

SEVE, THE NEW TOOL FOR ROAD BUILDERS COMPANIES A TOOL TO PROMOTE WMA AND COLD ASPHALT MIXES

Christine Leroy

USIRF [French Road Builders Union], France

ABSTRACT

Starting point:

In order to be in a position to bid with a new set of ecologically-minded evaluation criteria, the members of the French Road Builders' Federation (USIRF) have developed a new eco-comparing software tool called SEVE, designed for use by the industry as a whole. In short, SEVE is designed for use during the bidding process to compare the impact of environmentally-friendly technical alternatives with initial specifications. Rolled out for the first time ever on July 9, 2010, SEVE originated as part of the French Grenelle Environment Roundtable talks in the form of a voluntary commitment signed on March 25, 2009 in Paris with the French government. The program has been designed for use in as many languages as needed. To date, the software exists in French and in English.

SEVE is quick, simple and easy:

Because the software is available on line, it requires no local updates or downloads. In addition, SEVE's calculations run on a shared, standardized data base and yet companies can add their own specific data (approval required). The software is also easy to use and quick: only 20 minutes are needed from start to finish..

SEVE compares 4 main indicators:

-) Greenhouse gas emissions (in tons of CO₂ eq.)*
-) energy consumption (in Mega-Joule)*
-) consumption of aggregates (in tons)*
-) reclaimed asphalt pavement or RAP content (in tons)*

How does SEVE work?

The system administrator manages SEVE's shared central database along with the more tailored-made rights of each member company's SEVE project manager. These specific rights include calculations based on special formulas and mix designs, thus allowing the software to accurately calculate the environmental impact of a specific mix made in a specific plant. Member companies may then grant user rights to its profit centers and industrial sites.

Concretely speaking, the user can compare a series of technical solutions for a given project (initial solution and technical alternative), using the database from a specific industrial site to ensure fine-tuned accuracy. The software calculates the environmental footprint of each solution, based on the criteria cited above. SEVE provides the users with a standard PDF format summary of the findings.

What are SEVE's targets?

SEVE software has been designed to help customers see tangible proof of the benefits of environmentally-friendly solutions, enabling the road industry pave the way to responsible development.

Keywords: SEVE, WMA, COLD ASPHALT MIXES

1. WHY PERFORM AN EVALUATION OF ENVIRONMENTAL VARIANTS?

This commitment is a continuation of the work undertaken by the USIRF since 1999 on a study of the inventory of the life cycle (ICV) of hot coating. In 2004, the part of the study was completed concerning the manufacture of bituminous coatings known as “cradle-to-grave analysis” then in 2006 the final report was published concerning the manufacture, transport, implementation, the life cycle when in use and the end of life of “cradle-to-grave” hot coatings. This life cycle analysis has been the subject of a critical review performed by Armines and it has been the subject of two articles published in the RGRA.(*)

Thanks to this fund of knowledge, the companies in question currently want to be able to show the improvements they are making, through their know-how and technical approach, to the environmental performance of the infrastructure which they help to construct, rehabilitate and maintain. The demonstration must be capable of being performed for the benefit of works owners and project managers as soon as bids in response to invitations to tender are submitted.

The USIRF is responsible for federating and representing road-builders, and to be active in the defence, promotion and enhancement of the industry in its dealings with various economic and political entities. The industry represents 1,512 enterprises and 100,000 employees in France.

The road-building companies who are signatories to the CEV want to publish the results of the work in which they have engaged to improve the environmental performance of the work they are doing, by demonstrating their efforts to project owners and project managers as soon as they submit bids for tenders.

Most of the time, the bids in response to tenders consist of a financial section and a technical section. The companies, especially the largest of them, have already introduced internal software which enables them to include an additional environmental response. Examples of such initiatives are “Ecologiciel” for the Colas Group, “Gaïa” for Eurovia and “Calculette CO₂” for Eiffage Travaux Publics.

Taking account of this environmental data in responses to tenders as mentioned in the Public Contracts Code (articles 5 - 6 – 14 – 45 - 50 - 53) can be expressed in various ways:

- either by direct requirements notified in the contract, such as the choice of materials or methods of execution, or even specific constraints as to the manner in which the works are performed.
- or by the creation of documents of the Sosed (Schéma d'organisation du suivi de l'évacuation des déchets) [flowchart monitoring waste removal] or Soged (Schéma d'organisation de la gestion d'évacuation des déchets) [flowchart for managing waste removal] type used in waste management or Sopae (Schéma d'organisation du plan d'assurance environnement) [flowchart for organising an environmental insurance plan] for a more comprehensive approach to the environment (management of water at the site, for example, and/or the

requirements for waste management and surplus materials from the building site and the reduction of noise, dust and other forms of nuisance).

- or through proposals for technical variations with a low environmental impact

It is often difficult and delicate to judge bids that include an environmental approach and there is a need to predefine the criteria for judgment in the invitation to tender, mostly in the form of the following annotation:

- Cost of services: 60%
- Technical value: 20%
- Ecological value: 20%.

Hitherto, the responses offering environmental variations were submitted in varying forms each based on the company's own software. Project owners and project managers see this as an additional difficulty in their attempts to perform relevant and objective analyses of the bids.

The USIRF will therefore be making available to its members a piece of software that can be used when replying to an invitation to tender, to produce the most suitable solution or solutions for the preservation of the environment. The name of the software is SEVE (Système d'Evaluation des Variantes Environnementales) [System for Assessing Environmental Variants].

SEVE presents a comparison between two technical solutions based on an analysis of the partial life cycle of each of them, based on the following procedures: a so-called basic solution which is the one described in the tender and one or more variation solution(s). There can therefore be as many responses to a single bid as there are variant solutions offered.

The comparison is performed on the impacts adopted for the NF P01-010 standard. The four indicators adopted are: tonnes of natural materials not used thanks to recycling and modern techniques, tonnes of coated aggregates reused in new coatings, energy consumed in MJ units, greenhouse gas emissions (GES in kg of equivalent CO₂).

The SEVE software is linked to a database of coating stations (production tools for bituminous materials) so as to be able to provide data for calculating the environmental impact. The database is managed independently from the part of the software devolved for calculating the LCA (Life Cycle Analysis).

2. WHY BECOME INTERESTED IN LIFE CYCLE ANALYSES?

The LCA studies the environmental aspects and potential impacts through the life of a product, from the acquisition of the raw materials for its production, its usage and destruction. The general principle is defined by the NF EN ISO 14040:2006 Environmental Management standards – Life cycle analysis – Principles and framework and NF EN ISO 14044:2006 Environmental Management – Life cycle analysis – Requirements and guidelines as well as a list of environmental indicators are provided in the NF P01-010 standard.

Evaluation method: the LCA applied to construction, the use and improvement/demolition of a highway

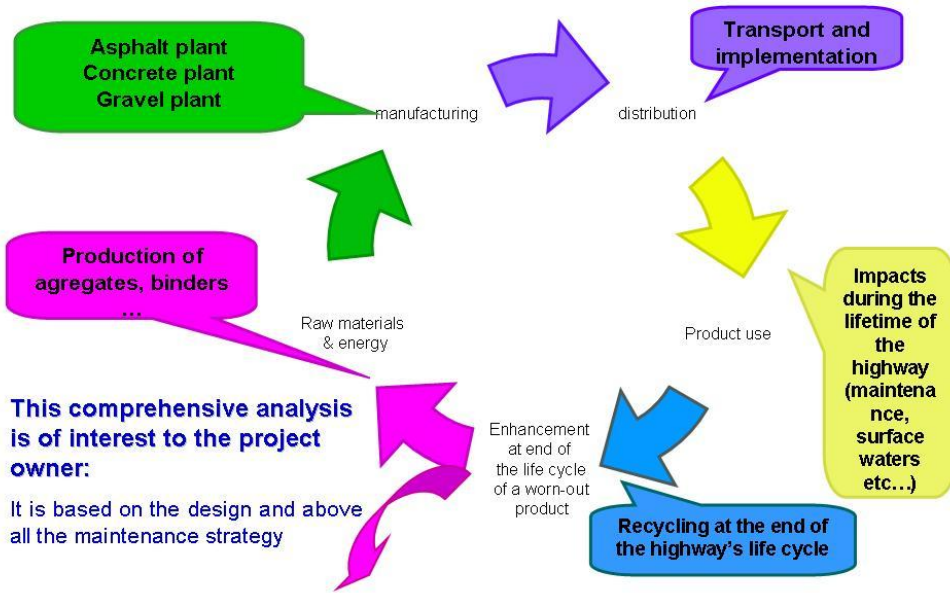


FIGURE 1

When responding to a bid, the companies cannot commit to the frequency of the maintenance sequences, and that is why it was decided to work on partial LCA in accordance with the following diagram:

Evaluation method: at the tender stage the LCA can only be applied to the Construction => inventory of life cycle alone (LCI)

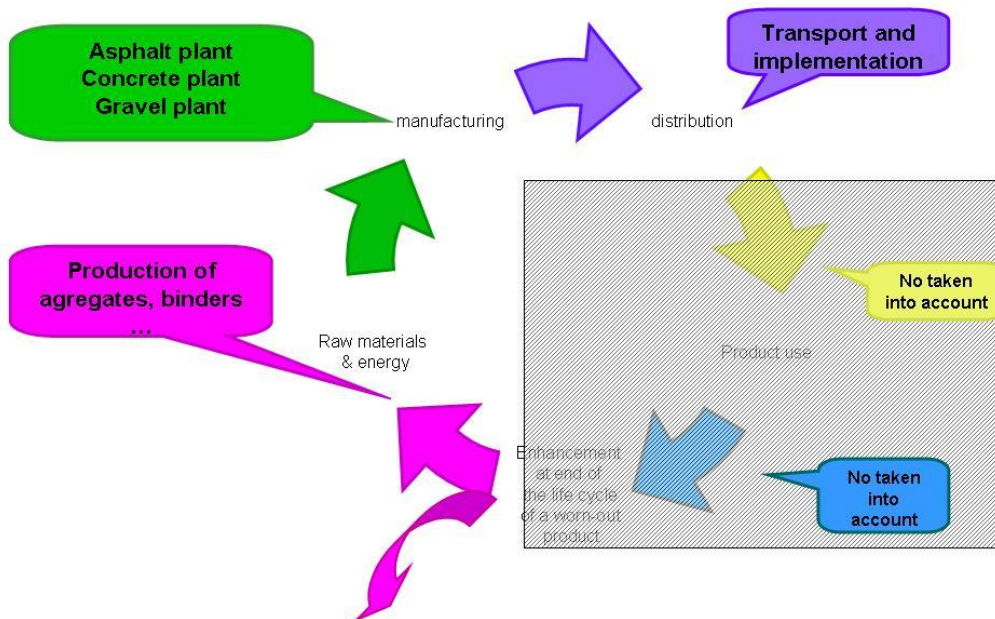


FIGURE 2

Environmental indicators (NF P 01-010 standard)

Exhaustion of resources	Equiv. kg antimony
Consumption of granulates	tonnes
Water consumption	litres
Consumption of energy resources	Mega Joules (MJ)
Greenhouse gas emission	kg of equiv. CO ₂
Atmospheric acidification	kg of equiv. SO ₂
Air pollution	m ³
Water pollution	m ³
Formation of photochemical ozone	kg equiv. Ethane C ₂ H ₄
Solid waste	kg

The greenhouse gas emissions indicator (kg equivalent CO₂)

This indicator reflects the impact of climate change. We sum the flux corresponding to the emission of greenhouse gases in the air for all the materials used but also all the operations necessary to the project and all transportation.

The indicator takes into account the various issues mentioned in the standard NF P 01 010 (CO₂, CH₄ and N₂O). Regarding the data in CO₂ equivalent was calculated by the USIRF, they are based on the Global Warming Potential of the IPCC 2007 (GWP):

$$\text{Mass CO}_2 \text{ equiv.} = (\text{mass CO}_2 \times \text{GWP CO}_2) + (\text{mass CH}_4 \times \text{GWP CH}_4) + (\text{mass N}_2\text{O} \times \text{GWP N}_2\text{O})$$

The masses are expressed in kilograms according to the SI unit:

$$\text{GWP of CO}_2 = 1 \text{ kg CO}_2 \text{ eq per kg}$$

$$\text{GWP of CH}_4 = 25 \text{ kg CO}_2 \text{ eq per kg}$$

$$\text{GWP of N}_2\text{O} = 298 \text{ kg CO}_2 \text{ eq per kg}$$

Citizen yardstick:

Light vehicle: 150 grams / km – 3 tonnes / year

Energy indicator (Consumption of energy resources) in MJ:

This is the total primary energy that represents the sum of renewable and non-renewable energy, really consumed in manufacturing, transportation from raw materials production to works realization. "Primary" is taken here to mean the necessary require in advance in order to provide energy to the end-client.

The indicator adopted is the sum of all of the energy expenditure produced by performing the works.

$$1 \text{ kWh} = 3.6 \text{ MJ}$$

Citizen yardstick:

Consumption in France / inhabitant / year = 193,000 MJ

Materials/ recycling indicator:

The exhaustion of resources indicator (Abiotic Depletion Potential) (equivalent kg antimony) is one of the indicators of the NF P 01-010 standard. As it is not very explicit because it is explained in kg equivalent antimony, it has also been judged preferable to clearly indicate the tonnes of granulates saved (by difference between basis and variant solutions), the material which is the basis for the products used.

Indicator of coated aggregates:

The reuse of coated aggregates in hot-coating or cold-coating is part of article 1 of the CEV:

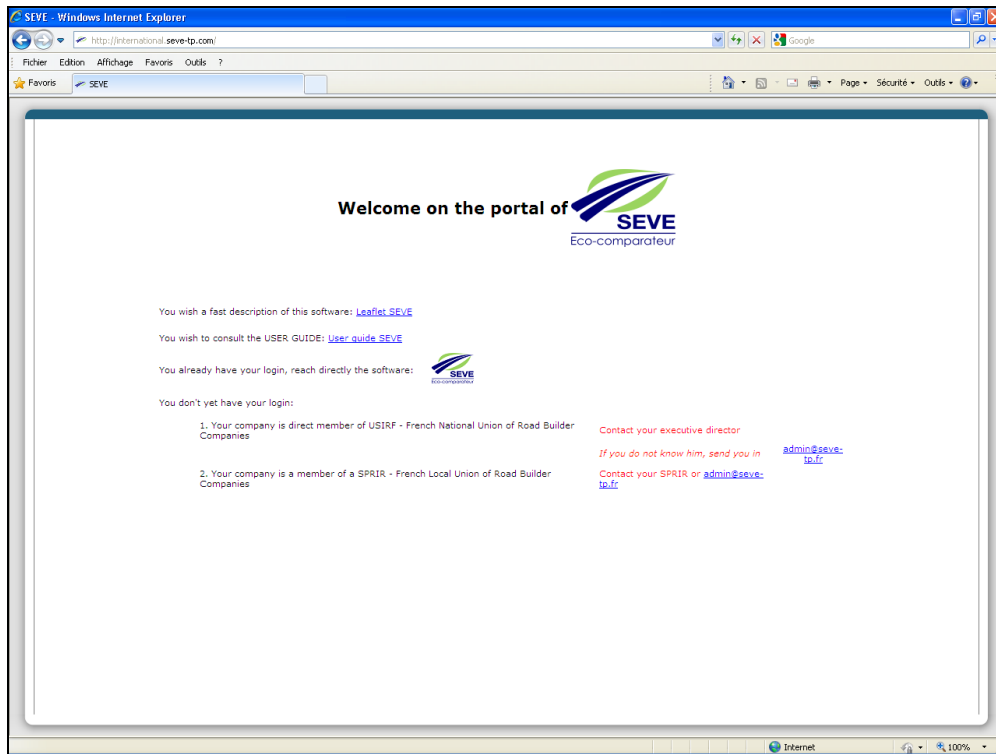
1. Preserving non-renewable resources:

- ✓ By re-using or 100% recycling of natural geological materials excavated from earthworks sites (Objective: 10% improvement from 2012 and **100%** by 2020)
- ✓ By increased recycling of surplus materials and waste from Public Works sites
- ✓ By increased re-use of bituminous materials resulting from removal of materials in highway reconstruction (objective: **60%** in 2012)

SEVE thus clearly indicates the tonnage of coated aggregates re-used in the formulation of hot, warm or cold bituminous materials. This method thus clearly illustrates the rate of recycling and the true re-use of materials.

3. WHO CAN USE THE SEVE SOFTWARE?

Initially, SEVE is destined for the consulting engineering departments of companies who are members of the USIRF which are preparing replies to invitations to tender. The software enables them to prepare, in combination with a technical study of the basic solution and its variations, a comparative environmental analysis of the various variants themselves or taking each variant solution and comparing it with the basic solution. There will be as many analyses as there will be variant solutions proposed. These analyses make it possible to produce a comparison using four indicators: tonnage of unused granulates, tonnage of coated aggregates used as new coatings, energy consumed and greenhouse gas or equivalent CO₂ emissions. This will highlight the environmental advantages of a variant solution. The analysis should be calculated and printed in more or less of 30 minutes, in accordance with the size of the project and the number of calculated variants.



Securitised internet access

The SEVE software is associated with a reference database for “materials, products, lifting gear, workshops, concrete, treated gravel formulas, coatings formulas, etc.”.

The user displays in real time the environmental impacts associated with each solution.

SEVE is also useful for managers of coating stations who can thus create their catalogue of bituminous coating formulas from which the consulting engineering department can make their choice.

The use of SEVE by the project owner’s representatives and the engineering department is obviously planned. It is obvious that they will need access to the functionalities of the tool in order to enable them to check themselves the technical solutions proposed by the construction companies.

4. CONFIDENTIALITY AT THE HEART OF SEVE’S OPERATION

Confidentiality is thus at the heart of the operation of this software. Companies in the same region will be replying to the same invitations to tender, and will also need to guarantee that the replies reflect the know-how of their own company.

SEVE must therefore guarantee the confidentiality of data input and output for each of its users.

The architecture of SEVE was constructed in order to meet this essential requirement. Internet access is securitised by a login and password allocated to each user.

One central administrator per member company manages the users' access rights for its company by being appointed its representative in dealing with the consulting engineer's technical staff of a public works agency.

The managers of the coating stations and the various industries constitute users of a different type. The formulas for products manufactured are made available to the consulting engineers who may need them.

This rule makes it possible to solve the difficult problem of coating stations which can just as easily manufacture the many confidential formulas for company processes as they can standard formulas made available to all their customers.

- Thus, the consulting engineers have available to them the resources shared by all the users of SEVE: this may be quicklime, or CEM I cement, etc. This data is included in the USIRF database, explained by references to official publications (EUROBITUME 1999, ATILH 2009, etc.) or to be found in recognised databases of the Ecoinvent 2.0 type. The "USIRF" database is maintained and updated centrally and directly in liaison with SEVE so that the users will always have the same updated database on line.
- The hot, warm and cold asphalt mixes formulations from each asphalt plant.

Furthermore, companies will be free to create and use their own data for the preparation of replies to invitations to tender. These resources, which are specific to each company, and most of the time are confidential, are the subject of an environmental assessment by a third party in order to guarantee the quality and reliability of the data supplied.

These resources and their documentation, as well as the third-party review, will appear transparently in the document of submission of the bid.

5. TRANSPARENCY, A MAJOR ELEMENT OF TRUST IN THE SEVE

SEVE makes it possible to output a document in standard form, with an exhaustive summary of all the assumptions adopted. Comparisons of the impacts of each of the variants are highlighted in each of the four indicators, in the form of tables of values accompanied by a graphic.

The SEVE document submitted in reply to the invitation to tender also clearly indicates all of the data used to calculate the environmental impacts of the variations proposed, in terms of quantities of materials, the travelling involved in their manufacture and delivery to the site, all of the data concerning their implementation such as the machinery used, the workshops created (e.g.: a workshop for producing bituminous coatings at an average rate will consist of a finishing machine and a compacter, etc.). A project owner or a project manager wishing to check the calculations produced by SEVE can do so in complete transparency with the help of the entry data shown in the document.

On the other hand, the data supplied by the document are usually checkable while the building site is in operation: quantities of materials supplied, number of items of machinery, how long the works will take, etc.

For example, the variation chosen suggests a re-treatment workshop on site which will thus reduce the amount of journeys as well as the lifetime of the site in comparison to the basic solution. All of the elements of which the variation consists will be clearly entered in the document, such as the composition of the implementation workshop, the amount of time the workshop will be in operation, etc. This data will be checked in principle by the project owner while the works are taking place: the elements of variants constitute a verifiable contractual commitment therefore.

6. THE PRECISION OF COMPARISONS: CENTRAL REQUIREMENT OF SEVE:

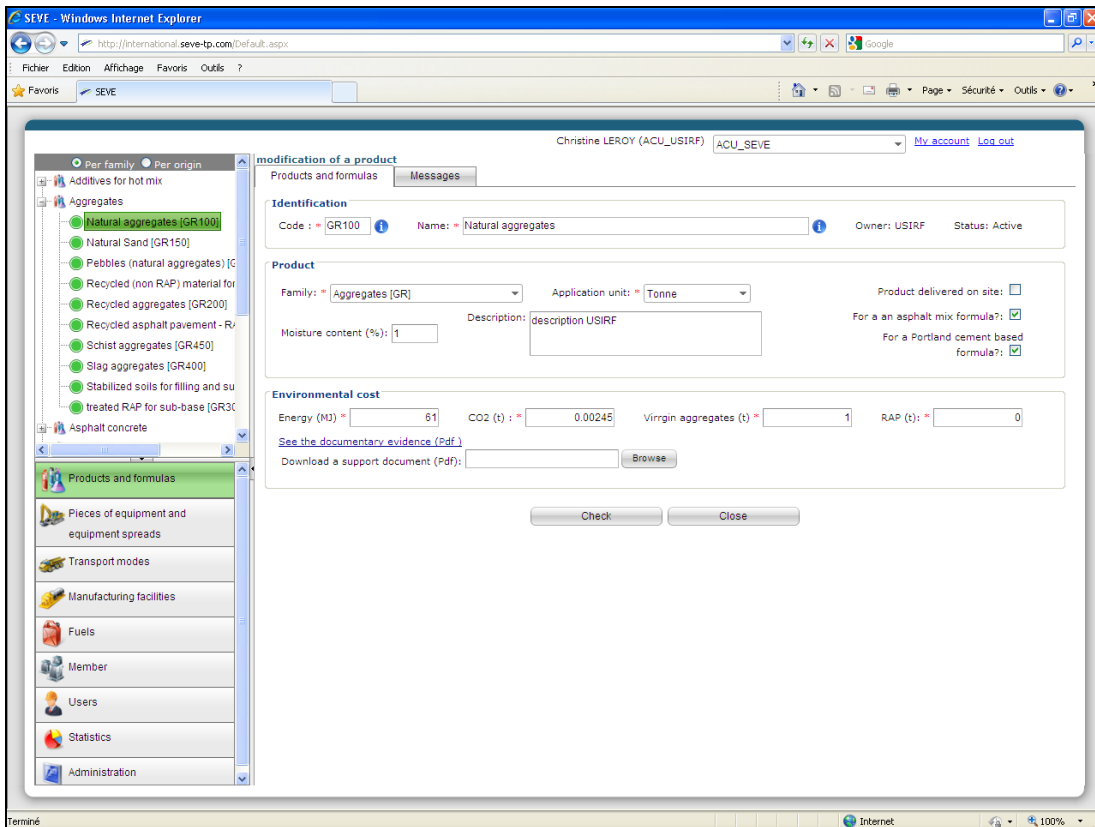
In a competitive logic it is very important that inherent uncertainty in the analyses of cycle of life or in the balance sheet carbon does not allow to call into question the environmental hierarchy of offered resolutions. And this uncertainty is fluently understood between 25 and 50 %. To avoid this reef, SEVE is restricted to the 4 impacts before named (energy, greenhouse gas, economy of materials and recycling asphalt pavement) because they take part well in definite counting for every construction site, while the resignation indicators, as themselves subject to debate, were chosen with rigour and transparency in the most dependable databases: finally expressions of counting and their definition of parameters are based on all returns of experiments of last ten years in occupation to model well the main elements acting on results - transport notably.

As a result if the total for one of the four indicators can always be questioned due to certain simplifications, the difference between two resolutions for the same construction site is an inevitable objective in context co advice.

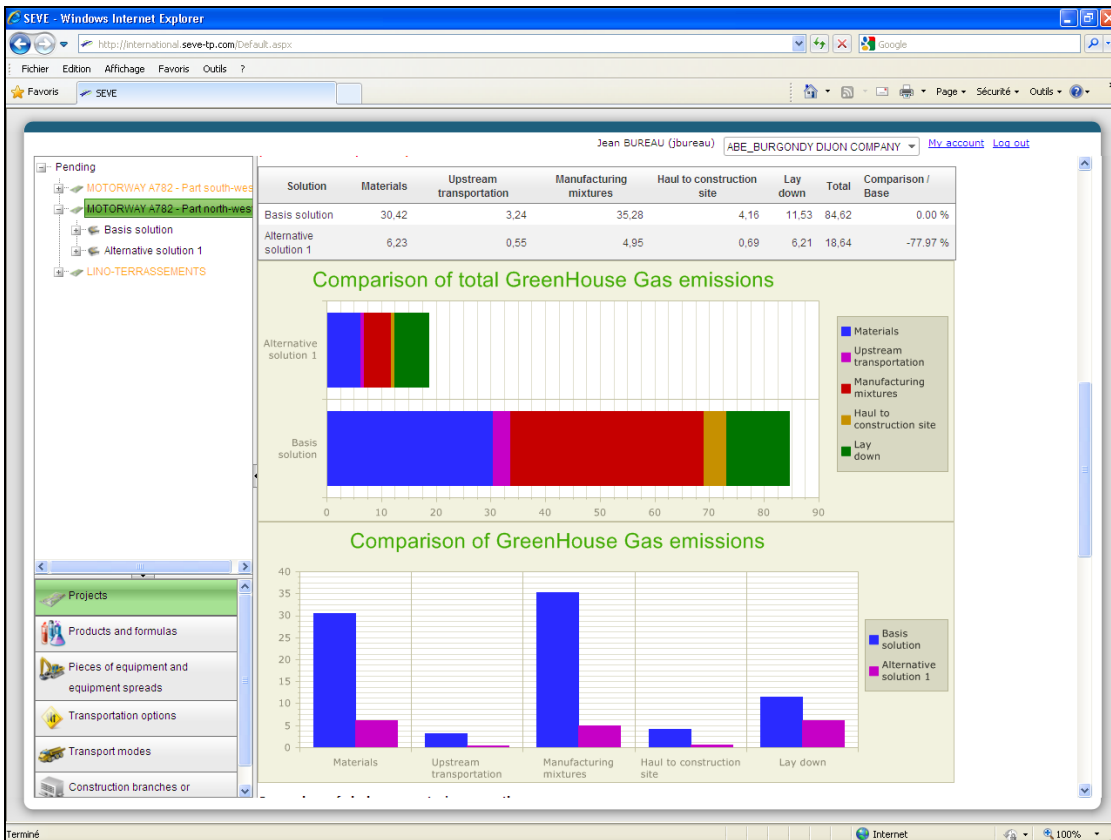
7. THE EXAMPLE OF THE WMA OR COLD ASPHALT MIXES:

The system administrator manages SEVE's shared central database along with the more tailored-made rights of each member company's SEVE project manager. These specific rights include calculations based on special formulas and mix designs, thus allowing the software to accurately calculate the environmental impact of a specific mix made in a specific plant. Member companies may then grant user rights to its profit centers and industrial sites.

For example, SEVE can compare two different mix design of HMA, WMA and cold asphalt mixes. Concretely speaking, the user can compare a series of technical solutions in HMA, WMA and cold asphalt mixes for a given project (initial solution and technical alternative), using the database from a specific industrial site to ensure fine-tuned accuracy. The software calculates the environmental footprint of each solution, based on the criteria cited above.



Step of choice of aggregates



Comparison of GHG emissions

8. CONCLUSIONS:

SEVE makes it possible to respond to invitations to tender as from now, for which the cost, technical quality and environmental features can be assessed objectively and quantitatively.

Access to SEVE by all companies is in preparation. There will thus no longer be anything to stop a project owner, as well as the associated project management requiring in their invitations to tender that the project responses will include solutions that are better for the environment, while being the best technically and offered at a more accurate price.

The consistency of the databases from the various eco-comparison software packages is of course an essential stage in judging the bids. The IFSTTAR (ex LCPC) and the USIRF have begun working together on this subject and the USIRF is also participating in the Commission Infrastructures de Transports de l'Observatoire Environnement, Énergie, Transport (OEET) chaired by Yves CROZET for which the SETRA will be the secretariat.

In this context which is still evolving, SEVE makes it possible to have a more pragmatic approach based on four known and mastered indicators. Subsequent versions will gradually incorporate additional knowledge acquired, validated and expressed in measurable indicators. SEVE is a software in progress...

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