

NRA ADDENDUM TO

HD 35/95

PAVEMENT DESIGN AND MAINTENANCE TECHNICAL INFORMATION

Standard HD 35/95 – Pavement Design and Maintenance: Technical Information – is applicable in Ireland with the following amendments:

GENERAL

1. At several locations:

For: “Overseeing Organisation”
Read: “National Roads Authority”;

For: “Specification for Highway Works (MCHW 1)” or “Specification (MCHW 1)”
Read: “NRA Specification for Road Works”.

SPECIFIC

1. Page 1/1, Paragraph 1.3:
Delete Paragraph 1.3 and replace with:
“1.3 This Standard should be used forthwith for all schemes for the construction and/or improvement of national roads. The Standard should be applied to the design of schemes already being prepared unless, in the opinion of the National Roads Authority, application would result in significant additional expense or delay progress. In such cases, Design Organisations should confirm the application of this Standard to particular schemes with the National Roads Authority.”
2. Page 2/1, Paragraph 2.3:
Delete Paragraph 2.3.
3. Page 2/1, Paragraph 2.4, line 1:
Delete first sentence “The Specification . . . natural aggregates.” and replace with:
“The NRA Specification for Road Works permits reclaimed materials, such as crushed concrete and mineral by-products, such as PFA, to be used in place of natural aggregates.”

4. Page 2/1, Paragraph 2.5, line 12:
Delete fourth sentence “Similarly the re-use . . . cost effective.” and replace with:
“Similarly the re-use of old pavement quality concrete, after crushing and grading, as aggregate for the lower layer of a monolithic slab is likely to prove efficient and cost effective.”
5. Page 2/2, Table 2.1:
Delete Table 2.1 and replace with revised Table 2.1 enclosed on Page 5.
6. Page 2/3, Paragraph 2.11, line 4:
Delete: “and are named”.
7. Page 2/4, Paragraph 2.12, line 1:
Delete: “specified by name as being”.
8. Page 2/4, Paragraphs 2.16 and 2.17:
Delete Paragraphs 2.16 and 2.17.
9. Page 2/4, Paragraph 2.18, line 2:
Delete: “specified by name as”.
10. Page 2/4, Paragraph 2.19, line 2:
Delete: “specified by name as”.
11. Page 2/4, Paragraph 2.20, line 2:
Delete: “specified by name as”.
12. Page 2/5, Paragraph 2.21, line 12:
Delete: “in accordance with the Highways Agency’s Road User’s Charter”.
13. Page 2/5, Paragraph 2.23, line 6:
Delete second sentence: “Un-jointed concrete . . . flexible overlay.”
14. Page 2/5, Paragraph 2.25, line 4:
Delete second sentence: “Depending on design . . . flexible pavements.”
15. Page 2/5, Paragraph 2.27, line 7:
Delete third sentence “The use of ... DoE (NI).” and replace with:
“The use of such materials which will be in contact with water should be discussed with the Environmental Protection Agency and the Regional Fisheries Boards.”
16. Page 2/6, Paragraphs 2.28 and 2.29:
[Note: The above paragraphs provide detailed advice on the handling, storage, processing and deposition of waste materials used in the UK. For use in Ireland the relevant legislation includes the Environmental Protection Agency Act 1992, The Water Pollution Acts 1977, 1990 and the Waste Management Act 1996 (and the Regulations made under its powers). Design Organisations shall agree with the NRA the procedures and legislation to be followed.]
17. Page 2/6, Paragraph 2.32, Blast Furnace Slag, line 5:
Delete last sentence: “Blast Furnace ... Regulations (1994).”

18. Page 3/1, References, 1990:
Delete “Environmental Protection Act 1990. HMSO 1990” and replace with:
“The Water Pollution Act 1990.”

19. Page 3/1, References, 1992:
Add the following text:
“Environmental Protection Agency Act 1992.”

20. Page 3/1, References, 1994:
For: “Structural Assessment Procedure”
Read: “Maintenance Assessment Procedure”.

21. Page 3/1, References:
Add the following text:
“**1977**

The Water Pollution Act 1977.

1996

Waste Management Act 1996, and the Regulations
made under its powers.

2000

NRA Manual of Contract Documents for Road
Works:

Volume 1: Specification for Road Works

Volume 2: Notes for Guidance on the
Specification for Road Works.”

22. Page 4/1, Chapter 4:
Delete text and replace with:
“4.1 All technical enquiries or comments on this Standard should be sent in writing to:

Head of Project Management and Engineering
National Roads Authority
St Martin’s House
Waterloo Road
Dublin 4”.



.....
E O’CONNOR
Head of Project Management and
Engineering

APPLICATION & SERIES ►	EMBANKMENT AND FILL	CAPPING	UNBOUND SUB-BASE	BITUMEN BOUND LAYERS	CEMENT BOUND SUB-BASE	CEMENT BOUND ROADBASE	PQ CONCRETE
MATERIAL ▼	600	600	800	900	1000	1000	1000
Crushed Concrete	A	B	B	C	B	B	B
Bituminous Planings	B	B	C	B	B	C	C
Demolition Wastes	B	B	C	C	B	C	C
Blastfurnace Slag	B	B	B	B	B	B	B
Steel Slag	C	C	B	B	B	C	C
Burnt Colliery Spoil	B	B	B	C	B	C	C
Un-burnt Colliery Spoil	B	C	C	C	B	C	C
Spent Oil Shale	B	B	B	C	B	C	C
P F A	B	B	C	C	B	A	A
F B A	B	B	C	C	B	C	C
China Clay Waste	B	B	B	B	B	B	B
Slate Waste	B	B	B	C	B	B	B

A Specific Provision

B General Provision – permitted if the material complies with the Specification requirements but not named within the Specification

C Not Permitted

IMPORTANT NOTE

Materials indicated as complying with the NRA Specification for a particular application may not necessarily comply with all the requirements of the series listed, only particular clauses. For example in the 600 series, Un-burnt Colliery Spoil can satisfy the specification as a general fill but is excluded as a selected fill.

**TABLE 2.1: NRA SPECIFICATION FOR ROAD WORKS
APPLICATION OF SECONDARY AGGREGATES**



THE HIGHWAYS AGENCY

HD 35/95



THE SCOTTISH OFFICE INDUSTRY DEPARTMENT



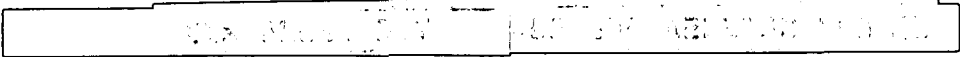
THE WELSH OFFICE
Y SWYDDFA GYMREIG



THE DEPARTMENT OF THE ENVIRONMENT FOR
NORTHERN IRELAND

Technical Information

Summary: This document gives advice on the conservation and use of reclaimed materials in road construction and maintenance.



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VOLUME 7 PAVEMENT DESIGN AND
MAINTENANCE
SECTION 1 PREAMBLE

PART 2

HD 35/95

TECHNICAL INFORMATION

SUMMARY

This part provides information on the

Conservation and Re-use of Materials

Guidance is provided to design organisations on the conservation techniques and the use of reclaimed materials and industrial byproducts that are currently permitted in the Specification (MCHW 1) and in the earthworks and pavement construction parts of the Design Manual (DMRB 4.1 and 7).

INSTRUCTIONS FOR USE

This is a new document to be inserted into the manual.

1. Insert HD 35/95 into Volume 7 Section 1.
2. Archive this sheet as appropriate.

Note: A new contents page for Volume 7 dated March 1995 is available with HD 26/94 Amendment No. 1.

REGISTRATION OF AMENDMENTS

Amend No	Page No	Signature & Date of incorporation of amendments	Amend No	Page No	Signature & Date of incorporation of amendments

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VOLUME 7 PAVEMENT DESIGN
AND MAINTENANCE
SECTION 1 PREAMBLE

PART 2

HD 35/95

TECHNICAL INFORMATION

Contents

Chapter

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4. Enquiries

1. INTRODUCTION

General

1.1 This part contains general items of a technical nature that have relevance to the construction and maintenance of all types of pavements. Advice is given on the conservation and use of reclaimed materials in road construction and maintenance.

Scope

1.2 This part gives guidance to design organisations on conservation techniques and the use of reclaimed materials and industrial byproducts that are currently permitted in the Specification (MCHW 1) and in the earthworks and pavement construction parts of the Design Manual (DMRB 4.1 & 7).

Implementation

1.3 This part may be used forthwith on all schemes for construction, improvement and maintenance of trunk roads including motorways being prepared, provided that in the opinion of the Overseeing Organisation, this would not result in significant additional expense or delay progress. Design organisations should confirm its application to particular schemes with the Overseeing Organisation. For use in Northern Ireland, this part will be applicable to those roads designated by the Overseeing Organisation.

2. CONSERVATION AND THE USE OF RECLAIMED MATERIALS IN ROAD CONSTRUCTION AND MAINTENANCE

General

2.1 The attention of those responsible for the design, specification, construction and maintenance of roads is drawn to the opportunities to conserve and re-use materials arising from road works and the potential uses of reclaimed or reprocessed materials from other sources that may be proposed when cost effective.

2.2 It is Government policy to encourage conservation and facilitate the use of reclaimed and marginal materials wherever possible to obtain environmental benefits and reduce the pressure on sources of natural aggregates. Suitable materials may be those reclaimed from roads during reconstruction, from residues of industrial processes including mining and from the demolition of other construction projects. Such materials may provide good value for money particularly if their use involves less haulage. Where existing road foundations are in good condition, conservation of the pavement structure, strengthening with an overlay or inlay and widening where necessary, can also be an effective strategy for reducing the demand for natural aggregates.

2.3 The Joint Circular from the DoE (20/87), DoT (3/87) and Welsh Office (36/87) entitled 'Use of Waste Material for Road Fill' sets out administrative procedures to ensure that information about future road schemes and their likely fill requirements are given to local planning authorities at the earliest possible stage. The circular states that while it will be for tenderers to choose their sources of fill on a commercial basis, the acceptability of sites for borrow pits is a matter for the land use planning system. It recommends that Planning Authorities should therefore treat planning applications for borrow pits in the same way as applications for other mineral developments, taking into account the availability of suitable waste material. In Scotland the National Planning Policy Guideline NPPG4 Land for Mineral Working issued by the Scottish Office Environment Department gives guidance to planning authorities on the recycling and re-use of construction waste and

materials in waste tips where this is environmentally acceptable.

2.4 The Specification for Highway Works (MCHW 1) permits a wide range of reclaimed materials such as road planings, crushed concrete and mineral by-products such as slags, PFA and the like, to be used in place of natural aggregates. But where the Specification (MCHW 1) refers to individual materials, this may be taken to imply that other materials not specified by name might be inherently unsuitable in some way even if conforming to the appropriate standard. One aim of this chapter is to highlight the existing provisions made in the Specification (MCHW 1) for the re-use and recycling of reclaimed materials and to encourage their widest application.

2.5 The variability of reclaimed materials may require more frequent test regimes to enable their re-use at high level within the road pavement construction. Recycling of road planings, for example from hot rolled asphalt (HRA) surfacing to form new HRA surfacing requires considerable processing and control procedures to ensure standards are maintained. Thus it may prove more efficient and cost effective to re-use such arisings lower down in the pavement or in the foundations or alternatively to limit replacement levels in higher layers to percentages which will minimise additional testing. Similarly the re-use of old pavement quality concrete, after crushing and grading, as aggregate for the lower layer of a monolithic slab or as a continuously reinforced concrete roadbase (CRCR) slab is likely to prove efficient and cost effective.

2.6 The conservation of existing pavements and the use of reclaimed materials helps to reduce the impact on the environment by reducing the extraction of primary aggregates and at the same time reducing the amount of waste which is accumulating. Environmental benefits can also arise from the consequent reduction of construction traffic on local roads. Savings to offset the costs of sorting and processing reclaimed materials may arise from reduced energy requirements compared with the extraction and transportation of primary aggregates and in the reduction in the amount of fresh bitumen required when recycling bituminous bound materials.

APPLICATION & SERIES	EMBANKMENT AND FILL	CAPPING	UNBOUND SUB-BASE	BITUMEN BOUND LAYERS	CEMENT BOUND SUB-BASE	CEMENT BOUND ROADBASE	PQ CONCRETE
MATERIAL	600	600	800	900	1000	1000	1000
Crushed Concrete	A	B	A	C	A	A	A
Bituminous Planings	B	B	C	A	B	C	C
Demolition Wastes	B	B	C	C	B	C	C
Blastfurnace Slag	A	B	A	A	A	A	A
Steel Slag	C	C	A	A	B	C	C
Burnt Colliery Spoil	A	B	A	C	B	C	C
Unburnt Colliery Spoil	B	C	C	C	B	C	C
Spent Oil Shale	B	B	A	C	B	C	C
P F A	A	A	C	C	B	A	A
F B A	B	B	C	C	B	C	C
China Clay Waste	B	B	B	B	B	B	B
Slate Waste	B	B	B	C	B	B	B

- A Specific Provision
- B General Provision - permitted if the material complies with the Specification requirements but not named within the Specification
- C Not Permitted

IMPORTANT NOTE:

Materials indicated as complying with the Specification (MCHW 1) for a particular application may not necessarily comply with all the requirements of the series listed, only particular clauses. For example in the 600 series Unburnt Colliery Spoil can satisfy the specification as a general fill but is excluded as a selected fill.

**TABLE 2.1: SPECIFICATION FOR HIGHWAY WORKS (MCHW 1)
APPLICATION OF SECONDARY AGGREGATES**

THE PROVISION FOR RECLAIMED MATERIALS WITHIN THE SPECIFICATION FOR HIGHWAY WORKS (MCHW 1)

2.7 Table 2.1 illustrates that all the reclaimed materials listed **can** be suitable in one form or another for inclusion in earthworks, foundations or pavements, providing always that they comply with the requirements of the Specification (MCHW 1). For definitions of terminology used in this chapter refer to the Glossary of Terms (paragraph 2.32).

Health and Safety

2.8 Although Table 2.1 indicates that all the reclaimed materials listed are permitted by the Specification (MCHW 1), consideration must be given to aspects of health and safety. Of particular concern is dust arising from materials which may affect both workers and others, as well as reducing visibility and hence safety. Leachates from reclaimed materials should be assessed from a health and safety point of view and appropriate protective equipment used and washing facilities provided.

Series 600 Earthworks

2.9 The Specification (MCHW 1) permits a very wide range of bulk fill materials under the headings 'general granular fill' and 'general cohesive fill'. Unacceptable materials are listed and include materials having hazardous chemical or physical properties. Thus the possibility of leachates from reclaimed wastes and by-products must be addressed.

Crushed Concrete can comply as a selected granular fill and is specified by name. It is however excluded from granular fill overlaying buried steel structures.

Reclaimed Bituminous Materials can comply as bulk fill, although this would in general be a wasteful re-use of a premium material. Accurate measurement of the moisture content of bituminous planings can be difficult and advice should be sought from the Overseeing Organisation.

Demolition Wastes. Crushed demolition debris can comply as bulk fill provided it does not contain unacceptable materials as defined in this Series.

Blast Furnace Slag can comply as selected

granular fill and is specified by name, but this could be a wasteful re-use of a premium material.

Steel Slags are excluded as bulk or selected granular fill because of the possible presence of free lime (CaO) and free magnesia and the consequent risk of expansion when hydration occurs.

Burnt Colliery Spoil can comply as bulk or selected granular fill and is specified by name for many applications.

Unburnt Colliery Spoil can comply as bulk fill but is excluded from selected granular fill.

Spent Oil Shale can comply as bulk fill but is not permitted as selected granular fill.

PFA is specified by name as both general cohesive fill and as conditioned ash as selected cohesive fill to structures and for reinforced earth.

FBA can comply as bulk fill and as selected granular fill that is to be stabilised with cement. It is not a named selected granular fill however as it would generally fail the strength requirement.

China Clay Wastes being natural aggregates, both Stent and Tip Sand can comply as bulk and selected granular fills.

Slate Waste is a crushed rock and can comply as both bulk and selected granular fill.

Series 600 Capping

2.10 Table 2.1 shows that all reclaimed materials except steel slag and unburnt colliery shale can meet the Specification (MCHW 1) as capping, either as unbound selected granular fill or stabilised with cement. Selected conditioned PFA for stabilisation with cement to form capping is specified as a separate class. Accurate measurement of the moisture content of bituminous planings and the determination of optimum moisture content can be difficult and advice should be sought from the Overseeing Organisation.

Series 800 Unbound Sub-bases

2.11 Crushed concrete, blastfurnace slag and well burnt, non-plastic shale (burnt colliery spoil and spent oil shale) can all comply with the Specification (MCHW 1) and are named. Steel slag, well weathered and conforming to the requirements of BS4987: Part 1

is also specified. China clay and slate wastes are crushed rocks and can also comply when processed, although they are not referred to by name.

Series 900 Bitumen Bound Layers

2.12 **Industrial By-products.** Slag is specified by name as being one of the materials that can be used for dense macadam roadbase specified in BS4987: Part 1 and for rolled asphalt roadbase in BS594: Part 1. In this context slag refers to both blastfurnace and steel slag, provided in the latter case that it is well-weathered. Selected china clay waste, Stent, being crushed granite has the potential to comply with the British Standards, but crushed slate, not being named within those standards, does not.

2.13 **Reclaimed Materials.** Reclaimed bituminous materials can be used for hot mix recycling in the production of bituminous roadbase, basecourse and wearing course, up to 10% of reclaimed bituminous material being permitted without a requirement for trials. The maximum content of reclaimed material permitted is restricted to 10% for hot rolled asphalt wearing course and 30% for hot rolled asphalt and coated macadam basecourse and roadbase. New bituminous roadbase produced in a central plant containing up to 30% reclaimed material is considered the optimum mix for ease of quality control. It should be noted that not all road planings are suitable for hot mix recycling as older layers may contain tar. For further advice refer to HD 31 (DMRB 7.4.1).

2.14 **In-situ Recycling.** 'Repave' is a process that conserves existing structurally sound pavements, restoring the surface by bonding a thin overlay or inlay to the pre-heated, scarified and reprofiled existing road surface. The 'Remix' process is an adaption of the 'Repave' system where the machine is fitted with a small mixing unit. Material from the scarified surface is augured into the pugmill mixer where it is blended with hot freshly-mixed new material. The recycled mix is placed evenly on the heated surface to form the replacement wearing course which must conform to the British Standard for surfacings, BS 594.

2.15 Cold in-situ recycling is only suitable for lightly trafficked roads. The 'Retread' process in which pavement surfacing layers are scarified in-situ, new binder added and recompacted, has been in use for many years and new techniques utilising

cement and foamed bitumen are undergoing trial. For more detailed information refer to HD 31 (DMRB 7.4.1).

Series 1000 Cement Bound Sub-Base

2.16 **CBM 1** - All reclaimed materials listed in Table 2.1 can comply with the Specification (MCHW 1) which includes a CBM strength requirement and excludes any CBM material that swells or cracks after immersion for 7 days in water.

2.17 **CBM 2** - Any of the reclaimed materials listed in Table 2.1 could comply after washing or processing if they meet the Specification (MCHW 1) requirements which are more stringent than those for CBM1. Blastfurnace slag is specified by name.

2.18 **CBM 3** - Crushed concrete, crushed air-cooled blastfurnace slag and PFA are specified by name as capable of complying with the Specification (MCHW 1). Stent from china clay waste and slate waste, crushed and graded, both have the potential to comply with the Specification (MCHW 1) being natural aggregates. China Clay Tip Sand is also potentially suitable as fine aggregate.

Series 1000 Cement Bound Roadbase and Pavement Quality Concrete

2.19 **CBM 3, 4 & 5** - Crushed concrete, crushed air-cooled blastfurnace slag and PFA are specified by name as capable of complying with the Specification (MCHW 1). Stent from china clay waste and slate waste, crushed and graded, both have the potential to comply with the Specification (MCHW 1) being natural aggregates. China Clay Tip Sand is also potentially suitable as fine aggregate.

2.20 **PQ CONCRETE** - Crushed concrete, crushed air-cooled blastfurnace slag and PFA are specified by name as capable of complying with the Specification (MCHW 1). Stent from china clay waste and slate waste, crushed and graded, both have the potential to comply with the Specification (MCHW 1) being natural aggregates. China Clay Tip Sand is also potentially suitable as fine aggregate.

CONSERVATION OF EXISTING PAVEMENTS

2.21 When maintaining or improving existing roads by far the most efficient approach is to conserve sound pavement layers or to stabilise and strengthen unsound layers, thus making the best use of materials by leaving them in place. This will require careful attention to the timing of maintenance and decisions will be influenced by the type of road and the residual life of the pavement. For further advice refer to HD 30 (DMRB 7.3.3). Traffic management alternatives and likely traffic delay costs must be taken into account to ensure the most cost effective solution overall in accordance with the Highways Agency's Road User's Charter. Numerous opportunities exist for conservation.

Concrete Pavements

2.22 **Surface Restoration.** The skidding resistance of concrete surfaces that have polished, but after minor repair are otherwise sound, can be restored by transverse grooving, surface dressing or by overlaying with a bituminous surfacing. For further advice refer to HD 32 (DMRB 7.4.2) and to Road Note 39 (1992).

2.23 **Strengthening.** Concrete pavements which are structurally sound can be strengthened by thin bonded concrete or thick unbonded concrete overlays, using 'fast track' concrete paving techniques where necessary in accordance with HD 27 (DMRB 7.2.4). Un-jointed concrete pavements (CRCP) can be converted to become the roadbase (CRCR) with a strengthening flexible overlay. Jointed concrete pavements can be converted to function as a lower roadbase with a strengthening flexible overlay of adequate thickness to inhibit the formation of reflection cracks over joints. Using crack and seat techniques, concrete pavements can also be conserved as the lower roadbase in flexible composite construction or as the sub-base for a new pavement. For further advice refer to HD 30 (DMRB 7.3.3).

Flexible Pavements.

2.24 **Surface Restoration.** The skidding resistance of flexible surfaces that have polished but are otherwise sound can be restored by surface dressing, by application of a bituminous overlay or inlay, by retexturing or for low speed roads, by slurry sealing. Apart from the retexturing option,

the systems all help to reseal the pavement against the ingress of water and arrest disintegration. For further information refer to HD 31 (DMRB 7.4.1).

2.25 **Strengthening.** Flexible pavements can be strengthened by the application of a bituminous overlay with or without the removal of the existing surfacing layers. Depending on design constraints and traffic flows, continuously reinforced concrete pavement (CRCP) or roadbase (CRCR) can also be used to overlay or as an inlay to flexible pavements. These are probably the best options where significant differential settlement of the existing road has occurred and is likely to continue. For further advice refer to HD 30 (DMRB 7.3.3) and HD 31 (DMRB 7.4.1).

2.26 **Road Widening.** Advice on the widening of roads and motorways is given in HD 27 (DMRB 7.2.4) which stresses that the maximum use should be made of existing construction wherever possible. There is no restriction on the type of material to be laid alongside an existing pavement providing it conforms to the Specification (MCHW 1). There can be positive advantages in having dissimilar construction, for example to increase load carrying capacity of the new lane yet match the thickness of the new pavement with the existing to ensure drainage is not impeded. Where an existing pavement is to be partially or wholly removed, the material arising can be re-cycled and re-used in or under the new construction, subject to compliance with the Specification (MCHW 1).

PROTECTION OF THE ENVIRONMENT

2.27 Many reclaimed materials and industrial by-products which are available in sufficient quantities for road construction cause no significant environmental problems. However, materials containing water soluble salts may give rise to leachates at concentrations that would in some circumstances give cause for concern. The use of such materials which will be in contact with water should be discussed in England and Wales with the National Rivers Authority (NRA), in Scotland with the appropriate River Purification Board and in Northern Ireland with the DoE (NI). If there is a risk of contaminants leaching into receiving waters, appropriate measures should be taken to ensure that the concentration of any leachate is not excessive. The Specification (MCHW 1) specifically restricts the soluble sulphate content of fill and sub-base materials adjacent to concrete structures and the maximum chloride ion content of selected fills around buried steel structures.

2.28 The handling, storage, processing and deposition of waste materials are subject to separate control by the Waste Management Licensing Regulations made under the Environmental Protection Act 1990 (EPA). These will apply to all surplus materials taken off site. The carriage and processing of waste will need to be licensed; however there will be a general exemption from requirements for waste to be deposited at a licensed site, if instead it is to be incorporated into a development which has planning consent. It is presumed that such use of waste materials will be adequately controlled since they must be deposited in accordance with the specification for the development including any special conditions required to prevent adverse effects on the environment. It should be noted that by-products such as Blast Furnace slag are not subject to the requirements of the Waste Management Licensing Regulations (1994).

2.29 The Waste Management Regulations permit temporary storage on site of up to 20,000 tonnes of any material approved for incorporation in the works, after the award of a contract but prior to beginning work. Up to 50,000 tonnes of road planings may be stockpiled off-site for reprocessing. Nevertheless, there are good reasons to utilise planings as they arise or as soon as possible thereafter. Stockpiles can become quite difficult to break up if they are allowed to consolidate. On the other hand, if they become saturated with water, then compaction as fill or to form a capping layer may be difficult and considerable amounts of energy are needed to drive off water if they are to be recycled to form a new roadbase. There may also be concerns about the possibility of both organic and mineral leachates if water begins to drain through a large stockpile.

2.30 Where reclaimed materials are being considered for use in landscaping and areas of planting, care should be taken to ensure they are compatible with the plants and trees to be grown. For further advice refer to HA 44 (DMRB 4.1.1).

FUTURE DEVELOPMENTS

2.31 It is expected that the quantities of materials recycled will increase as the range of industrial by-products permitted in the Specification (MCHW 1) is extended. A number of research projects are currently underway which aim to develop suitable acceptance criteria to encourage the wider use of

such materials when they offer best value for money. Once these criteria have been established, appropriate amendments will be made to the Specification (MCHW 1) and to the DMRB.

GLOSSARY OF TERMS

2.32 The following terms are used in this Chapter:

RECLAIMED BITUMINOUS MATERIALS:

Millings, planings, return loads and offcuts from bituminous layer joint preparation. Waste material stockpiled at plants may also be suitable. Some planings and millings can be acceptable for direct addition to new mixes or for different uses. Other reclaimed material should be granulated or crushed or similarly prepared prior to re-use.

BLAST FURNACE SLAG:

A by-product from the production of iron, resulting from the fusion of fluxing stone (fluorspar) with coke, ash and the siliceous and aluminous residues remaining after the reduction and separation of iron from the ore. Blast Furnace slag is not subject to the requirements of the Waste Licensing Regulations (1994).

STEEL SLAG:

By-products of the manufacture of steel from pig iron. There are two types; basic oxygen slag (BOS) and electric arc furnace (EAF) slag. EAF slag generally has lower free lime and magnesia contents than BOS as a result of the manufacturing process and is thus more easily weathered.

BURNT COLLIERY SPOIL:

Also known as burnt minestone. The residue following ignition of coal mine spoil heaps which results in partial or complete combustion of coal particles in the spoil and consists of calcined rocks.

UNBURNT COLLIERY SPOIL:

Also known as minestone, a by-product of coal mining. It is derived from the rocks which lie above, below and sometimes within the coal measures of Carboniferous geological age. These rocks comprise mainly siltstones and mudstones and in some areas sandstones and limestones.

SPENT OIL SHALE:

The residue of Shale mined in the Lothian Region of Scotland after heating to drive off volatile hydrocarbons. Similar in nature to well-burnt colliery shale.

PFA:

Pulverised-fuel ash or fly-ash is extracted by electrostatic precipitation from the flue gases of modern coal-burning power stations and is similar in fineness to cement.

FBA:

Furnace bottom ash is the coarser fraction of ash produced in coal burning power stations resulting from the fusion of PFA particles which fall to the bottom of the furnace. It varies in size from fine sand to coarse gravel and has a porous structure.

CHINA CLAY WASTE:

The by-product of the extraction of china clay from decomposed granite, consisting largely of two distinct materials: 'Stent' which is waste rock and 'Tip Sand'. The Tip Sand is predominantly quartz with some mica and is also relatively consistent from within each source of production.

SLATE WASTE:

The by-product of slate quarries primarily producing roofing slates. The waste represents 70-90% of gross quarried volume.

3. REFERENCES

References

1987

Use of waste material for road fill. DOE Circular 20/87, Department of Transport Circular 3/87, Welsh Office Circular 36/87; HMSO

Undated

Specification for Highway Works. (MCHW 1) HMSO

1990

Environmental Protection Act 1990. HMSO 1990

1991

HA 44 (DMRB 4.1.1) 'Earthworks: Design and Contract Documents'

1992

BS594 : 'Hot rolled asphalt for roads and other paved areas'; Part 1 : 'Specification for constituent materials and asphalt mixtures'. BSI

Road Note 39 : 'Guide to Road Surface Dressing'.
TRL

1993

BS4987 : 'Coated macadam for roads and other paved areas'; Part 1 : 'Specification for constituent materials and for mixtures'. BSI

1994

HD 27 (DMRB 7.2.4) 'Pavement Construction Methods' HMSO

HD 30 (DMRB 7.3.3) 'Structural Assessment Procedure' HMSO

HD 31 (DMRB 7.4.1) 'Maintenance of Bituminous Roads' HMSO


HD 32 (DMRB 7.4.2) 'Maintenance of Concrete Roads' HMSO

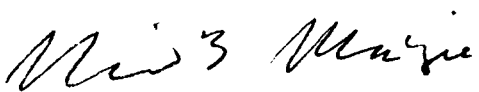
Road User's Charter. The Highways Agency;
HMSO

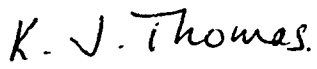
Waste Management Licensing Regulations 1994.
SI 1994 No 1056; HMSO


4. ENQUIRIES

All technical enquiries or comments on this Part should be sent in writing as appropriate to:

<p>Chief Highway Engineer The Highways Agency St Christopher House Southwark Street London SE1 OTE</p>	 <p>T A ROCHESTER Chief Highway Engineer</p>
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<p>The Deputy Chief Engineer The Scottish Office Industry Department Roads Directorate New St Andrew's House Edinburgh EH1 3TA</p>	 <p>N B MACKENZIE Deputy Chief Engineer</p>
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<p>The Director of Highways Welsh Office Y Swyddfa Gymreig Government Buildings Ty Glas Road Llanishen CARDIFF CF4 5PL</p>	 <p>K J THOMAS Director of Highways</p>
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<p>Director of Roads Service Department of the Environment for Northern Ireland Roads Service Headquarters Clarence Court 10/18 Adelaide Street BELFAST BT2 8GB</p>	 <p>W J MCCOUBREY Director of Roads Service</p>
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Volume 7 Pavement Design and Maintenance
Section 1 Preamble, Part 2
HD 35/95 Technical Information



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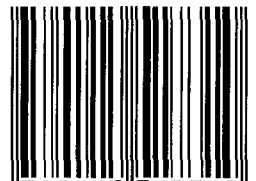
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