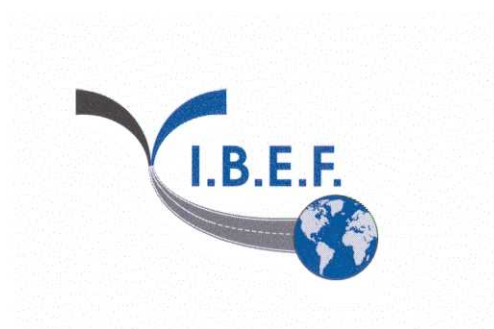


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Asphalt emulsion: worldwide trends

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Content

1. Introduction: which trends?
2. Facts and figures
3. Orientations
4. A new background
5. Conclusions: towards an action plan



1. Introduction

Worldwide trends may be understood in a variety of ways:

- Which parameters to assess?
- Which period to study?

1.1. Parameters

Several parameters may be taken into account. As long as the IBEF brings together federations from countries representing the private sector, it is clear that volumes are the first parameter that must be taken into account.

Indeed, this parameter is not the only one. The technical aspects of the product should also be taken into account. Asphalt emulsion can be used only if it brings an appropriate cost v/s performance ratio to the customers.

Last but not least, the general context also has an impact on the development of any technique; the way emulsion is used today is different from 10 to 20 years ago. The same will apply for the years to come; therefore, there is a need to anticipate future changes to adapt techniques to the market.

1.2. Period

Investments made by the industry need to be depreciated on a medium or long term. Asphalt emulsion was invented in the 20's, some 80 years ago. Today, what we need is to anticipate the future over a period that will be compatible with the investments made today. 10 years should be the right target for this exercise.

2. Facts and figures

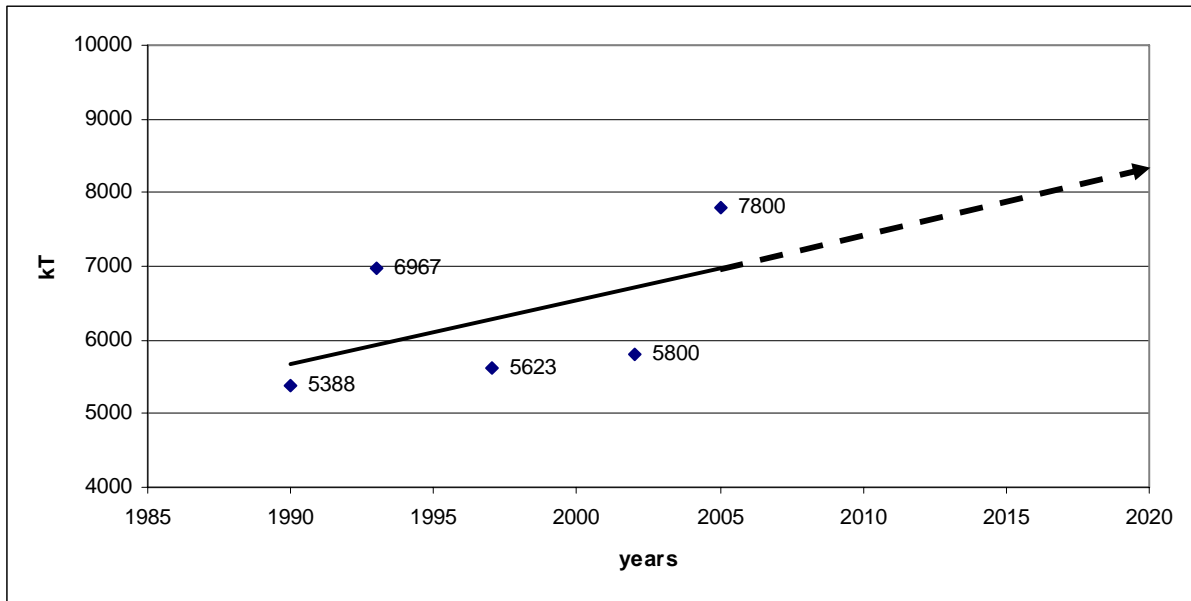
2.1. Production

The main figures were made available at the IBEF conferences, held in 1993, 1997, 2002 and 2006. They are as follows (kT):

1990	1993	1997	2002	2005
5,388	6,967	5,623	5,800	7,800

These figures are not an accurate reflection of reality. Collecting data from many countries is not an easy task, and some countries even have a hard time collecting data within their own borders. The most reliable figure is probably for production in 2005, as it was drawn from a comprehensive enquiry made by the SFERB for the "a world emulsion" meeting, held in Lyon on October 2nd 2006.

This data does nonetheless show a global trend as seen on the graph hereunder.



2.2. The slope of the unbroken line corresponds to a 23% increase spread over a 15 year period. The next question is: will this trend be similar or hopefully better for the years to come? What will be the slope of the dotted line?

The increase during the past years results from the development of new markets, whereas some mature markets have decreased. The following examples clearly show these opposite trends:

	1993	2005	Variation
<i>Traditional markets</i>			
USA	3,200	2,400	-25%
France	1,200	977	-19%
Japan	335	205	-39%
<i>New markets</i>			
China	-	300	
India	15	100	x 6.7
Mexico	167	650	x 3.9
Russia	-	200	

We can see that asphalt emulsion is able to gain market shares, but also to loose market shares. However, the situation is not so simple. In Japan, for example, the global asphalt cement market has decreased, and the emulsion has simply followed the same trend.

2.3. Pros and cons

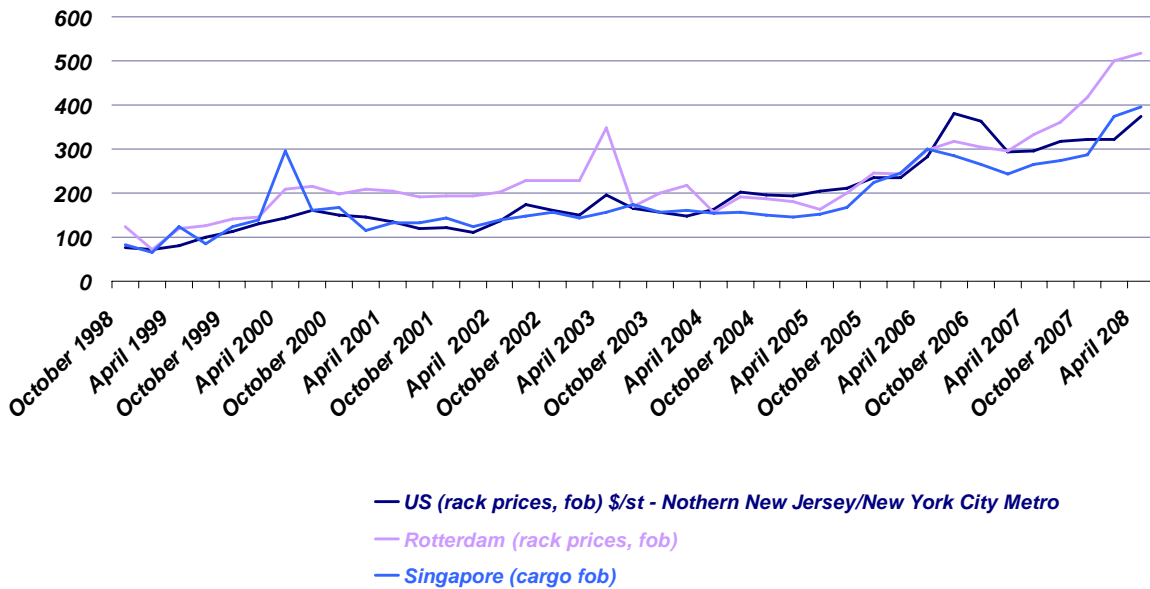
From the above, it is clear that the emulsion usage is both boosted and slowed by various factors, the impact of which differs from one country to another. The general context is of course a factor, but the real question remains how the emulsion techniques are able to compete with other systems.

Regardless of the advantages offered by any technique, the customer always keeps a close eye on cost. It is usually a predominant factor, but is certainly not the sole one. A good example of this is reported from Australia: "Contractors think emulsion adds to cost. However, a detailed analysis of cost reveals a different answer. A concentrated effort should be made to ensure a proper and

comprehensive assessment is conducted and the results available so that a “common” man can understand”.

2.3.1. Drawbacks

Amongst the adverse factors, cost remains an ongoing concern. The main component of emulsion is asphalt cement. For the past 10 years, the cost of this material has dramatically increased, as shown on the following graph.



In the field of hot mixes, competition is a reality for several reasons:

- The hot mix industry has for a long time developed a very dense network of asphalt plants; this the case in Europe with 4821 asphalt plants reported in 2006 (EAPA). The same situation may be seen in other countries such as Japan, where the emulsion industry is suffering from this situation.
- Asphalt emulsion cannot compete with thin and very thin overlays, especially on high traffic roads, such as in Germany. As reported in the UK, cold mixes are not yet seen as a viable alternative to hot mixes.
- This would confirm the fact that the emulsion techniques are not yet able to challenge the hot systems on high traffic roads, and should focus more on the extensive networks of medium and low traffic roads.

As far as hot sprays are concerned, competition is also a reality. This is clearly reported in the Netherlands, Australia and South Africa: “Cohesion development of emulsions vis-à-vis hot binders is one of the main reasons why contractors prefer the latter product because it allows them to achieve greater production rates when constructing spray seal”. We may question this statement when the temperature drops down or in case of wet conditions.

2.3.2. Advantages

Asphalt emulsions do not have any competitors on some new developing markets, such as India, when the first techniques developed are tack coats and prime coats.

In Mexico, the appropriate use of surface dressing with the right equipment and trained staff for educated customers has led to a tremendous increase of emulsion usage. This is a real achievement that can be brought to the credit of the AMAAC.

Although Asphalt emulsion faces competition from hot sprays, the development of polymer modified emulsions helps boost its market share, like in Australia, UK and France.

As far as equipment is concerned, improvements in production facilities as well as sprayers have contributed to the development of sales. Asphalt emulsion is increasingly seen as an industrial product.

The environmental advantages of emulsions are progressively being taken into account by authorities, but the situation is quite contrasted. This is the case in Australia where “HSE is a key feature in the use of emulsions: energy utilization, carbon emissions, VOC, are high on the agenda for Australia”. The same applies in the UK, where the “main achievement is the non-use of cutback asphalts for surface dressing”. In Japan “Global warming is also an important issue”. On the other side, “in the Indian context, HSE issues are not given major importance and hence are not useful in emulsion promotion”.

3. Orientations

Figures in paragraph 2.1 should be used as indicators for global trends, even if the 2005 data is likely quite reliable. For the future, one may wonder whether the growth that has occurred over the past 15 years will continue and how.

To this end, IBEF has launched an enquiry amongst its main members. Questionnaires have also been sent to the industry in countries with significant production. Two terms have been selected:

- short term: 2010
- medium term: 2020

The results of this enquiry are shown hereafter:

	Countries	2010	2020
IBEF Members	Mexico	↑	↑
	Netherlands	↔	↓
	South Africa	↑	↑
	UK	↓	↑
	Germany	↔	↔
	France	↔	↑
	Japan	↓	↓
	USA	↑	↑
Other Countries	India	↑	↑
	Australia	↑	↑
	China	↑	↓
	Morocco	↑	↑
	Thailand	↑	↑

On the short term, the forecasts are mainly linked to the current situation. Growth in new markets will continue; in traditional markets, a more stable trend is forecast.

On the other hand, the long term forecast is more linked to the specific characteristics of emulsion techniques within a changing context. In this respect, the global trend is favorable, as more than 75% of the answers are positive (or neutral).

A comment for China, where the emulsion market has been driven by the construction market, and especially the 100,000 km motorway network: it is believed that the emulsion market will decline as soon as this construction boom will end. We may however expect that new maintenance needs will result from this network expansion, and that the asphalt emulsion will have its share to catch.

4. A new background

For the years to come, the context will have an impact on the development of emulsion techniques. What are the main building blocks of the new background?

4.1. Pavement preservation

Pavement preservation is not a new concept but its importance is growing, for several reasons:

- The lack of funds has led authorities to realize the real value of the road networks they are in charge of, and to consider them as assets that need to be maintained. This situation may be quite severe like in Japan: "the budget for road construction [...] has been decreased every year, and it is estimated that the construction work will decrease in the future".
- The consequences are two-fold: authorities are increasingly in favor of spending to maintain the assets they are in charge of but with less money.

This paradox is a challenge that can be met through the implementation of pavement preservation strategy. One of the keys to this strategy is to maintain a road in due time, i.e. before it is totally damaged.

The "First International Conference on Pavement Preservation" to be held in April 2009 (TRB and FP²) is an illustration of this strong trend to optimize the use of funds that are reportedly growing increasingly scarce. Emulsion based techniques have their role to play in this strategy. In this respect, at the AEMA annual meeting in San Jose del Cabo, a new Emulsion Task Force was formed as part of the Pavement Preservation Task Group.

In July 2008, the 1st International Sprayed Sealing Conference was held in Adelaide – Australia (AARB Group). The attendance from the five continents has demonstrated the interest of some techniques such as surface dressing, a typical maintenance technique.

4.2. Cost & performance + HSE

4.2.1. A new parameter

Until 10 to 20 years ago, a technique was promoted by highlighting its performances and its cost, aiming the best ratio performance v/s cost. Health, Safety and Environment issues did not play the role they do

today. When the first meeting of the Emulsion Association was organized in 1993, the agenda did not include one single presentation about HSE. However, in his interview, the chairman of the SFERB stated: "Asphalt emulsion contributes to the respect of the environment since it is one of the most ecological road products. It is, with no doubt, a product with numerous applications and good prospects". In 1997, two papers were presented about "safety" and "environment".

During the 2008 E&E congress in Copenhagen, the moderator of Session 7 (Energy reduction / Lower temperature technologies / Technology transfer) started his introduction: "Some twenty years ago, an easy way to start a presentation on paving materials was to state that the road network had to face increasing traffic volumes and axle weights. Nowadays, the new challenges are energy saving, sustainable and environmental-friendly development".

This confirms that the industry has been taking this third parameter into account for some time, especially through its associations. The balance is no longer "performance – cost", but "performance – cost – HSE".

For instance, tar was used for years in many countries, and was progressively abandoned or even prohibited. The same trend has occurred for the cut backs. On the other hand, the industry has been more and more promoting "green" systems, such as the use of rape oil instead of solvent for some surface dressing emulsions.

The industry is permanently updating its communication means, using both the NTIC and the more traditional media such as:

- The asphalt emulsion manual, issued by the AEMA (USA) in 2006,
- The updated version of "red book", issued by the SFERB (France) in 2008; the English version is about to be released.

4.2.2. GHG emissions

Since the Kyoto conference was held in Dec. 1997, 172 countries have ratified the "Kyoto protocol", aiming at reducing the greenhouse gas emissions. For the industrial countries, the commitment is to reach emission levels below those of 1990, during the period 2008 - 2012. The Kyoto protocol has entered into force on Feb. 16th 2005. The last industrial country that has ratified this protocol is Australia on Dec. 3rd 2007, but the USA have not yet joined the "club".

In June 2008, the Group of 8 adopted a "Declaration on Environment and Climate Change". Even if it differs from a treaty, this declaration states: "We seek [...] to consider and adopt in the UNFCCC negotiations, the goal of achieving at least 50% reduction of global emissions by 2050 [...]. Substantial progress toward such a long-term goal requires [...] the acceleration of the deployment of existing technologies, and in the medium- and long-term, will depend on the development and deployment of low-carbon technologies [...]. In this regard, we emphasize the importance and urgency of adopting appropriate measures to stimulate development and deployment of innovative technologies and practices."

Such an approach will definitively help the development of cold technologies, based on the use of emulsions. As an example, a comparison is made between hot and cold mix manufacturing.

Manufacturing process	Eq. CO2 (kg/MT)	Energy MJ/MT
Hot mix 160°C moisture content 3%	21	277
Cold mix	3	36

This is not theory: in Japan, "JEEA has been promoting that cold mix with asphalt emulsion can be manufactured at low energy consumption and it effective to decrease CO2 emission".

Other comparison can be made when in place recycling is used instead of conventional strengthening works:

Manufacturing and placing included	Eq. CO2 (kg/T)	Energy MJ / ton
Bituminous concrete	46	683
Continuous reinforced concrete	165	1586
Cold in place recycling (emulsion)	8	138

4.2.3. REACH

In Europe, HSE concerns have driven European policy to implement the REACH regulation for the **Registration, Evaluation, Authorization and Restriction of Chemicals**. REACH entered into force on June 1st 2007 and places greater responsibility on industry to evaluate and manage the risks that chemicals may pose to health and environment. REACH applies to all chemical substances and thus, to Asphalt and emulsifiers. First in-line are the producers and importers of the substances who have to do the actual registration. But emulsion producers and users will be impacted as well. Some emulsifiers and additives that are currently being used may indeed disappear from the market. And emulsion producers and downstream users will have to contribute to the assessment of risk by estimating and measuring the exposure to substances in relation to emulsion formulation and its application.

The incentives to develop energy saving, safe and environmentally friendly techniques are higher than ever and it is believed that bituminous emulsions are still in a leading position.

4.3. Performance-based and standardized techniques

For many years now, the drive to optimize use of available funds has driven techniques from recipe-based techniques towards performance-based systems.

In Europe, this is typically the case for standards that are meant to be based on performances. One should also notice that the European standard system requires additional commitments from the industry regarding systematic and audited quality control. This trend is in favor of a real industrial approach of emulsion manufacturing as well as of its uses.

This approach is not unique to Europe. In New Zealand, performance-based chip sealing contracts are reported. Since the original "scientific" analysis of chip seals and a development of a design methodology were made by Hansen in the 1930s, some major changes have occurred.

5. Conclusion: towards an action plan

Through the short enquiry on which this paper has been based, a lot of success stories have been reported. Such successes should be shared for the benefit of the whole asphalt emulsion industry. Learning lessons from failures is also a source of improvement.

Outside the industry, it is clear that communication should always be improved. More than communication, education is still a necessity. Some achievements should be reported like in UK: "The most high profile area is in surface dressing where the industry has greatly improved over the last decade. The trade association "Road Surface Treatment Association" has promoted Surface Dressing performance and publicized the success rate. Training has given better designs and site performance whilst more use of polymer binders has certainly contributed to lower failure occurrence". Beyond the customers, the academics should also be educated. As the AEMA states: "We need to teach the teachers".

Some challenges are clearly before us: HSE as a growing concern and the scarcity of funds. Asphalt emulsion techniques are able to meet these challenges. The whole community needs to focus on these goals.

Technical problems still need solutions, such as the cohesion buildup of the emulsions. The mechanical characteristics of the emulsion based mixes are also behind the goal. Many studies have been carried out in this respect, but the industrial results are insufficient. The market is still waiting for reliable answers.

Promising developments will occur in the years to come. The next IBEF emulsion meeting, to be held in Oct. 2010 before the World Emulsion Congress, will be the opportunity to update everyone on worldwide trends.

Asphalt emulsion: meeting the world challenges!

