IDRRIM
Institut Des Routes, des Rues
et des Infrastructures pour la Mobilité

TECHNICAL REPORT No. 160

September 2013 | Validity: 7 years

ECO-COMPARATOR

SEVE

Contents

SEVE

Environmental Alternatives Evaluation System V2

The SEVE (Système d'Evaluation des Variantes Environnementales – Environmental Alternatives Evaluation System) software is an eco-comparator developed by the road transport industry to honour the commitment it made by signing the Voluntary Agreement of 25 March 2009.

It directly compares the environmental impact of the technical solutions and their execution (materials, equipment used and organisation of the construction site) for a given road construction site, using 5 indicators (energy consumption, CO_2 emissions, natural aggregate consumption, reclaimed asphalt pavement (RAP) specific to the public works sector, tonne-kilometre).

It is aimed at and available primarily to:

- contractors, for developing projects and/or evaluating environmental alternatives
- companies, for offering environmental alternatives.

The tool was the subject of an assessment in 2011, which contributed to ensuring the consistency of the data and to validating the calculation methods used.

1 EVALUATION SUMMARY

The SEVE software is an eco-comparator developed by the road transport industry to honour the commitment it made by signing the Voluntary Agreement of 25 March 2009. It directly compares the environmental impact of the technical solutions and their execution (materials, equipment used and organisation of the construction site) for a given road construction site, using 5 indicators (energy consumption, CO_2 emissions, natural aggregate consumption, reclaimed asphalt pavement (RAP) specific to the public works sector, tonne-kilometre).

The design assumptions and the results are published in reports dealing with all or some of the five indicators in the form of tables and graphs.

It allows

- in the upstream phase of a project, the evaluation of the environmental impact of various technical solutions,
- for an existing project, the proposal of solutions in the form of environmental alternatives
- the comparative analysis of environmental alternatives to a basic solution
- while the works are in progress, the making of an environmental assessment of work carried out.

The use of the software is facilitated by the provision of materials and work groups of standard jobs. Choices more specific to a given building site are possible.

This software is a web application. All users can access the same database, with the same updates, at any given moment. It is protected to guarantee compliance with the competitive tendering rules.

It is aimed at and available primarily to

- contractors, for developing projects and/or evaluating environmental alternatives
- companies, for offering environmental alternatives.

The tool was the subject of a peer review in 2011, which contributed to ensuring the consistency of the data and to validating the calculation methods used.

2 DESCRIPTION OF THE TOOL BY THE EDITOR

A. GENERAL DESCRIPTION OF THE SOFTWARE

The principle of the SEVE Eco-comparator (Environmental Alternatives Evaluation System):

To respond to invitations to tender, integrating new environmental evaluation criteria, the members of USIRF (Union des Syndicats de l'Industrie Routière Française – Union of Trade Unions of the French Road Transport Industry) created SEVE, an environmental eco-comparator, shared by the whole sector. SEVE compares at least two technical solutions starting with the partial life cycle analysis (LCA) of each of them, according to the methods defined below: the "basic" solution which is the one

described in the invitation to tender and the alternative solution(s). For the same tender, there can therefore be as many responses as suggested alternative solutions.

B. SCOPE OF APPLICATION

The LCA studies the environmental aspects and the potential impacts throughout the life of a product, including the raw materials, its production, its transport, its use and its disposal. The general principle is defined by the standards NF EN ISO 14040: 2006 and NF EN ISO 14044:2006 and the list of environmental indicators taken in part from the standard NF P01-010.

C. TARGET USERS

The software SEVE tool is available to the whole road transport industry sector

- project owners, main contractors, engineering and design firms for the development of projects and tender documents with environmental alternatives
- companies who wish to propose environmental alternatives
- engineering schools, universities.

D. DATABASE AND MANAGEMENT

The SEVE software is connected to a database of materials, machines, products etc. shared by all the users and a base of formulas (concrete, asphalt) specific to each manufacturing plant (production tools for asphalt or concrete).

SEVE can therefore calculate the environmental indicators of the projects according to the specific environmental cost of the resources present in these bases. This specific cost is calculated according to several criteria:

- Distance and type of transport of the raw materials to the plant
- Type of fuel
- Temperature of the asphalt mixes
- Percentage of aggregates added to the formula

This base is managed independently of the part of the software reserved for calculations of the environmental costs of the basic solutions and alternatives.

E. INTENDED APPLICATION

SEVE was first used for the response to invitations to tender, integrating the evaluation criteria based on the environmental aspects.

F. SCOPE OF THE ENVIRONMENTAL ANALYSIS

The environmental analysis is done according to a truncated Life Cycle Analysis (LCA), i.e. from the extraction and transport of the raw material to their use during the execution of the works, via the manufacturing in plant and transport between the plant and the construction site.

G. THE INDICATORS

The comparison is carried out using 5 indicators from the framework of the voluntary agreement signed with the ministry in charge of ecology. (It is important to note that this does not convey the diversity of construction sites' potential types of impact on the environment).

They are composed of an impact indicator defined in standard NF P01 010 and corresponding to climate change and four flow indicators:

- A flow indicator corresponding to the “process” energy consumed
- Three flow indicators specific to the public works sector corresponding to the use of reclaimed asphalt pavement and natural aggregate as well as the tonne-kilometre.

The “process energy” indicator in MJ:

This is the basic process energy which represents the total amount of renewable and non-renewable energy used during the execution of the work. “Basic” means the energy necessary upstream to have energy available at the end customer. "Process" means the energy actually consumed: material energy is therefore not indicated.

The “GHG emissions” indicator (tonne equivalent CO_2):

This indicator reports on the impact on climate change. The flows corresponding to the greenhouse gas emissions for all materials used are added up, along with the operations necessary to the project and all the transport. This indicator takes into account the CO_2, CH_4 and N_2O emissions, converted into equivalent CO_2.

The “natural aggregates” indicator:

This indicator enters the tonnes of natural aggregates consumed on the construction site. In contrast to the basic solution, this makes it possible to measure the quantities of natural aggregates saved.

The "Reclaimed Asphalt Pavement" indicator:

This indicator calculates the quantities of reclaimed asphalt pavement re-used in the formulation of hot, warm and cold asphalt materials. This method thus emphasises only the actual recycling of the aggregates and the asphalt.

The "tonne-kilometre (t.km)" indicator:

This indicator accounts for the preservation of the road network or the reduction of the inconvenience to the user, translated into t.km. This indicator is calculated by multiplying the tonnes transported by the number of km travelled: "the tonne-kilometre is a unit of transport corresponding to the transport of one tonne over one kilometre".

H. CALCULATION PRINCIPLE

At the point of invitation to tender, companies cannot commit to the frequency of the maintenance sequences; this is why the decision was made to work with partial LCAs limited to the site handover. It is important to remember:

The alternatives suggested must offer the same level of service, for the same duration, as the basic solution.

The SEVE tool is an eco-comparator allowing the comparison of two or more solutions given in the response to an invitation to tender.

Under no circumstances is it possible to use this tool to calculate the absolute environmental impacts of a construction site and, consequently, it is not adapted to carry out an absolute value assessment of greenhouse gases.

I. DATA PROVIDED BY THE USER

The data to be given by the user in order to compare (at least) two environmental solutions are specific to each roadworks project, but can be summarised as follows:

- Distance and type of transport of the raw materials to the plant
- Type of fuel used by the plant
- Manufacturing temperature
- Percentage of each component of the formula studied
- Tonnages used on the construction site
- Number of machines
- Distance and type of transport between the plant and the construction site of the various manufactured products.

J. TYPES OF RESULTS OBTAINED AND PRESENTATIONS

The comparison of two solutions is carried out using four indicators: tonnes of natural materials used at the time of the project, the tonnes of reclaimed asphalt pavement re-used in the asphalt binders, the “process” energy consumed in MJ and the GHG emissions (in tonne equivalent of CO2).

The results obtained are comparisons displayed in numerical and graphic tables. All the numerical results can be exported in Excel files. The final summary is presented in a PDF document, in which all the results and data given by the user (tonnage, transport, conditions of manufacture…) is reproduced.

K. AVAILABILITY

Since 1st January 2012, the software tool SEVE has been available to anyone in the sector (companies, project owners, main contractors, engineering schools, universities, engineering and design offices…) who accepts the software's the conditions of subscription

3 EXAMINATION PROCEDURE

This technical evaluation of an “eco-comparator”, limited to the fields of the infrastructures of road transport, has been conducted by a Specialist Group (SG) elected by the IDRRIM (Institut Des Routes, Rues et Infrastructures pour la Mobilité – Institute for Roads, Streets and Infrastructures for Mobility). The investigation procedure for the evaluation request is as follows:

1/ The characteristics and functionalities of the tool described by the editor are checked by the Specialist Group against an evaluation grid created by the SG and attached to this Evaluation.

2/ The eco-comparator is examined against the analysis framework proposed by the infrastructure commission of the Observatoire Energie – Environnement des Transports (Observatory Energy – Transport Environment – OEET). The editor proposes a response to the 46 points detailed in this framework, which is examined by an independent expert, a member of the OEET and external to the Eco-comparator Specialist Group.

3/ Software use tests are carried out by the Eco-comparator Specialist Group, with the support of representatives of the software editor and then checked by experts external to the SG. These tests deal with a material list, as well as with two standard projects (urban and interurban).

The results of these tests are compared with the benchmark results defined by the Specialist Group (these references are likely to change according as more knowledge is acquired).

The results for the eco-comparator studied are based on the following indicators:

- Greenhouse gas emissions
- Energy
- Management of the aggregate resource.

4 INSTRUCTIONS

A– IDRRIM ASSESSMENT GRID

a. Scope of application

The SEVE eco-comparator is adapted to the execution of environmental assessments in the following phases:

- Project design studies
- Procurement of the works
- Execution of the works.

b. Target users

Anyone involved in road construction is a potential user of the SEVE eco-comparator.

c. Databases and management

The databases are hosted by the USIRF, and are secured and updated by the SEVE administrator. The data is confirmed by a peer review led by a third party.

d. Intended application

The SEVE eco-comparator allows the execution of environmental assessments for roadway courses, capping layers and upper parts of earthworks;

The clean-up and the road facilities are not taken into account, and neither is the specific works of the urban environment (kerbs, drains, ducts…).

e. Scope of the environmental analysis

The scope of the environmental analysis of the SEVE eco-comparator is a study of the partial Life Cycle Analysis from the extraction of the materials to the delivery of the work.

Use and recycling at the end of the work's lifetime are not taken into account. The maintenance of the roadway courses can be modelled.

f. Available indicators

The environmental indicators contained in the SEVE eco-comparator are:

- GHG emissions (t CO_2 equivalent);
- Energy Consumption (MJ);
- Consumption of aggregates (t);
- Recycling of RAP (t)
- Tonne-kilometre (t.km)

g. Calculation principle

The calculation of the environmental cost of a product, a formula or a procedure uses emission factors, i.e. it converts a concrete value (quantity of fuel, quantity of invoiced energy etc.) into an environmental cost to increment the indicators used (or by default uses the values of the LCI – Life Cycle Inventory of a product directly).

h. Procedure, data to be provided by the user

The user must indicate:

- The operations which make up the project;
- Quantities in tonnes or m^3 of materials;
- The type of work group predefined in the database and the number of days needed to complete each job depending on the operations envisaged or the composition of the specific work groups;
- Transport distances:
    - Upstream from the production locations to the manufacturing locations;
    - From procurement to the construction site.

i. Presentation of the results

The software generates a PDF file with details of the compared solutions and the necessary supporting documents (addendum…). It includes the option of exporting in spreadsheet format. The software automatically produces results based on the 5 indicators. Further information translating the results into equivalent energy values is only included in the summary (PDF).

j. Availability

The software is available to the entire road transport sector on signing up for an annual subscription.

k. General assessment of the ease of acquisition

Fairly intuitive process modelled on the structure and progression of construction sites (succession of drop-down menus and pop-up windows).

The proposal of predefined work groups depending on the construction site to be created facilitates use

B – OVERVIEW OF THE ASSASSMENT OF THE OEET GRID

(Observatory for Energy and Environment in Transport)

Report on USIRF's expert responses in regard to the OEET methodology infrastructures [V1, April 2011]:

The responses to the 46 points of OEET grid are incomplete as they are limited as much by the scope of the evaluation relating to the OEET methodology V1 as by the answers provided, which were often incomplete because they formed part of a broader technical evaluation process.

The answers given to the various criteria of the OEET methodology meet, as a whole, the requirements and recommendations of the methodology and raise only some minor issues.

- The SEVE tool includes the field of the environmental analysis of the construction of road infrastructures across the stages of production, transport and implementation, according to the existIng normative context.
- The tool lends itself naturally to the study of linear works.
- The five types of environmental impact calculated are specifically aimed at the road transport community within the framework of the public works contracts, in accordance with the Voluntary Agreement. The impact of the “depletion of resources” is not evaluated, and is replaced by “aggregate consumption” and “aggregate use”.
- The quality of the data is ensured by the choice of general and specific databases, identified and adapted to the context of road infrastructures.
- The tool was the subject of an assessment in 2011, which contributed to ensuring the consistency of the data and to validating the calculation methods used.

The SEVE tool meets the requirements of a user wishing to carry out an environmental assessment on the stages of production, transport, implementation and possible scenarios of a road infrastructure, in the upstream or downstream phases, by evaluating four types of environmental impact.

C–SUMMARY OF CALCULATIONS

With the aim of evaluating the eco-comparators, the following case studies were carried out:

- A list of road materials (components and processed products) and means of transport
- An environmental comparison on an urban construction site
- An environmental comparison on an inter-urban construction site

The software tests were carried out by people who were familiar with the software. The results of the tests were confirmed by experts external to the SG, in order to check the orders of magnitude obtained.

For the comparisons of the construction sites, these tests are carried out each time on a basic solution and then on an alternative.

These studies are carried out within defined parameters of analysis: extraction and transport of the raw material, manufacture, transport and implementation.

As part of the proposed tests, the software makes it possible to evaluate different environmental impacts and to highlight their differences among the solutions examined (reduction of energy consumption, greenhouse gas emissions and aggregates) and to approve their classification.

These results are consistent with the references retained by the SG.

The new version of the tool (upgrade from version v1.3 to version 2 in April 2013) did not involve any changes to the test results carried out by the SG.

.

5 COMMITTEE'S EVALUATION

The SEVE software, version v2, is an eco-comparator dedicated to comparing the environmental impact of different technical solutions, and is open to all members of the road transport community.

SEVE honours the commitments made by the companies who signed the Voluntary Agreement on 25 March 2009, who are all involved in the design, execution and maintenance of the road infrastructures, roadway systems and public spaces.

The preservation of non-renewable resources indicator envisaged in the Voluntary Agreement is represented here by two indicators of flow specific to the public works sector, corresponding to the use of reclaimed asphalt pavement and natural aggregate.

The software automatically produces results based on the 5 indicators. Further information translating the results into equivalent energy values is only included in the summary (PDF).

It allows

- in a project's upstream phase, the evaluation of the environmental impact of various technical solutions,
- in the submission of tenders phase, the proposition of environmental solutions (basic or alternative),
- in the assessment of tenders phase, the eco-comparison of the environmental impact of various technical solutions proposed by the companies,
- in the downstream phase of the execution of the work, the making of an environmental assessment of the work, carried out in relation to the initial offer presented by the company when the contract was drawn up.

Under no circumstances is it possible to use this tool to carry out an absolute value assessment of greenhouse gases.

The use of the software is facilitated by the provision of materials and manufacturing workshops which must be selected according to the normal progression of different construction work phases.

This software, a web application, contains protected and partitioned data, guaranteeing compliance with the competitive tendering rules and making it possible to publish reports on the 5 available indicators.

The tool was the subject of an assessment in 2011, which contributed to ensuring the consistency of the data and to validating the calculation methods used.

The SEVE eco-comparator can be used by anyone using the environmental criteria in the context of invitations to tender and also when creating post-works environmental assessments.

SEVE meets all the requirements of all the stages of this type of procedure.

This evaluation refers to version 2 of the SEVE tool. The GS would like to draw the reader's attention to the fact that Version 2's model and calculation engine are identical to the preceding version (version 1.3). Consequently, the results of a project carried out on the two versions are strictly identical (values and formulations).

6 APPENDICES

A.REFERENCES PRESENTED BY THE EDITOR ON THE PUBLICATION OF THE EVALUATION

Version of the tool	Year	Project name	Type of worksite	Project owner	Use	Incumbent company (if contract is obtained)	Comments (Specify whether post-construction works assessment, if project open to alternatives…)
Version v2	2013	In-place recycling of the roadway with bitumen emulsion on the secondary (departmental) road network	Recycling works	CG33	Use in the assessment of tenders phase	In progress	Award pending
Version v2	2013	A630 works	Widening works on the Bordeaux bypass	DIR A	Use in the assessment of tenders phase	In progress	Award pending
Version v2	2013	…	Call-off contracts on the asphalt mixes	Urban community of Greater Lyon	Use in the assessment of tenders phase	In progress	Award pending

Previous references

Version of the tool	Year	Project name	Type of worksite	Project owner	Use	Incumbent company (if contract is obtained)	Comments (Specify whether post-construction works assessment, if project open to alternatives…)
Version v1.3	2012	LLI020 – Redevelopment of the RD208 (“B” road) in the municipalities of Lomme, Sequedin and Ennetières-en-Weppes.	Earthworks Roadway clean-up operation	CG59	Use in the assessment of tenders phase and the end of project assessment but construction works in progress	Company Jean LEFEBVRE LILLE	The asphalt mixes proposed in the tender documents contain 20% aggregates recycled in the base and foundation and 10% in base course
Version v1.3	2012	Operation CAG504 RD630-114 Construction of a gyratory in the CAMBRAI municipality	Earth works Roadway clean-up operation	CG59	Use in the assessment of tenders phase	Eiffage TP Nord	Open to alternatives
Version v1.3	2012	RD 300 – Road reinforcement works on the PR 0+0000 to 10+0729 Firm tranche: from PR 0+0000 to 5+0754	Structural reinforcement works	CG59	Use in the assessment of tenders phase	SCREG Nord Picardie	Variants on - sub-bases (purges and bases) and wearing courses in terms of characteristics, rather than in manufacture, thickness and implementation. - And/or milling thickness. The candidate could propose, for sub-bases only, asphalt mixes at a recycling rate above 10%. They could also propose, for sub-bases only, asphalt mixes at a lower implementation temperature, by confirming the technical and weather conditions of implementation.
Version v1.3	2012	VAI011 OPERATION VAI 011 - RD 955 - Construction of the Western Entrance of the agglomeration in the municipality of DENAIN	Earth works Roadway clean-up operation	CG59	Use in the assessment of tenders phase	Jean-Lefebvre Denain	Opening to alternatives to capping layers, road base courses, road base layers and wearing courses (with phonic characteristics at least identical to the basic solution or higher)
Version v1.3	2012	DOF007 – Reinforcement works on the RD 143 between PR 5+0200 and 5+0594 in the municipality of Fenain	Earth works Roadway clean-up operation	CG59	Use in the assessment of tenders phase	Eiffage TPN Denain	Not open to alternatives
Version v1.3	2012	New Secondary (departmental or "B") road to SARTROUVILLE and MONTESSON Western, Southern and Eastern sectors: Earthworks / Roads / Ground Reinforcement / Engineered Structures	New road	CG78	Awarding of tender	SACER	Project open to alternatives

Version v1.3	2012	TENDERS REPORT RD 65 – RD 113 – RD 983 - Interchange Mantes East Reinforcement works to the ground and roads	Modification of the intersection	CG78	Awarding of tender	Company - Jean-LEFEBVRE IDF/GTS	Project open to alternatives
Version v1.3	2013	RD606 Rocade d'Avallon - Tranche 3	New roadway	CG89	Appraisal		Open to alternatives
Version v1.3	2013	RD90 Bléneau crossing	Crossing	CG89	Appraisal		Not open to alternatives
Version v1.3	2012	Wearing course repairs Batch n° 2	Asphalt concrete	CG 33	Appraisal and checks	COLAS	Post construction site assessment carried out on the alternative incorporating RAP + WAM
Version v1.3	2012	Wearing course repairs Batch n° 6	Asphalt concrete	CG 33		SACER	Basic solution retained
Version v1.3	2012	RD 137/RD 737 intersection layout	Various roads, SEVE as a basis + wearing	CG 33	Appraisal and checks + modification of the SEVE responses to conform with public liability	MOTER (Eurovia)	Alternative incorporating RAP + WMA retained
Version v1.3	2012	RD 1215 intersection layout	Various roads SEVE as a basis + wearing	CG 33	Appraisal and checks	GUINTOLI	Alternative incorporating RAP + WMA retained
Version v1.3	2012	RD 1215 intersection layout, diversion	Various roads SEVE as a basis + wearing	CG 33	Appraisal and checks	GUINTOLI	Alternative incorporating RAP + WMA retained
Previous references							
Version v1.2	2011	RD 61 - Layout between Lunel and La Grande Motte -	Reinforcement of roadways in the northern section	CG34	Assessment of the tenders – "roadway" plant	Eurovia	Positive assessment but calculation of the variations and construction site tolerance to be improved
Version v1.2	2011	RD600 Link A9/Sète - Reconnection works in the Méréville locality	Engineered structures and roadway	CG34	Assessment of the tenders – "roadway" plant	Eiffage	No assessment: construction works still in progress (confirmation of conditional tranche)
Version v1.2	2011	RD 612 - Cers / Portiragnes - PR 56+230 to 62+000	Reinforcement of roadway	CG34	Assessment of the tenders – "roadway" plant	Eiffage	Open to alternatives – no post construction site assessment

B. IDRRIM TABLE

General:	
Software name	**SEVE** **Système d'Evaluation des Variantes Environnementales** (Environmental Alternatives Evaluation System)
Designer	**USIRF**
Launch date	**2010 for companies** **01/01/2012 open to the whole sector** **(companies, labour force, main contractors…)**
Version examined	**Version V2**
Origin of the project	**The signing of the voluntary agreement (point 5) by the majority of the road transport industry** **Several concerns encountered before 2009:** ■ **various existing software (eco-comparators: COLAS eco-software, Gaïa by EUROVIA and the CO2 Calculator by EIFFAGE TP, and others…)** ■ **credibility of the results questioned by contractors** ■ **questions about the relevance of the database and the initial assumptions** ■ **use of average environmental costs although they are variable for the same formula, depending on the asphalt plant** ■ **impossible for labour force to use the company software** ■ **- difficult / impossible to compare the results and thus to analyse the environmental criterion**
Objectives	**To build an eco-comparator shared by the whole the road transport community (companies, project owners, main contractors) based on existing tools, to allow the environmental comparison between the basic solution and one or more proposed alternatives in response to a tender**
Scope of application:	
Phase(s) of the road project	■ **Upstream in the design phase: environmental evaluation of the basic solution** ■ **During the assessment of the tenders: in response to the tender documents with environmental criterion** ■ **Downstream: follow-up of the execution of the operation and a posteriori evaluation, which consists of the carrying out of an environmental assessment**
Target users	**Project owners / Main contractors / Companies / Universities…**
Sector(s) concerned	**Roadways: capping layers; upper part of the earthworks** **Currently lacking the products and processes specific to urban building sites (kerb, surfacing, machines…)** **Future versions envisage the integration of these specific elements**

Scope of analysis	Truncated Life Cycle Assessment (LCA) (point 7 OEET methodology): Extraction and transport of the raw material; manufacturing; transport and implementation
Time needed to carriy out a study	In a simple case (comparison of a basic solution and an alternative): 30 min but depends on the complexity of the structure of the roadway and the number of work phases...
Available indicators:	
GHG emissions(CO_{2eq})	Yes (only CO_2, CH_4 and N_2O taken into account)
Energyconsumption(MJ)	Yes (process energy)
Consumption of size-graded aggregates	Yes
Recycling of RAP	Yes
Acidification	No
Chronic toxicity	No
Water consumption	No
Ecotoxicity	No
Eutrophication	No
Material Consumption	No
Photo-chemical ozone	No
Addition of new indicators	Possible in the future
Tonne kilometre	Yes
Calculations:	
Calculation principles	The calculation of the unit environmental cost of a product, a formula or a machine uses emission factors, i.e. it converts a concrete value (quantity of fuel, quantity of invoiced energy etc.) to increment the indicators used. Otherwise, direct use of the product's LCI values
Integration o f company-specific data as complement to general database	Yes, possible, supplied by the company, reported in the assessments but with the product's supporting environmental documentation.

Necessary Data	**On the design side, user's formulas with the plant formulas, showing:** ■ **the plant's fuel;** ■ **transport type and distances for the materials;** ■ **the manufacturing temperature of the asphalt mixes;** ■ **the water contents;** ■ **% of each component (asphalt, size-graded aggregate, additive agent…)** **The software calculates and displays the environmental costs of each formula.** **On the project creation side, the user enters the project data:** ■ **the operations which make up their project (planing, tack coat, earthworks, base course, wearing course, etc.) ;** ■ **quantity in tonnes or m³ of materials;** ■ **type of work group and number of days depending on the operations considered;** ■ **transport types and distances to the construction site** **The software conducts an environmental assessment of the basic technical solution and compares it with the alternatives suggested according to various criteria (energy, CO_2, resources, recycling and tonne-kilometre).**
Phases of the work's life cycle taken into account	
Lifespan of the work	**Not indicated.** **But directly integrated via the performance imposed on the structure of the roadway in the tender (response to a mechanical performance with guide equivalences of the roadway structures or optimised ALIZE calculation)**
Maintenance	**Not in the context of the "response to the tender" but maintenance can be integrated as an additional layer**
Production and extraction of raw materials	Yes
Upstream transport	Yes
Manufacturing plants	**Yes (option to choose the plant's fuel and the manufacturing temperature)**
Transport and implementation	Yes
Recycling of structure at end of service life	No
Utilisation (traffic)	No
Authorisation and case of use:	
Information technology interface of the tool	**Internet portal, accessible to all (companies, main contractors, project owners) by sending a request to the SEVE administrator, via the website.**
Need for control of the roadworks environment	Yes

Results obtained	Direct acquisition of numerical and graphic comparisons of the solutions (comparison of maximum 5 solutions)
General assessment of the Human/Machine Interface	Fairly intuitive process modelled on the structure and progression of construction sites (succession of drop-down menus and pop-up windows)
Management of central resources database:	
Modification or addition of information	SEVE administrator only
Update opossibilities	Once per annum
Consolidation of new data	Data to be confirmed by third party
Assistance - Support:	
Expert(s) or Hot Line system	SEVE administrator
User club	Under development
Data:	
Origin of the information in the shared central database	All the data comes from specialists' LCAs (Euro Bitume, Union nationale des producteurs de granulats etc.) and/or justified parties.
How the result are returned	Generation of a pdf. file with the details of the solutions compared and the necessary supporting documents (addendum…). Can be exported in spreadsheet format
Deployment and use of the software	Eco-comparator shared by the whole road transport community (companies, project owners, main contractors, universities…)In August 2013: Approx. 50 companies Approx. 40 project owners (CG, ComAgglo, CETE, DIR), of which more than a dozen have already subscribed Approx. 10 universities 2300 users, 3900 projects studied.
Reliability of data	An analysis by a firm of engineering consultants specializing in LCA was carried out in 2011 (BIO IS); the results are available on the site's homepage
Data security - confidentiality	Execution in 2011 of an internal IT audit showing the reliability of the tool (backup, stability…) and the securing of the data
Peer review	Yes
Cost of the product:	
Purchase	The user must take out an annual subscription…
Licences	
Maintenance	

C. CASE STUDIES

These results do not constitute, under any circumstances, absolute reference values, but a comparison of environmental assessments among various options created by the same software.

		SEVE	
Product studied (for 1t)	**Fuel**	**Energy Consumption (MJ)**	**Greenhouse gas emissions (kg CO_2 equivalent)**
Binder for asphalt mixes		3886	247
Binder modified with polymer (5%)		5884	418
Transport by 24T semi truck (for one t.km)		1.01	0.081
Semi-coarse asphaltic concrete 0/10 cl3 *	Heavy fuel oil (HFO)	570	41.2
Semi-coarse asphaltic concrete 0/10 cl3 *	Natural gas	570	35.9
Road base asphalt 3 0/14 120°C 30% RAP *	Heavy fuel oil (HFO)	472	34.4
Road base asphalt 3 0/14 120°C 30% RAP *	Natural gas	472	29.3
Treated base material *		278.2	20.3

Hypotheses for the urban construction site:

	Urban building site: creation of a 500 m^2 urban pavement	
Materials used	Asphalt concrete 0/10 Class 3 at 160°C (heavy fuel oil)	5.3% binder 0.7% filler 94% size-graded aggregate
	Class 3 treated base material	3.5% CEM II 96.5% size-graded aggregate
	Blinding concrete	11.25% water 18.75% cement CEM II 70% size-graded aggregate
	Concrete	11.25% water 23.75% cement CEM II 65% size-graded aggregate
Transport	Refinery – plant: Plant – construction site: Quarry - plant: Filler – plant: Reclaimed Asphalt Pavement: Water: Unbound gravel material:	400 km by 24t tanker 50 km by 24t semi truck 100 km by 24t semi truck 100 km by 24t tanker on site on site 50 km by 24t semi truck
Solution 1	5 cm of A C 0/10, density 2.3t/m3: 15 cm of class 3 treated base material, density 2.2t/m3: 18cm of UGM, density 2.1 t/m3: ***Work group / machines:*** Grader: Compactor: Water sprayer: Front-end loader: Compactor: Front-end loader:	57.5 tonnes 165 tonnes 189 tonnes 1.5 days 1.5 days 1.5 days 0.5 days 1 day 1 day
Solution 2	12 cm concrete, density 2.55t/m3: 5cm of blinding concrete, density 2.55t/m3: 20 cm of UGM, density 2.1 t/m3: ***Work group / machines:*** Track loader: Small compactor: Concrete slipform paver:	153 tonnes 64 tonnes 210 tonnes 2 days 2 days 2.5 days

Urban project results:

	SEVE		
Solution studied	**Energy Consumption (MJ)**	**Greenhouse gas emissions (kg CO_2 equivalent)**	**Consumption of size-graded aggregate (t)**
Solution 1 *	169 002	13 850	406
Solution 2 *	342 353	41 440	383

Hypotheses for the interurban construction site:

	Interurban construction site: 30 000 m²	
Materials used	Asphalt concrete 0/10 Class 3 at 160°C	5.3% binder 0.7% filler 94% size-graded aggregate
	Class 3 treated base material	3.5% CEM II 91.5% size-graded aggregate 5% water
	Asphalt concrete 0/10 at 95°C	4.3% binder 0.685% filler 75% size-graded aggregate 20% reclaimed asphalt 0.015% additive agent for WMA
	Concrete	11.25% water 23.75% cement CEM II 65% size-graded aggregate
Transport	Refinery – plant: Plant – construction site: Quarry - plant: Filler – plant: Reclaimed Asphalt Pavement: Water: Emulsion plant – construction site:	300 km by 24t tanker 25 km by 24t semi truck 50 km by 24t semi truck 100 km by 24t tanker on site on site 35 km by spreader
Solution 1	**Asphalt Concrete 0/10:** ***Work group / medium capacity work group: 700 t/day*** **Emulsion 65%** **Treated base material:** **Emulsion 65%:** **Chippings:** ***Curing membrane work group:*** ***Cement bound aggregates work group: 2000 t/day*** **Stripping of overburden** **Grader:** **Combination roller:** **Crawler excavator:** **Dump truck**	8 500 tonnes 12 days 15 tonnes 16 500 tonnes 21 tonnes 300 tonnes 2 days 8 days 3 days 3 days 3 days 6 days
Solution 2	**Asphalt Concrete 0/10, 95 °C, 20% RAP:** ***Work group / medium capacity work group: 700 t/day*** **Emulsion 65%** **Treated base material:** **Emulsion 65%:** **Chippings:** ***Curing membrane work group:*** ***Cement bound aggregates work group: 2000 t/day*** **Stripping of overburden** **Grader:** **Combination roller:** **Crawler excavator:** **Dump truck**	8 500 tonnes 12 days 15 tonnes 16 500 tonnes 21 tonnes 300 tonnes 2 days 8 days 3 days 3 days 3 days 6 days

Interurban project results:

	SEVE		
Solution studied	**Energy Consumption (MJ)**	**Greenhouse gas emissions (kg CO_2 equivalent)**	**Consumption of size-graded aggregate (t)**
Solution 1 *	10 751 987	787 000	23 620
Solution 2 *	9 644 817	694 700	22 004

Document created by the Institut Des Routes, des Rues et des Infrastructures pour la Mobilité (Institute for Roads, Streets and Infrastructures for Mobility)

IDRRIM - 9, rue de Berri - 75008 PARIS - France
Phone: +33 01 44 13 32 87 - Fax: +33 01 42 25 89 99
Email: idrrim@idrrim.com

Available for download at **www.idrrim.com**

Document reference: AT160-0913

Translated by USIRF

Disclaimer: The aim of this evaluation is to provide a quick insight into the topic in question. The limitation of this speed is the risk of error and incompleteness. This document does not render liable, under any circumstances, either the authors or the Institut des Routes, des Rues et des Infrastructures pour la Mobilité.

This technical evaluation was prepared by the IDRRIM Evaluations Operating Committee's ECO-COMPARATOR Specialist Group.

Institut Des Routes, des Rues et des Infrastructures pour la Mobilité

ADF – ADCF — ADSTD — AFGC — AITF — AMF — AFPGA — ASCQUER — ASFA — ATEC ITS France — ATR – CEREMA — CETU - CF-AIPCR - CINOV Infrastructures et environnement — CISMA — CNFPT — CTPL - DGAC/STAC — DSCR —Ecole des Ponts Paris-Tech — ENTPE - ESITC Cachan — ESTP — FNTP — GART — GPB — IFSTTAR - MEDDE [DGITM, DIT,DIR,CETE] — IREX — Office des Asphaltes — Ordre des Géomètres Experts — RFF — SER — SETVF — SFIC — SNBPE — SPECBEA — SPTF — STRRES — SYNTEC INGENIERIE — UNPG — USIRF - UPC