

Arguments to stimulate the government to promote asphalt reuse and recycling

EAPA – Position Paper



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Summary

The re-use and the recycling of reclaimed asphalt pavements (RAP) started more than 30 years ago. In many European countries the use of RAP is common practice. Asphalt is 100% re-usable / recyclable and for sustainable development its re-use / recycling should therefore be encouraged. RAP can be re-used to produce new asphalt (in plant and in-situ) and it can be recycled by using emulsions, foamed bitumen and by adding cement (in plant and in-situ). To stimulate the re-use and the recycling of RAP this document provides arguments for governments and public authorities to stimulate this process.

Each year about 50 million tons of RAP is produced and a large amount of this 50 million tons is reused and recycled. The goal should be to achieve 100%.

This document addresses the need for re-use and recycling for sustainable development by consideration of legislation, economical aspects, the supply and demand market, creating awareness of the client, technical and contractual issues as well as environmental aspects.



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1. Introduction

Asphalt pavements are built by using natural resources including aggregates and binders. These resources are limited and therefore recycling of reclaimed asphalt is important for sustainable development.

The most well known definition of sustainability is the Brundtland definition [1]: “Development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs.”

Asphalt is 100% re-usable / recyclable and **should** be re-used / recycled. Reclaimed asphalt pavements (RAP) can be re-used to produce new (hot or warm mixed) asphalt (in an asphalt plant or in-situ) and it can be recycled by cold methods by using emulsions, foamed bitumen and by adding cement (in a plant or in-situ).

In some European countries re-use of reclaimed asphalt started more than 30 years ago. Each year about 50 million tons of RAP is produced and a large amount of this 50 million tons is reused and recycled. In many European countries the use of reclaimed asphalt pavements (RAP) is already common practice, however there are still several European countries where there is hardly any (hot) re-use of RAP. The goal is to have 100% of the RAP reused or recycled. In order to stimulate this re-use (and recycling) this document provides arguments for governments to stimulate the re-use of RAP.

Definitions of recycling and re-use used in this document

Re-use means adding reclaimed asphalt to new asphalt mixes, with the aggregates and the old bitumen performing the same function as in their original application.

- *Recycling means the utilisation of reclaimed asphalt as foundation, fill or road base material, with the recovered aggregate and bitumen performing a lesser (or alternative engineering) function than in the original application.*

2. The need for re-use and recycling for sustainable development

Recycling and re-use are important to preserve natural resources to ensure that there are also adequate resources for the future generations. This description fits in the definition of “Sustainable developments”.

Sustainability can be defined as [1]: Development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs.

In the EAPA document “Industry Statement on the recycling of asphalt mixes and use of waste of asphalt pavements’ (May 2004) [3] there is a general EAPA statement on the recycling of asphalt mixes:

“EAPA as a responsible industry organisation taking into consideration the current trends towards:

- *sustainable development;*
- *minimizing environmental impact;*
- *optimising the use of natural resources;*
- *increased restrictions on the dumping of reusable material, possibly leading to a ban on their disposal into landfills;*
- *potential economic incentives to encourage the re-use and/or recycling of material.*

promotes increased re-use of asphalt mixes and constructive evaluations of the suitability of, alternative sources of re-usable material into asphalt mixes.

These materials must be combined with technical innovation and enhanced quality management systems in order to generate a product that retains the potential for 100% re-usability.

The European asphalt industry is environmentally conscious and feels responsible for its product during its whole lifetime. EAPA therefore strongly supports, where economically and technically feasible, all efforts to optimise the re-use and recycling of asphalt.”

Although the asphalt industry has the techniques and knowledge to re-use, not every country does re-use RAP in significant quantities. This document is meant to stimulate re-use and to remove obstacles.

3. Items to be addressed to stimulate re-use

In order to be able to use RAP in the production of new asphalt mixtures in an economical way, it is necessary to meet several conditions and assumptions.

The first and most important issue is the quality of the asphalt mixture. Research in the past 30 years has showed that asphalt containing RAP can perform as adequately as asphalt containing virgin materials only.

The second important issue is the market: There should be a market; meaning there should be a supplying party and a demanding party. So the use of RAP should be attractive for both parties (the asphalt supplier and the client / the road authority).

In most cases, the government itself is a producer of waste materials / RAP, resulting from re-construction and/or maintenance of the existing (asphalt) infrastructure. This means that if the government wants to use the private industry to solve its own problems, it must be attractive for the industry to operate in this market.

In this chapter several issues will be addressed that influence the re-use of RAP.

3.1. Legislation / Waste legislation

A good legal framework is needed to allow and to stimulate re-use. For a successful sustainability policy aiming at minimising the use of primary raw

materials there should be encouragement or incentives to stimulate reuse and recycling of reclaimed asphalt.

RAP should not be seen as a waste but as a valuable material that can save virgin material for the next generations.

RAP that can be reused in the production of new hot mix asphalt should meet the requirements stated in the European standard for RAP: EN 13108-8. According to this European Standard for Reclaimed Asphalt (EN 13108-8), reclaimed asphalt may not contain tar.

For the application of RAP, it is necessary that there is a clear government policy for now and for the future.

The reuse of RAP is sometimes seen as a new technique with additional risks and uncertainties. The risks concern both material-technical risks and environmental-hygienic risks. As far as the environmental-hygienic risks are concerned, there is no problem when reusing RAP meeting the requirements of the European Standard for Reclaimed Asphalt (EN 13108-8), meaning RAP without tar.

The material-technical risks have largely been solved . There are many countries that have a record of reusing RAP for more than 20 or 30 years.

In order to stimulate industry to invest in new technologies and new equipment a clear government policy is needed. Industry is ready to invest if the prospects are sufficiently attractive. That means that the government must pursue an investment-friendly policy, and should be reliable as legislator. (Reliable means here that the government should have a policy for a longer / prolonged period and that policy should not change totally within a short period. The words short and long should be related to the depreciation period of new equipment).

To be reliable also means that the government should be ready to take risks itself by, for example, stimulating, as a customer, the application of secondary materials in its works.

Government policy should set preconditions in such a way that its policy targets can be reached in a free market economy by the private sector. The government has to facilitate the market in order to realise policy targets.

National regulations are needed to stimulate recycling.

The European standards for Bituminous Mixtures (EN 13108) give the opportunity to use RAP in the production of bituminous mixtures.

3.2. Economics

In general it can be stated that the market of RAP is influenced by:

- Availability and price of primary aggregates
- Cost of landfill
- Transport costs

The price/performance ratio of asphalt containing RAP must be at least comparable with a traditional material. Practice has shown that the performance of asphalt containing RAP has at least the same performance as asphalt produced by using virgin materials

only. This means that the price of RAP should be at the same level as (or lower than) the equivalent virgin aggregate/material.

At the time of writing, in certain countries the costs of producing RAP might be higher than the costs of the equivalent aggregate. If the RAP is not being recycled or re-used it has to be dumped at a landfill site. By taking Whole Life Cycle Costs into account there will or should be a fee on dumping. If this fee is high enough the price of RAP will become equal or lower than the equivalent aggregate.

Several countries use this mechanism to regulate the prices of secondary materials to stimulate recycling.

In the UK the government introduced a levy (tax) on aggregate intended to stimulate re-use and recycling. Some of the revenues from this levy on aggregate are used to stimulate the reuse and recycling via promotion by the Waste Resources Action Promotion Programme (WRAP).

The UK also has a landfill tax. These levies and taxes can be adjusted to ensure that alternative / secondary materials remain financially competitive.

In Sweden a bonus might be given if recycled material is used. But it might also be a deduction as an example shows from Gothenburg: The normative requirement is that the mix shall contain 10 % of RAP and if the actual amount is > 10 % a bonus is given, but if the amount is < 10 % a deduction will be made.

In the Netherlands it is not permitted to dump building material that can be reused or recycled. In this way the market should ensure that secondary materials will be financially comparative. In the Netherlands the costs of asphalt containing RAP are lower than the same quality of asphalt containing virgin materials only.

So if a government introduces appropriate regulations, re-use and recycling or useful applications can be made competitive. Without creating these conditions by a government in a market-conforming manner, the market will choose the cheapest solution and that might be dumping instead of recycling.

3.3. The market for material supply and demand

When the economic playing fields have been set by making recycling cost beneficial (for example, by using high dumping costs or the prohibition on dumping or land fill for re-usable materials) it is up to the market to choose materials within the scope of existing contractual conditions and legal framework. Proper co-operation between the government (both policy maker and client) and private industry is needed in order to be able to create a durable market.

A robust policy is needed to encourage recycling.

It should be realised that the market for secondary materials is very inelastic. The production of RAP is largely determined by the size of the projects (creating RAP) and not primarily by demand for the product. This means that it might be difficult on some occasions to match the supply and the demand of RAP. It also means that good planning is essential and it is important to decide where to stockpile the RAP. Planning in advance and coordination between interested parties is essential to match the demand and supply. Stimulating the re-construction and maintenance of asphalt roads could ensure the ongoing availability of RAP in the market.

3.4. Awareness and education of the client

If the price level of the RAP is competitive then the client should be willing to accept or to specify asphalt mixtures containing RAP.

There might be a need to change the culture in which contractual parties are used to working together.

In the beginning (when the use of asphalt containing RAP is not accepted as "normal") the client (road authority) should be willing to take responsibility and to open their works for the application of asphalt containing RAP.

When it can be demonstrated that asphalt containing RAP can perform as adequately as conventional asphalt, it is likely to become accepted as a "normal practice".

At this time there are hundreds of papers reporting success stories of the re-use of RAP in asphalt mixtures. Many websites promote the benefits of recycling. Therefore people working in real practice should be aware of the available knowledge.

The EPA "Industry Statement on the recycling of asphalt mixes and use of waste of asphalt pavements" [3] is one of the documents giving an overview of the possibilities to re-use and recycle RAP.

It is also important that the management level of the client (the road authority) has a clear policy for the use of secondary materials / asphalt containing RAP. Often the decision whether or not to apply secondary materials is taken at a low level without clear guidelines from management.

In general countries having no natural resources were more eager to start recycling than countries with enough resources. Nowadays, countries with enough natural resources also see that sustainable development is needed. They are increasingly aware of the present trends and see that re-use and recycling should become normal practice

3.5. Techniques for reuse and recycling

In the Annex of "Industry Statement on the recycling of asphalt mixes and use of waste of asphalt pavements" [3.] a state of the art in recycling & re-use is shown.

Reuse/recycling processes can be divided into two major methods: hot or cold techniques. These can be further sub-divided into central plant (ex-situ) or in-situ recycling. Central plant reuse consists of removing the material from the site to a plant located elsewhere which reuses the reclaimed asphalt either on the original project or on other projects. In-situ reuse allows the reclaimed material to be incorporated directly back into the new asphalt pavement under construction or maintenance.

The choice of process will depend on several factors, including:

- the proximity of a suitable recycling plant,
- the nature, quantity and quality of the reclaimed asphalt.
- the amount and type of possible contaminants within the reclaimed material
- the programmed duration of construction
- the availability of space for interim storage of reclaimed asphalt prior to recycling
- and the engineering performance required from the new pavement.

In [3.] the following techniques are described:

- Hot mix reuse technologies in a stationary plant. This can be an asphalt batch mixing plant - or an asphalt drum mixing plant designed for recycling.
- Hot mix technology in in-situ reuse. Here the techniques are all similar in concept and require the use of special equipment which have several brand or patent names, among them are Road train, Reshape, Repave and Remix.
- Cold mix reuse (or recycling) technologies in a stationary plant
- Cold mix technologies applied to In-situ reuse or recycling.

3.6. Technical specifications, standards and test methods

Good regulations to support the use of RAP are needed otherwise the asphalt suppliers have to prove each time that asphalt containing RAP will perform adequately. Everything that is needed to produce and supply CE marked asphalt is found in the European Asphalt Standards (EN 13108).

The test methods for asphalt containing reclaimed asphalt are the same as those for “virgin” asphalt.

For a customer, it is important to obtain certainty about the quality of the materials to be applied. The (amount of) information on the CE mark is the same for asphalt with or without RAP.

3.7. Contract conditions

To stimulate recycling, contracts should also encourage recycling and the use of recycled materials.

In some countries a minimum percentage of use of recycled materials is specified in the contract documents.

Legislative and contractual demands for recycling can provide the drivers for the industry to invest in asphalt plants to be able to recycle RAP.

3.8. Environmental concerns (pollution / leaching)

According to the European standard for Reclaimed Asphalt (EN 13108-8), reclaimed asphalt may not contain tar.

In “Terms, definitions, symbols and abbreviations” reclaimed asphalt is defined as “asphalt reclaimed by milling of asphalt road layers, by crushing of slabs ripped up from asphalt pavements or lumps from asphalt slabs and asphalt from reject and surplus production” and asphalt is “mixture of aggregates and bituminous binder”.

The leaching behaviour of asphalt containing RAP is not different from asphalt produced with virgin materials. Asphalt with or without RAP does meet the most onerous requirements in Europe with regard to leaching.

4. Conclusions

Research carried out regarding the performance of asphalt containing RAP over the past 30 years shows that the quality of asphalt containing RAP is (at least) as adequate as the quality of asphalt containing virgin materials only.

Arguments to increase / promote recycling are:

- it saves virgin materials
- it saves limited natural resources, minimizing environmental impact
- it contributes to sustainability
- the quality of asphalt containing RAP is (at least) as adequate as asphalt containing virgin materials only
- it is (or can be) financial attractive
- it avoids landfill and a burden for future generations
- it is good for the image of the industry
- European standards give the possibility to use RAP in the asphalt mixtures
- there is a European standard for RAP
- some countries have already more than 30 years of experience
- asphalt is 100% recyclable / re-usable

In order to stimulate recycling it is important to have a government policy which sets conditions for the asphalt industry to invest in equipment to recycle RAP. Next to that it should be economically attractive to recycle RAP. Dumping RAP in a landfill should be financially less attractive than recycling.

A good example is to be found in the Netherlands. Here an infrastructure for hot mix recycling has been in place since the 1970s. Now over 95% of all asphalt plants are suited for hot mix recycling (a large amount employing up to 50% addition of RAP). In the Netherlands the success factors for recycling are based on two decades of a recycling policy, which is a combination of economy and a governmental policy, which sets the conditions for the asphalt industry to invest in recycling [4.]. The most important success factor has been the cooperation between the government and the industry. The industry is able and willing to invest if there is a clear long-term policy.

5. Literature

- [1] World Commission on Environment and Development (WCED) (1987). Our common future (The Brundtland Report). World Commission on Environment and Development. Oxford: Oxford University Press.
- [2] Dutch (environmental) policy concerning the use of secondary materials - Reuse and recycling of waste materials in the Netherlands by ir. J. Th. van der Zwan, Road and Hydraulic Engineering Division, Directorate-General for Public Works and Water Management, Ministry of Transport, Public Works and Watermanagement, Delft, The Netherlands.
- [3] "Industry Statement on the recycling of asphalt mixes and use of waste of asphalt pavements", EAPA, May 2004.
- [4] Review of the growth and development of recycling in pavement construction. PIARC Technical Committee 4.3 Working Group 2, July 2007.
- [5] Asphalt in Figures 2006, EAPA, Brussels, 2007

- [6] J. Th. Van der Zwan; Application of secondary materials, a success now, a success in the future. Proceedings of the 3rd International Conference on the Environmental and Technical Implications of Construction with Alternative Materials. "Putting Theory into Practice", WASCON '97, June 4 - 6, 1997. Houthem St. Gerlach.

Appendix

Asphalt Re-use and Recycling in Europe in 2006				
Country	Available reclaimed asphalt (tonnes)	% Actually used in hot recycling	% Used in cold recycling	% Of the new hot mix production that contains reclaimed material
Austria	600,000	10	10	5.0
Belgium	1,300,000	50		36
Czech Republic	604,400	30	50	10
Denmark	240,000	> 80		53
France	6,500,000	13	< 2	< 10
Germany	14,000,000	82	18	60.0
Great Britain	5,000,000			15
Hungary		15	0	0.6
Ireland	48,000	38	0	2.1
Italy	14,000,000	18	2	
Luxembourg	200,000	90	10	60
Netherlands	3,000,000	80	20	65
Norway	590,000	7	26	8
Poland	1,000,000	4	55	0.2
Slovakia	1,250			
Slovenia	22,000	50	10	15
Spain	690,000	30	15	5.0
Sweden	650,000	50	50	40
Switzerland	945,000	50	50	

Totally available RAP about 50 million tons.

Table 1: The availability and use of reclaimed asphalt in Europe [5.]

Production Hot Mix Asphalt 2006			
Country	Hot mix production in 2006 in million tonnes	Number of Stationary Plants	Number of Mobile plants
Austria	10,0	120	5
Belgium	5,0	40	0
Croatia	3,7	65	0
Czech Republic	7,4	106	3
Denmark	3,4	43	3
Estonia	1,5	13	13
Finland	5,5	70	46
France	41,5	427	79
Germany	57,0	680	0
Great Britain	25,7	300	
Greece	7,8	240	10
Hungary	4,4	71	11
Iceland	0,3	6	4
Ireland	3,5	57	17
Italy	39,9	650	10
Latvia	0,6	23	4
Luxembourg	0,6	4	0
Netherlands	9,8	44	0
Norway	5,1	90	14
Poland	18,0	332	26
Portugal	8,9	40	140
Romania	2,8		
Slovakia	2,2	41	0
Slovenia	2,2	17	2
Spain	43,4	385	95
Sweden	7,3	87	15
Switzerland	5,4	136	2
Turkey	18,9	147	208
Europe	341,8	4234	707

Table 2 : Asphalt production plants in Europe [5.]

The tables 1 and 2 show that the reuse of RAP is already common practice in many countries. In some countries 100% of the RAP is reused / recycled. National surveys also show that the number of asphalt plants fit for hot recycling varies from 10 to 90%. This means that there is still a considerable incentive to increase this number.