBMs), bituminous bound mixtures (asphalts) and unbound mixtures. Each of these groups is characterised by the material’s engineering behaviour, with the performance and durability of these materials accounted for in the Specification1.

It is important to select the right material for the appropriate application. Where materials can be used is dependent on location of the excavation and level within the reinstatement. The incorporation of recycled aggregates into concrete, foamed concrete, HBMs, asphalt and unbound mixtures are all publicised and increasingly well understood. Capital investment and research has led to increased availability of recycled aggregates and increased confidence in their application. A summary of materials suitable for use within trench reinstatement is given in Table 1, with guidance on their potential for recycled content.

Approval status
Specific provision is given for the use of recycled materials and the reuse of trench arisings within the Specification1, either as unbound or bound mixtures. This has recently been complemented by Advice Note No 2009/011, which has been produced “to clarify various issues associated with Appendix A9” of the Specification1.

Advice Note No 2009/011 confirms that:

- Materials complying with Series 800 of the Highways Agency’s Specification15 can be used without an Appendix A9 trial. Series 800 includes specifications for HBMs in subbase and base layers; and
- When a material has gained approval from one Authority (and the results and audit records are available), other Authorities cannot withhold permission to use the material unless there are engineering reasons for doing so.

Recycled materials
Recycled aggregates are derived from the processing of inorganic material previously used in construction. This includes processed trench arisings (covering as dug soils, aggregate, asphalt and/or concrete), Recycled Concrete Aggregate (RCA), Recycled Asphalt Planings (RAP) and Recycled Aggregate (RA). Secondary (industrial by-products) or manufactured aggregates can be used in place of primary reinstatement materials. For simplicity, both are referred to in this guide as recycled aggregates. Some of these materials, such as pulverised-fuel ash (fly ash) and granulated blastfurnace slag, can also be used as hydraulic binders.

Appendix A9 approval trials
A scheme for approval trials is set out in Appendix A9 of the Specification1. Trials are carried out to develop and/or assess the performance of alternative reinstatement materials (ARMs); they can only be undertaken by formal agreement between an Authority and an Undertaker through an Approval Trial Agreement. The duration of all approval trials shall be two years with one month grace for the final inspection. However, further use of ARMs under trial may be permitted on or before completion of the approval trial, with written approval of the relevant Authority, in accordance with S1.6 of the Specification1.
Table 1: Summary of reinstatement materials

<table>
<thead>
<tr>
<th>Material/Mixture</th>
<th>Potential for recycled content</th>
<th>Covered by BS EN</th>
<th>Specification requirement for A9 trial</th>
<th>Application</th>
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<tbody>
<tr>
<td>Concrete</td>
<td>Low/medium</td>
<td>Yes</td>
<td>No</td>
<td>Rigid pavements</td>
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<tr>
<td>Bituminous Bound Mixture (Asphalt)</td>
<td>Medium</td>
<td>Yes</td>
<td>No</td>
<td>Flexible pavements</td>
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<tr>
<td>Foamed Bitumen</td>
<td>Medium</td>
<td>No</td>
<td>No*</td>
<td></td>
</tr>
<tr>
<td>Structural Material for Reinstatement (SMR)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foamed concrete</td>
<td>Medium</td>
<td>No</td>
<td>No*</td>
<td>Up to base and subbase in road Types 1 to 4</td>
</tr>
<tr>
<td>Flowable (FSMR)</td>
<td>Medium</td>
<td>No</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>BS EN HBM</td>
<td>High</td>
<td>Yes</td>
<td>No*</td>
<td></td>
</tr>
<tr>
<td>Proprietary NFSMR</td>
<td>High</td>
<td>No</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Unbound Mixtures (GSB 1/Type1)</td>
<td>High</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Stabilised Materials for Fill (SMF)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class S SMF (will not exist in the third edition of the Specification)</td>
<td>High</td>
<td>No</td>
<td>Yes</td>
<td>Backfill and subbase</td>
</tr>
<tr>
<td>Class A to D SMF</td>
<td>High</td>
<td>No</td>
<td>Yes</td>
<td>Backfill</td>
</tr>
<tr>
<td>Aggregates for bedding and surround materials</td>
<td>High</td>
<td>Yes</td>
<td>No</td>
<td>Bedding and surround</td>
</tr>
</tbody>
</table>

* In accordance with Advice Note No 2009/019
Quality control

Quality is defined as conformance with requirements, freedom from defects or contamination. Quality assurance is achieved by confirming the standard of quality of a product is met by using a Quality Management System; this includes quality control testing and record keeping which provides an audit trail. Demonstration of compliance with the requirements of specifications is achieved through compliance testing.

Production
Standardised materials such as Type 1 subbase, asphalt and BS EN HBMAs are produced in accordance with the appropriate standard [see the Table of Standards]. These materials can all have a recycled content as the standards focus on fitness for purpose and do not discriminate on source. Aggregate, mixture and testing standards specify the quality control testing required to ensure a quality controlled product. Standard quality control testing includes:
- Water content
- Composition
- Angularity
- Particle shape
- Water absorption
- Strength
- Particle size distribution
- Quantity and quality of fines
- Chemical testing
- Binder addition
- Penetration
- Los Angeles abrasion

The Quality Protocol for the production of aggregates from inert waste22 has established a quality management scheme for aggregate processing to meet aggregate standards and has defined a waste recovery process. This provides confidence that the resultant aggregate conforms to standards that are common to both recycled and primary aggregates and that it is no longer a waste.

WRAP have developed a quality manual for hydraulically bound mixtures24, which provides guidance on selection, design and quality production. WRAP have also developed a template quality management scheme for the production of a hydraulically bound mixture25.

Workmanship
Workmanship covers aspects of production, installation and design. Therefore, good workmanship will ensure that the right materials, methods and installation procedures are used in adherence with the Specification1 and associated guidance.

Reinstatement materials with recycled content are permitted providing they meet the relevant performance criteria for each construction layer. They are not more susceptible to poor workmanship than primary materials.

Education and training
Education and training underpin any quality control system.

Under the New Roads and Street Works Act 19912 it is the duty of the Undertaker executing street works to secure that, except in such cases as may be prescribed;
- the execution of the works is supervised by a person having a prescribed qualification as a supervisor – S67(1) and S125 (1)2; and
- there is on site at all times when any such works are in progress at least one person having a prescribed qualification as a trained operative – under S67(2) and S125 (2)2.

Accredited products
Standardised materials may carry a CE mark to demonstrate that the product meets all the appropriate provisions of the relevant legislation implementing European Directives. CE-marking applies to the circulation of a product within the European Economic Area.

National approval arrangements for non-standard/innovative products, materials and systems for use in highways and related areas may be available through the Highways Authorities Product Approval Scheme (HAPAS). HAPAS was set up by the Highways Agency, County Surveyors’ Society (CSS) and the British Board of Agrément (BBA) in 1995 to remove the need for individual authorities to carry out their own assessments and tests.
The suitability of a quality product for a given application may then be confirmed through compliance testing which ensures that the product complies with the relevant specification. Compliance testing can follow one of two routes:

- Recipe – whereby the material properties measured through control testing (such as particle size distribution) must comply with the specification. For example, Type 1 aggregate grading; or
- End performance – normally a strength, stiffness or fatigue value must be achieved to comply with the specification. For example, 28-day strength of cement bound granular mixture (an HBM).

Standardised materials can be produced to comply with either recipe or end performance specifications. Where a recipe is specified, the relevant control testing will be declared as evidence of compliance. When end performance ensures compliance, control testing for BS EN standardised materials is not usually declared. However, the test results will be recorded as part of a factory production control system, which can be made available on request.

Non-standard materials are generally produced to comply with an end performance specification. If these products have not been produced in accordance with a material or mixture standard or followed a factory production control system, they must undergo an Appendix A9 trial if they are to be used within trench reinstatement. The Specification permits three products that are not standardised:

- Non BS EN non-flowable structural material for reinstatement;
- Non BS EN flowable structural material for reinstatement; and
- Non BS EN stabilised material for fill.

Where there is no specified quality control requirements, then it is important to adopt a quality control procedure which is acceptable to all parties. Early consultation with the Authority is recommended to agree the appropriate standard of quality control, and gain agreement for an approval trial.

### Storage and transportation

HBMs have a shelf life which should be declared by the producer. The contractor using the materials should endeavour to use the material within the specified shelf life.

Where HBM is to be stored, it is imperative that the producer has laboratory evidence of the performance properties appropriate to the time of use and that these are quoted for design purposes. In addition, samples for compliance testing should be taken at the time of use.

The two main material properties that can change during storage and transportation are water content and segregation of the grading curve.

Reinstatement materials have an optimum water content for placement, and adequate precautions to maintain the water content during drying and wetting conditions and protect from freezing conditions are required. Therefore, materials that are stockpiled require adequate protection from the elements and regular testing to ensure compliance.

Segregation is the non-uniform distribution of coarse and fine aggregate components which can occur during the transportation and storage of asphalt, unbound and hydraulically bound mixtures. Compaction of a segregated mixture may result in high air voids, which can ultimately lead to reduced pavement life.

Segregation can occur when aggregate is loaded on top of a conical stockpile or in one large dump from a truck; under these circumstances the larger aggregate sizes tend to roll to the outside and bottom.

### In situ testing

A wide range of portable in situ test devices are available. They generally provide an indication of acceptable performance, but must always be taken in context of adequate quality control at the point of material production.

The more fundamental measurement of material properties can be achieved by using more complicated test devices such as a nuclear density meter; whereas a Clegg hammer will give an impact value which is correlated to a CBR for simple comparison.
Installation

Quality assurance of installation is achieved through method compliance rather than end performance. Method compliance includes:

- Layer thickness;
- Compaction plant;
- Number of passes;
- Temperature;
- Water content;
- Density; and
- Time.

The Specification\(^1\) details requirements for compaction of granular, cohesive and cement bound materials; and supplementary information is given in the Practical Guide to Street Works\(^8\). The Specification\(^1\) also recognises that certain alternative reinstatement materials may not require the full compaction specified in Appendix A8, Table A8.1, and that these materials may be damaged if compaction is continued. Such materials should be placed and compacted in accordance with the manufacturer’s recommendations with due regard to the requirements of Appendix A9.

Generally the method statement for placement of an alternative reinstatement material is based on experience with the material and compliance with the Specification\(^1\) or the Highways Agency’s Specifications\(^15\). Note: the BS ENs cover production and testing not installation requirements.

Core sampling of bound reinstatement materials may be undertaken to check layer thickness, and facilitate laboratory testing\(^12\) to assess compliance with the Specification\(^1\). In situ testing may be used for control purposes and/or to measure material performance; for example, the light weight falling deflectometer gives a surface stiffness value. In situ tests that provide a profile of resistance to penetration with depth such as the dynamic cone penetrometer and Panda 2 may identify horizons with low penetration resistance, indicative of soft material and/or inadequate compaction. The output from both penetration tests can be converted to a CBR value for comparison. However, specific in situ test devices and targets are not given in the Specification\(^1\); these are usually covered in the method statement for installation.

In situ testing

A wide range of portable in situ test devices are available\(^26\). They generally provide an indication of acceptable performance, but must always be taken in context of adequate quality control at the point of material production.

The more fundamental measurement of material properties can be achieved by using more complicated test devices such as a nuclear density meter; whereas a Clegg hammer will give an impact value which is correlated to a CBR for simple comparison.
Dissemination and good practice

The recent HAUC (UK) Advice Note 2009/01\(^\text{1}\) recognises the requirement for dissemination of Appendix A9 approval trials. The intention is that, on completion of any alternative reinstatement material (ARM) trial, the results and auditable records from the trial should be shared with other highway and road authorities from whom permission for the use of the ARM is to be sought.

In addition, any agreement between the highway or road authority and the utility company for the use of the material shall follow the requirements of S1.6.1 of the Specification\(^1\). Liaison and consultation at regional levels within HAUC/RAUC should ensure dissemination of good practice.

**Database of street works recycling**

WRAP have developed a database of street works recycling\(^1\) to act as a central repository of information on the status of Appendix A9 materials and trials. It allows a search for examples of use of materials by material type, HAUC/RAUC and approval status.

The database is not limited to Appendix A9 trials, as it also includes agreed materials from S1.6 of the Specification. It will enable the promotion of materials which meet the specified performance and quality requirements set out in the Specification\(^1\) and the proactive sharing of knowledge on these materials.

**Dealing with problems**

It is inevitable that there will be problems from time to time, whether from unexpected changes in circumstances, human error or misunderstandings, incomplete or inaccurate information, mechanical failure or other causes\(^2\). Where problems do arise:

- they should be resolved as speedily as possible;
- where errors or mistakes are made, those involved should work together to put them right; and
- discretion should be used to handle these situations – not mechanistic processes, but all parties should work together to find solutions that minimise disruption for the public.

**Case study evidence**

The AggRegain website (www.aggregain.org.uk) provides a comprehensive online guide to sustainable aggregates and has a variety of case studies demonstrating good practice in:

- producing high quality recycled aggregates;
- sustainable procurement and recycled content targets;
- use of recycled materials and hydraulically bound mixtures in road construction and trench reinstatement; and
- use of the WRAP CO\(_2\) emissions estimator tool in construction projects.

Other WRAP sources\(^1\) contain exemplar information and case study evidence focusing on recycling of trench arisings to encourage both acceptance and uptake. In addition, further case studies are being developed on behalf of WRAP to demonstrate good practice in street works.

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Fig 5: Schematic diagram of the Utility Industry Agreement and suite of supporting documents
Sources of further information

For more information on:

- Waste management regulations - www.netregs.gov.uk
- HAUC (UK) and the use of alternative reinstatement materials - www.hauc-uk.org.uk
- Street works and to access the Specification - www.dft.gov.uk
- Utility industry agreement and waste reduction - www.wrap.org.uk/construction/utility_industry_agreement/
- Health and safety at work - www.hse.gov.uk
- Public services - www.direct.gov.uk
- Specifying recycled aggregates for a chosen application - www.aggregain.org.uk

References

3 The Street works [Reinstatement] [Amendment] [Wales] Regulations 2006. Available online at www.opsi.gov.uk/legislation/wales/wsi2006/20062934e.htm
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11 Recycled and stabilised materials in trench reinstatement, WRAP 2007. Available online at www.wrap.org.uk
12 Trench reinstatements: recycled materials and performance testing, WRAP 2008. Available from WRAP upon request
14 Database of Street Works recycling, WRAP. Available online at www.wrap.org.uk/construction/utility_industry_agreement/supporting_info.html
21 WRAP carbon emissions estimator tool. Available online at www.aggregain.org.uk
22 The quality protocol for the production of aggregates from inert waste, WRAP 2005. Available online at www.aggregain.org.uk
26 Recycled materials in trench reinstatement: Compaction trial, WRAP 2009. Available online at www.wrap.org.uk
Table of standards

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<th>Standard Title</th>
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<td>BS EN 206-1:2000</td>
<td>Concrete. Specification, performance, production and conformity</td>
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<tr>
<td>BS 8500-1:2006</td>
<td>Concrete. Complementary British Standard to BS EN 206-1. Method of specifying and guidance for the specifier</td>
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<tr>
<td>BS EN 12620:2002</td>
<td>Aggregates for concrete</td>
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<td>Hydraulically bound mixtures. Specifications. Soil treated by lime</td>
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<td>PD 6682-2:2003</td>
<td>Aggregates. Aggregates for bituminous mixtures and surface treatments for roads, airfields and other trafficked areas. Guidance on the use of BS EN 13043</td>
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## Glossary

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<tr>
<th>Acronym</th>
<th>Description</th>
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<tr>
<td>ARM</td>
<td>Alternative Reinstatement Material</td>
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<tr>
<td>BS EN</td>
<td>British and European harmonised standard</td>
</tr>
<tr>
<td>CBGM</td>
<td>Cement Bound Granular Mixture</td>
</tr>
<tr>
<td>FCR</td>
<td>Foamed Concrete for Reinstatement</td>
</tr>
<tr>
<td>FSMR</td>
<td>Flowable Structural Material for Reinstatement</td>
</tr>
<tr>
<td>HAUC</td>
<td>Highway Authorities and Utilities Committee (England and Wales)</td>
</tr>
<tr>
<td>HAUC [UK]</td>
<td>Highway Authorities and Utilities Committee for the UK</td>
</tr>
<tr>
<td>HBM</td>
<td>Hydraulically Bound Mixture</td>
</tr>
<tr>
<td>MCHW</td>
<td>Manual of Contract Documents for Highways Works</td>
</tr>
<tr>
<td>NFSMR</td>
<td>Non-Flowable Structural Material for Reinstatement</td>
</tr>
<tr>
<td>NIRAUC</td>
<td>Northern Ireland Road Authority and Utilities Committee</td>
</tr>
<tr>
<td>NRSWA</td>
<td>New Roads and Street Works Act 1991</td>
</tr>
<tr>
<td>RA</td>
<td>Recycled Aggregate</td>
</tr>
<tr>
<td>RAP</td>
<td>Recycled Asphalt Planings</td>
</tr>
<tr>
<td>RAUC(S)</td>
<td>Roads Authorities and Utilities Committee (Scotland)</td>
</tr>
<tr>
<td>RCA</td>
<td>Recycled Concrete Aggregate</td>
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<tr>
<td>SMF</td>
<td>Stabilised Material for Fill</td>
</tr>
<tr>
<td>SROR 2003</td>
<td>Specification for the Reinstatement of Openings in Roads, Revised October 2003, for Scotland</td>
</tr>
<tr>
<td>Undertaker</td>
<td>as defined in the New Roads and Street Works Act 1991 and the Street Works (Northern Ireland) Order 1995 - is the person in whom a statutory right to execute works is vested or the holder of a street works licence</td>
</tr>
</tbody>
</table>

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